

Senior Projects

2023–2024



BASIS PHOENIX



SENIOR PROJECTS & SENIOR RESEARCH PROJECTS

At this point in their senior year, BASIS Charter School students have completed a set of four BASIS Capstone classes to earn their BASIS Honors Diploma. In addition, many students are in the process of completing the College Board's AP Capstone Diploma™, a challenging, two-year sequence of AP Seminar™ and AP Research™, plus four other AP® Exams—all of which require extensive research, writing, and oral defense. The BASIS Diploma Senior Project marks the culmination of this hard work and perseverance.

Completed in the third trimester of a student's senior year, the Senior Project is unique, self-designed, and reflective of each student's varied academic interests and passions. Regardless of the discipline—business, art, humanities, science, engineering, social work, medicine, or law—each senior must develop and explore a research question. Creating an abstract that sets the tone of the research, participating seniors must submit a project proposal, and later, orally defend their methodologies.

Under the guidance of an external advisor who is a professional in their field, as well as a faculty advisor from their school, students dedicate 10–15 hours per week to the completion of their Senior Project. To document their journey, students post weekly blog entries about their experiences, successes, and challenges as they explore their guiding question. This journaling provides a unique viewpoint on the students' activities and adds a reflective layer to their research process.

Throughout the development of the Senior Project, BASIS Charter Schools support their seniors every step of the way. The project summaries in this publication clearly illustrate each senior's ability to apply the knowledge and intellectual curiosity they have acquired in the classroom to professional research methods. At the successful conclusion of this project, students are eligible for a BASIS Diploma with High Honors, the most distinguished accolade offered by BASIS Charter Schools.

Each member of the BASIS Charter Schools network commends our seniors for their dedication and motivation—not only for completing this Senior Project, but for their commitment to the BASIS Charter School Curriculum. Congratulations to them on this powerful achievement, and our best wishes as they move forward on their educational journey.



Carolyn McGarvey
Chief Executive Officer
BASIS Ed AZ, DC, LA



David Hubalik
Chief Executive Officer
BASIS Ed Texas



Phoenix SENIOR PROJECTS

NICHOLAS A.



INCREASING PERFORMANCE OF FIBER-REINFORCED AEROSPACE COMPOSITES WITH GRAPHENE OXIDE

SUMMARY: Spaceflight faces an extremely important limiting factor: mass. Composite materials have seen increased use in the structures of spacecraft because of their higher strength to density ratio compared to metals. However, the benefit of composites could potentially be extended further with graphene oxide (GO) reinforcement. I will layup, cut, and perform tensile testing on composites made with and without GO. Based on previous data, I expect the GO samples to be mechanically stronger than the other samples. Then, I will research the potential applications of GO-reinforced fiber composites in the aerospace field.

• **BASIS ADVISOR:** Akash Joseph • **ON-SITE MENTOR:** Wahyu Lestari • **LOCATION:** Embry Riddle Prescott

NATANIA A.



THE EFFECTS OF MUSIC ON LANGUAGE ABILITIES IN RESIDENTS WITH NEUROLOGICAL AND PSYCHIATRIC DISORDERS

SUMMARY: For my senior project, while shadowing a psychologist rounding in multiple assisted living facilities, I studied the effects of music on language abilities in residents with various neurological disorders and psychiatric disorders, including Alzheimer's Disease, Parkinson's Disease, Huntington's Disease, Schizophrenia, Schizoaffective Disorder, and Bipolar Disorder. There are certain language deficits present in individuals with various neurodegenerative disorders, including aphasia in Alzheimer's patients, a loss of phonetic abilities in Parkinson's patients, and an excessive or lack of speech in patients with Schizophrenia or Bipolar Disorder. Music has been known to improve people's mood and memory by invoking emotions that activate the brain and has therefore been proven to play a therapeutic role in dementia patients, and moreover, has been known to increase verbal fluency in dementia patients. Although music's beneficial role in the language and memory of dementia patients has already been observed, this research project sought to investigate whether similar effects would be observed in patients with psychosis and if music would have an impact on patients' language in the short term by increasing their mood and attention in the given moment. From conducting my study, I hoped to find that listening to music improves language processing and speaking abilities in the short term for residents with both neurological and psychiatric disorders.

• **BASIS ADVISOR:** Brittany Holtzman • **ON-SITE MENTOR:** Dr. Julia Lesselyong, PsyD
• **LOCATION:** Fairmont Village, Sunshine Village, Paseo Village

AYMEN B.



COMPUTATIONALLY COMPARING CBD

SUMMARY: The research will test different variants of CBD to find the cheapest and most neurointeractive variant of CBD through computational simulation of interactions between CBD and neurotransmitter/biopolymers. CBD is one of the drugs that require the highest dosages to produce psychoactive pain relief and relaxation effects, and producing more interactive CBD would decrease the dosage required to benefit from these effects while decreasing costs for both consumers and farmers of the drug. The result hoped for is identifying the variant of CBD that proves to be more interactive to humans while providing a cheaper holistic cost for growing and purchasing the drug through computational testing and models.

• **BASIS ADVISOR:** John Goodwin • **ON-SITE MENTOR:** Jeff Yarger • **LOCATION:** Arizona State University

MOKSHA D.



INTEGRATING RENEWABLES INTO THE ELECTRICAL POWER GRID: THE CURRENT PROBLEMS AND POTENTIAL SOLUTIONS

SUMMARY: From running the stove someone cooks on to the car they drive, everyone needs energy and power to efficiently run their life. As humans we have created highly dependent energy generation sources such as coal, nuclear, and gas, which accommodate the variations in our hourly energy demands. However, to reduce our carbon footprint, we are on an exciting journey to transition our energy sources to renewables, which include wind, solar, and hydro as early as 2050. While this transition is compelling, it comes with both engineering and economic challenges. Renewables, while environmentally friendly, have inconsistencies in their availability which fail to match hourly variations in energy demand. It is crucial to design a system which not only generates the required power but can store it as well. This leads me to my research question of how utility companies such as SRP can sustain their supply of energy during this progression into renewable energy by highlighting different aspects of renewable energy generation, the challenges in their accessibility, and providing solutions via industry research.

• **BASIS ADVISOR:** Bryce White • **ON-SITE MENTOR:** Dale Fox • **LOCATION:** Salt River Project

SHREEYA D.



TRIGGERING AN EFFECTIVE IMMUNE RESPONSE: CANCER IMMUNOTHERAPY

SUMMARY: In this project, I will be focusing on cancer immunotherapy, a therapy used to treat cancer patients that takes advantage of the components of the immune system to recognize and eliminate cancer cells. This will mainly be done by using checkpoint inhibitors and CAR-T therapy; these checkpoint inhibitors release the “brakes” on the immune system, allowing T cells to recognize and attack cancer cells more effectively across multiple cancer types. This methodology can provide insights into each unique patient’s individual cancer—its genetic makeup, its behavior, and its interactions with the immune system—which doctors can then use to determine the approach most likely to benefit a particular patient.

- **BASIS ADVISOR:** Johnson Truong • **ON-SITE MENTOR:** Dr. Prashant Sharma, Ph.D
- **LOCATION:** University of Arizona School of Medicine

AKHIL D.



ASSESSING DEVELOPMENT FINANCE INSTITUTION ACTIVITIES IN AFRICA

SUMMARY: This research project will deeply examine Development Financial Institution (DFI) investments in Africa. It will answer questions regarding the past, present, and future. What DFI activity already exists in Africa? Is DFI activity beneficial for developing economies in Africa? What changes can be made to streamline DFI investment? What is the future of DFI activity in Africa as economic nationalism and isolationism increases? Developing economies worldwide are at an inflection point. Globalization spearheaded by DFIs has ushered in a new era of economic growth, while also making these economies more volatile and their governments less effective in implementing policy. Africa is yet the most recent continent to undergo this phenomenon, with countries undergoing both massive infrastructural advancements and political corruption. Moreover, the rising tensions between the U.S. and China are only creating more tensions on the continent, with DFIs getting strongarmed to promote these hegemonies’ self-interest. It is critical to research the causes and effects of this phenomenon. The hoped result is that DFI activity becomes less beneficial to the economies the more they are influenced by the hegemonic battle between the U.S. and China.

- **BASIS ADVISOR:** Bryce White • **ON-SITE MENTOR:** Ravi Gupta • **LOCATION:** Ernst and Young

SURYA SAKETH E.



THE SENSYM PROJECT

SUMMARY: This research project seeks to pioneer an innovative approach to therapy by integrating artificial intelligence (AI) to decipher emotions from various forms of expression, including text, speech, facial cues, and drawings. The goal is to create a comprehensive tool that revolutionizes emotional intelligence assessment in therapeutic settings. Drawing on prior research in emotional analysis, sentiment detection, and facial expression recognition, this interdisciplinary study aims to bridge the gap between traditional qualitative methods and cutting-edge technological analyses. The project's significance lies in its potential to elevate therapy by giving therapists deeper insights into their clients' emotional states. Through precise analysis and AI-driven tools, therapists can gain a clearer understanding of their client's feelings and perspectives, enabling more tailored and effective interventions. Integrating technology, including real-time analysis of facial expressions, speech patterns, and artistic creations, opens new frontiers in mental health treatment. The research methodology involves exploring existing literature on emotional analysis in diverse mediums, from artwork to text, and incorporating technological advancements in AI-driven emotional intelligence tools. By understanding how different forms of expression connect to emotional states, the project aims to provide therapists with comprehensive and empathetic tools for personalized therapy. Findings from this study could revolutionize emotional intelligence assessment, fostering collaborative efforts with mental health professionals, technology developers, and academic communities. Ultimately, the research envisions enhancing the well-being and lives of individuals seeking mental health support through a novel, AI-driven therapeutic approach.

• **BASIS ADVISOR:** Camille Bennett • **ON-SITE MENTOR:** Isac Artzi, Ph.D. • **LOCATION:** Grand Canyon University

ANIRUDH G.



AN ANALYSIS OF THE EFFECT OF ARTIFICIAL INTELLIGENCE CHATBOTS ON HIGH SCHOOL STUDENTS

SUMMARY: Given the recent rise of chatbots such as ChatGPT, there has been a growing concern of the usage of these tools in academic environments, specifically high schools. The exploration of how these chatbots are used by high schoolers can provide insight into the future of these tools in educational institutions. Questions important to foundational research in this arena include: What percentage of high school students use ChatGPT and in what capacity? Do high school students believe that it is ethical to use AI tools (such as ChatGPT) to help them with assignments?

• **BASIS ADVISOR:** Suzanne Ungar • **ON-SITE MENTOR:** Emilia Gracia • **LOCATION:** Independent Project

YAJAT G.



UNDERREPRESENTATION OF MINORITIES IN SPINE DISEASE CLINICAL TRIALS

SUMMARY: Setting up clinical trials is a complicated process that requires lots of manpower and financial support. Implementing these clinical trials needs support from sponsors, which are limited and out of reach for smaller corporations looking to start their research. Another problem caused by the lack of sponsorship is the need for proper representation and sample sizes in clinical trials. This lack of minority representation can lead to improper treatment of certain groups, as diseases can affect different groups differently and cause unique symptoms. With this research, we will identify the extent of the problem and then develop potential solutions in addition to the ones currently established.

• **BASIS ADVISOR:** Dylan Crane • **ON-SITE MENTOR:** Sohail Daulat • **LOCATION:** Virtual via Rajesh P. Daulat, DPM

SAAHITHI I.



THE INFLUENCE OF SOCIAL DETERMINANTS OF HEALTH ON CARDIOVASCULAR DISEASE PROGRESSION WITHIN NATIVE AMERICAN POPULATIONS

SUMMARY: Cardiovascular disease is one of the leading causes of death in the United States among racial and ethnic minority groups. Health disparities are one of the few causes that lead to such high numbers in heart diseases. I will focus my research on Native American populations, a group historically impacted by health disparities. I will look into the impact of income/wealth gaps, education, social/community setting, health access and use, neighborhood and physical environment, and workplace. How do various social determinants of health in medical settings affect Native Americans with cardiovascular disease? Examining the impact of daily routines on potential life-changing diseases, the exploration aims to identify measures for mitigating these diseases. Additionally, I hope to acquire knowledge on methods to enhance healthcare access by diminishing disparities of interest.

• **BASIS ADVISOR:** Liz Mott • **ON-SITE MENTOR:** Jessica Hogan
• **LOCATION:** Arizona State University College of Health Solutions

DISHITA K.



EFFECT OF PARENT INVOLVEMENT IN THERAPY FOR CHILDREN WITH BEHAVIORAL ISSUES

SUMMARY: The questions I would like to answer are: Why is therapy involving parents more recommended for minors with behavioral health issues? How does family therapy compare to other forms of therapy available to minors? How does family therapy affect the child's behavioral health improvement? To determine an answer to my questions, I will be surveying the staff who work with children on their opinion regarding the effect of therapy with parents on the progression of the children.

- **BASIS ADVISOR:** Brittany Holtzman • **ON-SITE MENTOR:** Wendy L Pauker
- **LOCATION:** Banner Thunderbird Medical Center

ROHAN K.



IMPROVING SPEECH RECOGNITION TECHNOLOGY FOR PATIENTS WITH VOICE DISORDERS

SUMMARY: Speech recognition is an AI technology impacting our day-to-day lives. However, current models are biased towards healthy speech and do not perform well on tasks specific to disordered speech. The goal for my project is to piece together existing speech recognition models and fine-tune them to accommodate disordered speech. I will be analyzing audio data from the Dystonia and Speech Motor Control Laboratory at Harvard Medical School where speech recordings of patients with laryngeal dystonia and voice tremor are collected.

- **BASIS ADVISOR:** Bryn Sharp • **ON-SITE MENTOR:** Kristina Simonyan
- **LOCATION:** Harvard University, Dystonia and Speech Motor Control Laboratory

COLIN K.



THE COSTS AND BENEFITS OF INJECTIONS IN TREATING WET AGE-RELATED MACULAR DEGENERATION

SUMMARY: How do vitreoretinal injections for treating Wet Age-Related Macular Degeneration (WAMD) impact a patient's daily life? Do these injections help improve their vision? Do the benefits of getting injections outweigh the costs? How does a patient's vision loss affect their everyday functioning? What aspects of the patient's life (i.e. time spent driving to appointments, missed workdays, lost work hours) are mostly impacted by the demand of the injection treatment? If a patient has an unpaid caregiver, how does the treatment plan impact that caregiver's schedule? These are some of the questions that I am attempting to answer in my senior research project. During the course of my study, I will survey patients to gather data on the aforementioned questions. I will be working at Associated Retina Consultants (ARC) under the guidance of Dr. Welch.

- **BASIS ADVISOR:** Angelique Owanga • **ON-SITE MENTOR:** Dr. Matthew Welch and Dr. Clayton Kirk
- **LOCATION:** Associated Retina Consultants (ARC)

SRIMAYI L.



OPERATION TEAL: A BROADER LENS ON MILITARY SEXUAL TRAUMA AND ITS RELATION TO EASTERN AND WESTERN CULTURE

SUMMARY: How does the difference in the reports of sexual trauma faced in the military and the mental health effects compare between eastern and western cultures and the portrayal of their views on this issue? The title of my project is Operation Teal: A Broader Lens on Military Sexual Assault and its Relation to Eastern and Western Culture. I plan on collecting data derived from published sources and data reports from militaries of a group of both eastern and western countries, collecting rates of sexual trauma inside and outside of the military for each country and the resulting mental health rates. The rising number of sexual trauma cases in militaries across the world pose a significant threat to the mental health of military personnel, an issue that needs more awareness. The desired result is for there to be a statistical difference in the sexual trauma rates and resulting mental health issues between the eastern and western countries in order to find the vulnerable populations for this problem.

- **BASIS ADVISOR:** Thomas Carpenter • **ON-SITE MENTOR:** Dr. Rachel Larson • **LOCATION:** Arizona State University

BHUVI M.



UNDERSTANDING THE GENETIC CHANGES MEDIATING AFATINIB RESISTANCE IN ESOPHAGEAL ADENOCARCINOMA

SUMMARY: Although chemoresistance is a significant problem in cancer treatment, as resistance to a cancer therapy results in cancer-related morbidity, chemoresistance occurs more often with esophageal adenocarcinoma as specific targeted therapies have not been approved for esophageal cancer. Afatinib is a targeted chemotherapy for the Epidermal Growth Factor Receptor family and is effective until a resistant colony forms. The properties of the resistant colony are shown via an invasion assay. Differences in activated tyrosine kinase receptors between the parental and resistant esophageal adenocarcinoma can be found using a Phosph-RTK Dot Blot Array Kit. These differences will be confirmed through Western Blot Analysis and qPCR. The goal of this study is to identify growth-factor receptors that have been activated in a resistant colony to circumvent afatinib-mediated resistance.

- **BASIS ADVISOR:** Wendy Sandor • **ON-SITE MENTOR:** Timothy Fleming
- **LOCATION:** St. Joseph Hospital and Medical Center, Norton Thoracic Institute

PAYTON M.



A MISSION DESIGN TO ERIS: EXPLORING THE OUTER SOLAR SYSTEM WITH AN EMPHASIS ON TRAJECTORY ANALYSIS

SUMMARY: The origins of our world and our place in it has always been at the precipice of human imagination. Hence, many missions to explore our universe are proposed each year, but one of the biggest hindrances to these missions is the cost; one major way to cut costs is to minimize fuel consumption. This project will focus on comparing, contrasting, and designing different orbital trajectories to the dwarf planet Eris with the primary focus of minimizing fuel expenses. I focused on designing a space mission that would allow for a spacecraft with the appropriate instrumentation to be inserted into an orbit around Jupiter and subsequently Eris using Orbit Raising Maneuvers, a sequence of modified Hohmann Transfers and Plane Change Maneuvers. The research/data obtained from this project will be useful for future missions that are looking for fuel efficient trajectory maneuvers.

- **BASIS ADVISOR:** Akash Joseph • **ON-SITE MENTOR:** Joskua Xatini Carrillo Cuevas • **LOCATION:** Independent

ARNAB M.



EXPLORING THE GENOMIC EFFECTS OF PNPLA7 MUTATIONS ON CEREBRAL PALSY THROUGH RNA SEQUENCING

SUMMARY: Cerebral palsy (CP) is a prevalent, rare pediatric neurological movement disorder, with an incidence of 2–3 per 1,000 live births. While most cases are due to environmental factors like asphyxia, trauma, and infection, recent discoveries using revolutionary RNA genome sequencing technology provide researchers with a cost-effective way to look into the genetic causes of CP, leading to the discovery of many new causative genes (TUBA1A and CTNNA1). Recently, Dr. Michael Krueer's lab has identified PNPLA7 as a novel gene of interest for CP through whole exome sequencing. This research project aims to investigate the impact of damaging mutations in PNPLA7 on gene expression levels related to CP using RNA-Seq data analysis. The project seeks to unravel affected molecular pathways and explore potential implications for patients with PNPLA7 mutations. By collaborating with professionals at Phoenix Children's Hospital and the University of Arizona College of Medicine, this research endeavors to contribute to the cutting-edge field of bioinformatics in medicine and work towards improving the lives of children affected with CP.

- **BASIS ADVISOR:** James Kittredge • **ON-SITE MENTOR:** Peter Skidmore and Pritha Bisarad
- **LOCATION:** University of Arizona Department of Child Health, Krueer Laboratory

SOWMITHRA M.P.



SUSTAINABLE TRANSITIONS ACROSS URBAN WATER SYSTEMS

SUMMARY: This project aims to understand the push and pull factors of transitions to more sustainable urban water systems by looking at Phoenix, Miami, and Detroit. All three cities have various rates of success in implementing sustainable methods such as water conservation, climate resilient infrastructure, and water source diversification. I am focusing on the following questions: how comprehensive are current sustainability frameworks of urban water systems and how can they be improved in the context of various environmental and human factors such as nature-based solutions, migration, and climate change? Presently, the federal government is setting aside more money than it ever has before for water infrastructure. Making efficient and effective use of this money is highly important for the betterment of not only society itself, but also urban city planning. The intended result is to operationalize and identify three to five major sustainable transition markers. Additionally, it hopes to highlight regional differences and explain why one general system is inefficient.

- **BASIS ADVISOR:** Wendy Sandor • **ON-SITE MENTOR:** Dr. Margaret Garcia
- **LOCATION:** Arizona State University, Rob and Melani Walton Center for Planetary Health

JOHANNA P.



NECROTIZING ENTEROCOLITIS: PROVIDING EFFICIENT TREATMENT IN THE NICU

SUMMARY: Necrotizing enterocolitis (NEC) is a malignant condition that affects the colon, or large intestine, of newborns. The condition causes inflammation in the tissue of the colon, which can lead to bacterial invasion, cell damage, and necrosis. This can be life-threatening for newborns and has a high mortality rate of up to 50 percent in neonatology. Preterm babies, especially those with low birth weight, gastrointestinal immaturity, and severe NEC, are more likely to develop this condition. However, other risk factors, such as hypoglycemia or gestational diabetes, can increase the severity of symptoms or the onset of mortality. Despite the severity of the condition, the underlying biological mechanisms that cause NEC remain unclear, primarily due to the challenges presented by the lack of sample sizes, accurate models, and proper abdominal radiographs. Additionally, accurately diagnosing NEC in neonates remains a significant challenge. Early detection and diagnosis of the disease are crucial, but it is currently difficult due to a lack of understanding of the roles of genetics and inflammatory mediators, among other risk factors. Additionally, current treatments only address specific symptoms rather than targeting the underlying disease mechanisms. Therefore, there is a need to develop more effective treatment plans that can address the multifactorial nature of the disease. To effectively treat NEC, it is essential to identify how genetics, underlying biological mechanisms, and social factors influence the condition and account for its multifactorial nature. This approach can help provide targeted treatment that addresses the root cause of the gastrointestinal problem rather than just its symptomatic nature. By doing so, we can improve the prognosis for newborns affected by this condition. Through this internship, I hope to gain a better understanding of necrotizing enterocolitis in preterm babies so that we can improve our ability to recognize and diagnose the disease early and develop lucrative treatment plans. This will help us reduce the mortality rate of NEC and provide improved care to neonates.

- **BASIS ADVISOR:** Kaitlyn Johnson • **ON-SITE MENTOR:** Melissa Halpern, Ph.D
- **LOCATION:** University of Arizona College of Medicine

RHEA R.



AFTER HOW MUCH PRACTICE TIME DOES A DANCE ROUTINE BECOME FULLY INTEGRATED INTO MUSCLE MEMORY?

SUMMARY: Ever wonder how you can still remember parts of that school dance routine from five years ago? With enough repetitions, the human body automatically adapts to the motions and stores the motor information for later use. Muscle memory serves as the primary method that dancers effectively commit choreography to memorization and allows them to focus on adding on other elements such as facial expressions and confident energy that enhance their dancing and create a visual spectacle. Through my research, I aim to tackle the muscle memory process through researching approximately how long it takes a dancer to commit a dance to memory. I will be taking into account how long each dancer has been dancing, the age of the dancer, and the different styles of dance they have been trained in. I desire to survey my sample size to get a rough idea of these characteristics that pertain to each respondent. I strive to teach a routine to my subjects and record their learning process, including the amount of time each person believes they take for the choreography to be ingrained into muscle memory. This research can have practical applications to not only dance but also activities such as physical therapy or playing an instrument. It may be able to provide a rough estimate of recovery time or practice hours required to optimize the quality of performance. My research goal is to conclude the best approximation of repetitions and practice time needed to advance dance skills that can be tailored to different performers based on unique characteristics in order to help a dancer improve their abilities in learning, performance and beyond.

- **BASIS ADVISOR:** Suzanne Ungar • **ON-SITE MENTOR:** Trinity Gracia • **LOCATION:** Diamond Dance Works

TAARA S.



OUT OF THIN AIR: ATMOSPHERIC WATER CAPTURE AND THE FUTURE OF WATER HARVESTING

SUMMARY: With water scarcity taking the world by storm, millions of people lack access to clean drinking water and proper sanitation. Developing countries and countries with tendencies for droughts and water shortages are unable to accommodate their growing population. Many innovative water conservation methods are emerging to combat these challenges, however, many are impractical in certain climates or regions, not affordable to developing countries, or not long-term solutions. Atmospheric Water Capture is a promising alternative to combat water scarcity by directly capturing moisture from the air and harvesting it as fresh water, using little energy and allowing for various settings of operation. There are several ways to perform AWC, from using solar-powered moisture harvesters to using vapor compression cycles. In my project, I experiment with desiccant materials, which can directly collect humidity in the air. I test different desiccants in two setups: a vertical dehumidifier and a horizontal dehumidifier. After running adsorption experiments in each setup, I compare the adsorption capacity and kinetics of each material to determine which setup is most efficient for AWC, as well as observe what can be improved in the setups for the large-scale manufacturing of dehumidifiers.

- **BASIS ADVISOR:** Wendy Sandor • **ON-SITE MENTOR:** Dr. Shahnawaz Sinha
- **LOCATION:** Arizona State University Laboratory

NITHYA S.



BREAKING BARRIERS: ANALYZING INCOME-BASED DISPARITIES IN ACCESS TO BIRTH CONTROL IN ARIZONA FOR EQUITABLE REPRODUCTIVE HEALTHCARE

SUMMARY: This research project investigates income-based disparities impacting access to birth control in Arizona, perpetuating unequal reproductive healthcare. This topic is particularly pressing as the political climate in Arizona is so divided, making healthcare policies very inconsistent. Drawing from past research, my project will explore several barriers to quality reproductive healthcare that low-income women face such as insurance, location, and transportation. I will also examine recent developments in making birth control more accessible such as Title X funding and Medicaid expansion. By the end of my research, I hope to crack down on the biggest issues blocking financially disadvantaged women in Arizona from accessing birth control in order to call for policy changes.

- **BASIS ADVISOR:** Chuck Stewart • **ON-SITE MENTOR:** Paula Lehn
- **LOCATION:** Affirm Sexual and Reproductive Health for All

ISHITA U.



DEVELOPING A GAME PROTOTYPE TO EDUCATE WOMEN IN SELF DEFENSE

SUMMARY: This project's main goal is to design a prototype for a mobile game that educates women on how to defend themselves in different situations. I plan on building a simulation-like game with choices of how a woman could navigate an attack. My site placement is at Paradise Valley Community College with Professor James Loop. The main question of this project is how to make a simulation game interactive enough so the users can learn how to defend themselves. I wanted to do this project to help women who live in circumstances where they don't have access to proper self-defense education or classes, such as in rural villages or small third-world countries. The hoped result of this project is a prototype that works well with detailed graphics. In the future, I hope to send my prototype to companies to develop it into a marketable simulation game.

- **BASIS ADVISOR:** Camille Bennett • **ON-SITE MENTOR:** James Loop
- **LOCATION:** Paradise Valley Community College

KOUSHITA GOURI REDDY V.



S.E.T. IN: SEX EDUCATION TRANSFORMATION IN INDIA

SUMMARY: Growing up in India, I was aware of how purity culture affected how women were viewed. My senior research project aims to answer what curricula could India use to teach sex education to bridge the gap between culture/religion to the education sector in means of decreasing the importance and misinformation that India follows on purity when defining a person. Later, doing research, I realized that India has a cultural and religious mythology that boasts a rich heritage of sexual awareness seen through their historical literature and sculptures in temples, thus leading me to the question of how a country that was once open about sex, shifted to a perspective focusing heavily on purity. The significance of sex education cannot be overstated especially in India, a founding member of the United Nations, as it fails to answer article 26 of the "Universal Declaration of Human Rights [which] states: 'Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms'" (Sexual Education – Question of Morality or a Human Right?, 2019). In order to collect data, I will collect the data posted online such as population tracking, historical understanding about sex education, overviews of the government's response to the lack of a sex education curriculum, and curricula from other countries with similar conservative views which I will then combine to create a curriculum for India.

- **BASIS ADVISOR:** Jen Semtanick • **ON-SITE MENTOR:** Dr. Bhakti Mamtara and Allison Stewart
- **LOCATION:** University of Arizona and Arizona State University, hybrid

NEEL V.



CORPORATE HEALTHCARE: A CRITICAL ANALYSIS OF THE BENEFITS AND RISKS OF CORPORATE INVOLVEMENT AND STRATEGIES TO PRESERVE QUALITY CARE

SUMMARY: Many corporate transactions in healthcare face backlash due to the unwanted standardization of medical practices. I will use CliftonLarsonAllen's benchmarking tools to identify industry trends of healthcare organizations. Using this data, I will analyze financial motivations behind consolidation within the healthcare industry and explore how these private acquisitions affect how costs are managed in corporate healthcare. Furthermore, I will use my research to investigate if these activities have led to a change in patients' access to different care opportunities. I hope to suggest a model that would leverage the benefits of corporate/private equity backing while sustaining high-quality, personal care.

• **BASIS ADVISOR:** Bryce White • **ON-SITE MENTOR:** Christine (Chris) Abell • **LOCATION:** CliftonLarsonAllen LLP

ELIZABETH V.



EXPLORING THE EFFECTS OF DIFFERENT ASPECTS OF SCHOOL COUNSELING ON STUDENTS

SUMMARY: This project looks at the different methods used within school counseling, as well as the effects they have on students. By looking at pre-existing studies, as well as interviewing school counselors and school psychologists, I aim to answer questions like "how do different therapeutic techniques affect the lives of students?" and "why is it important to allocate resources to these systems?" By working on this project, I hope to gain a better understanding of this area of psychology and spread awareness regarding the importance of access to different mental health resources within school systems.

• **BASIS ADVISOR:** Aj Feffer • **ON-SITE MENTOR:** Kelly Hernandez-Villarreal • **LOCATION:** Ridge Zeller Therapy

AYUSHI Y.



BEYOND THE SCREEN – EXPLORING THE IMPACT OF VIOLENT CHARACTERS IN PSYCHOLOGICAL THRILLERS ON MENTAL HEALTH STIGMA

SUMMARY: As the film industry gains popularity, an intriguing trend emerges—the increased use of psychopathic characters to craft captivating stories. The manner in which psychopaths are portrayed in the media leads to the creation of many misconceptions regarding those with mental disorders in general. In order to find what traits cause psychopaths to be associated with other mental disorders as a whole, I ask the question, what traits lead the audience to view a character as “psychopathic” and how do these traits compare to other personality disorders? Through my research, I hope to provide insight regarding informed media portrayal to help create a more empathetic society towards those with mental health conditions.

- **BASIS ADVISOR:** Suzanne Ungar • **ON-SITE MENTOR:** Dr. Katherine Brazaitis
- **LOCATION:** Mountain View Mental Health, online

EDWARD Z.



ENHANCING SAFETY AND EFFICIENCY IN SCHOOL PICK-UP-DROP-OFF THROUGH SIMULATION-BASED TRAFFIC MANAGEMENT

SUMMARY: School pickups are almost an ubiquitous experience for on-campus K–12 students across the United States. In the morning and after school, parents come to pick up and drop off students (or students drive themselves) through a shared lane: the Pick-Up-Drop-Off (PUDO) lane. Because of the influx of traffic, the capacity of the lane is often unable to handle such cases. Despite being such a common problem, most schools have yet to address this issue, so potential solutions remain on the table. This research, in particular, focuses on simulating methods to tackle this challenge with optimization of different combinations of parameters not limited to the cars' waiting time, travel time, queue length, idling carbon emissions, etc. to attempt to propose new solutions to reduce these specified objectives. Using these simulations, we can develop more sustainable, resilient, and efficient cybernetic systems for school pickups, and hopefully, change BASIS Phoenix's and the surrounding communities' pickup lanes, for the better.

- **BASIS ADVISOR:** Kay Yoo • **ON-SITE MENTOR:** Xuesong Zhou
- **LOCATION:** Arizona State University AI + Transportation Lab

TYLER H.

ORBIT SYNCING MANEUVERS

SUMMARY: As humanity progresses to a Type I civilization on the Kardashev scale we will continue to explore our star system with Mars being a primary point of interest. It is imperative to establish effective systems of transport with optimized orbital trajectories. To form a sustainable, long-term commitment to Mars, we must establish a Mars international Space Station (MISS) to serve as the foundation of our commitment. This project is an investigation into the numerical and analytical techniques required to optimize spacecraft reentry dynamics for orbital insertions, rendezvous, and synchronization around celestial bodies, which will be vital for the transportation of resources to the MISS.



IN LOVING
Memory
OF
TYLER HUGON,
AN ASPIRING
PHYSICIST
AND A DEVOTED
FRIEND

- **BASIS ADVISOR:** Akash Joseph • **ON-SITE MENTOR:** Krystian Ojeda Confeiteiro
- **LOCATION:** Embry Riddle, Daytona Beach, remote



Phoenix SENIOR RESEARCH PROJECTS

SNIGDHA C.



KNOWLEDGE OF FOOD SUSTAINABILITY PRACTICES AND HIGH SCHOOL STUDENTS' LIKELIHOOD OF SELECTING ETHICALLY PRODUCED PRODUCTS – IS THERE A CORRELATION?

SUMMARY: This research project aims to find and explore the extent of a correlation between high school students' inclination toward selecting ethically labeled food products and their performance on a subsequent test focused on food sustainability practices. This project's implications contribute valuable insights into the consumer behavior of adolescents, particularly in the context of ethical consumption. The findings could prove beneficial for businesses and organizations seeking to promote sustainable and ethical products, shedding light on the preferences and awareness of high school students in this regard. Additionally, this research addresses a notable gap in existing knowledge, emphasizing the need for educational interventions to enhance understanding and awareness of food sustainability practices among high schoolers. The focus is on 9th to 11th graders, in consideration of their growing emphasis on advocacy and constructive problem-solving, signaling a shift in preferences compared to the spending habits of the present dominant generation. The hope is to discover a positive correlation between high schoolers' likelihood of choosing ethically labeled food and their performance on the subsequent quiz, reinforcing the importance of ethical consumption in this demographic.

- **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Nile Bunger
- **LOCATION:** Arizona Asian American Native Hawaiian and Pacific Islander for Equity (AZ AANHPI for Equity)

SREEVARENYA J.



A QUANTITATIVE ANALYSIS ON THE RELATIONSHIP BETWEEN METHODOLOGY OF CARE AND NURSE BURNOUT IN THE CONTEXT OF NEONATAL ABSTINENCE SYNDROME

SUMMARY: With the rise of an opioid epidemic in the United States, there have been an increasing number of cases where women continue using drugs during their pregnancy. This results in a condition commonly known as Neonatal Abstinence Syndrome where babies experience severe drug withdrawal symptoms and are required to stay in a specialized care unit (NICU) for an indefinite period of time. Based on the severity of the withdrawal, pharmacological and nonpharmacological treatment combined with decreased environmental stimulation is initiated. However, both approaches require significant time and effort put in from the medical staff and care technicians. Of the medical team, nurses play an important role in the care and improvement of these babies. Previous literature on the subject of Neonatal Abstinence Syndrome has suggested that there are various factors that may make nurses caring for an NAS baby a positive/negative experience, however, there have been no studies that have quantified burnout in nurses that work with NAS babies. This poses the question of: How does risk of burnout differ between nurses that work with Neonatal Abstinence Syndrome in two institutions with different models of care? The ultimate goal of this research study is to understand whether different institutional practices can affect the rate of burnout in nurses that work with NAS babies.

- **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Carolyn Burns
- **LOCATION:** Guidepost Montessori of North Scottsdale

SINCHANA K.



HOW HAS THE PREVALENCE OF TOXIC BEHAVIORS IN ROMANTIC RELATIONSHIPS PORTRAYED IN HINDI ROMANTIC-COMEDY MOVIES EVOLVED FROM 1994–2023?

SUMMARY: The Hindi film industry, commonly termed Bollywood, is the largest in the world, with an approximate 1500–2000 films released annually, compared to less than 500 films by Hollywood. With its wide audience, Bollywood has a strong influence in the film markets, making it important that they display healthy behaviors and relationships in their films. Toxic behaviors, defined as, "Behaviors that make you feel unhappy, including but not limited to disrespect, dishonesty, controlling behaviors, or a lack of support," are prevalent in the film and media we consume everyday (Healthline). In this senior research project, I will be studying the evolution of toxic romantic behaviors in the Hindi film industry. This paper will answer the question of: How has the prevalence of toxic behaviors in romantic relationships portrayed in Hindi romantic-comedy movies evolved from 1994–2023?

• **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Aakriti Agrawal • **LOCATION:** The NonProfiting Org

PRERNA K.



PSYCHOLOGICAL RESPONSES TO INJURY RECOVERY IN HIGH SCHOOL ATHLETES

SUMMARY: The prevalence of injuries within high school athletes continues to expand as pressures, competition, and expectations arise for athletes. Despite the physical recovery and return, the mental and psychological recovery and reset plays a vital role in an athletes success upon their return. Typically, once an athlete is injured, most attention is brought to their physical recovery but it has been expressed through past research that their mental recovery needs similar attention. Past research has studied how this willingness is impacted by factors of severity of injury or different stages of rehabilitation, but a common factor that alters the pressures faced by high school athletes in specific is the level of competition they compete in. This study aims to determine how the psychological willingness of high school athletes to return to their sport post injury differs as dependent on competition level.

• **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Dr. Steven Poon and Carter Jones
• **LOCATION:** Mayo Clinic Sports Medicine and Orthopedics Department

AANAND M.



“DID HE JUST DO THAT BY HIMSELF?”: EVALUATING THE ABILITY OF ADAPTED RIDE-ON CARS TO INCREASE INDEPENDENCE IN CHILDREN AGES 6–8 WITH DOWN SYNDROME

SUMMARY: Children with Down syndrome ages three and above face numerous complications regarding independent mastery motivation (the ability to independently try to solve a challenging problem). Consequently, the adapted ride-on toy car is being introduced as a novel method of “therapeutic play” to address motor and social delays in disability-affected pediatric populations. In addition, the car addresses the need for pediatric power mobility devices, which cost thousands of dollars and take years to receive. Although the overwhelmingly positive effects of these cars' have been found amongst children with Down syndrome ages 1–3, this study aims to address the absence of research surrounding the effects of ride-on cars on changing independent mastery motivation in children ages 6–8 with Down syndrome, an age range where children are still nurturing vital developmental milestones. Therefore, this study aims to provide insight into the effects of consistent “adapted ride-on car” use in improving independent mastery motivation in children with Down syndrome ages 6–8.

- **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Robin Lea-Amos
- **LOCATION:** GiGi’s Playhouse Phoenix (Down Syndrome Achievement Center)

VEDIKA P.



COMPARING DROUGHT INTEREST BETWEEN PHOENIX AND TUCSON USING INTERNET TOOL GOOGLE TRENDS

SUMMARY: This project aims to compare the levels of drought and water conservation interest between the two cities of Phoenix and Tucson in Arizona during the summer of 2023. Last summer was one of Arizona’s most intense summers yet. According to the Arizona Republic, the temperatures in Phoenix have been setting record-breaking temperatures every day and one of the driest monsoons ever. Additionally in the past, Arizona has had a track record of lacking a sense of emergency when it comes to the drought and that has affected many Arizona citizens today. On the other hand, Tucson, Arizona is known to be a more water-conservative city than Phoenix. As drought intensity in Arizona increases, it becomes more important to measure the interest in this phenomenon of each city’s residents. Drought interest can be measured using Google Trends, an internet tool that measures the amount of searches a certain word has been searched up in a certain area. By using Google Trends and key terms related to droughts and water conservation, the interest can be measured by seeing the relative number of searches in each city. This data can be used in the future to increase participation in water conservation and concern over the drought.

- **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Nile Bunger
- **LOCATION:** Arizona Asian American Native Hawaiian and Pacific Islander for Equity (AZ AANHPI for Equity)

TEJASVI S.



FACTORS INFLUENCING CONSUMER BEHAVIOR REGARDING E-WASTE MANAGEMENT

SUMMARY: Electronic waste, commonly referred to as e-waste, has emerged as a pressing global concern as societies become increasingly reliant on electronic devices. E-waste essentially consists of every electronic device that has been disposed of because the device had stopped working or because the consumer has chosen not to use it anymore for various reasons such as wanting a device upgrade. Given the surge of tech companies in Phoenix, Arizona, this research focuses on students from Arizona State University (ASU) and the Maricopa Community Colleges, the most attended colleges in the Phoenix metropolitan region. In this research, a survey is distributed among undergraduate students from various backgrounds in classes related to sustainability and biology, and aims to provide comprehensive insights into what factors, i.e. demographics, prior knowledge, access, etc. play a role in whether or not one participates in e-waste management. This survey focuses specifically on personal electronic devices (phones, laptops, video game consoles) for the purpose of data collection. By understanding students' perspectives, the research aims to contribute valuable insights into shaping effective e-waste management strategies in this dynamic and growing technological landscape.

• **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Terry Edgington • **LOCATION:** Banner Thunderbird Medical Center

KASHISH S.



CULTURE AND MENTAL HEALTH: THE RELATIONSHIP BETWEEN INDIVIDUALISM/COLLECTIVISM AND CHANGE IN WELLBEING

SUMMARY: Teenagers, especially those aged 14–17, are in the phase of middle adolescence, which makes them vulnerable to mental health struggles as they age. This middle adolescence is also characterized by the pushing of boundaries for more autonomy and a deeper perception of feelings and emotions. This challenge of parental authority and boundaries makes teenagers more prone to lower psychological well-being. Thus, my research question is "How do individualism and collectivism relate to personal psychological well-being amongst high schoolers aged 14–17 of various ethnicities in a college preparatory high school in Phoenix, Arizona?" The gap addressed by my research is the previously unaddressed gap of teenagers in high school. Many scholarly articles regarding individualism and collectivism in relation to well-being center around young adults, but no articles have examined the impact of the two societal characteristics on high schoolers' well-being. According to the Triandis and Gelfand theory, there are two dimensions of both individualism and collectivism: the horizontal and vertical dimensions. This project will evaluate the link between community models and psychological well-being through a survey method. The research will also look at how individualism and collectivism influence children in adolescence, especially when looking at differences across ethnicities. The anticipated value of the research project is that certain dimensions of individualism and collectivism, like horizontal individualism, will positively influence wellbeing and others might harm wellbeing or have no impact on wellbeing. This will also look at how individualism and collectivism influence children in adolescence, especially when looking at differences across ethnicities.

• **BASIS ADVISOR:** Amy Anderson • **ON-SITE MENTOR:** Susan Levy • **LOCATION:** Native Health Central

PRIYA V.



COVID-19 ANXIETY, EMOTIONAL LABOR, AND BURNOUT IN COMMUNITY HEALTH PROVIDERS

SUMMARY: This project aims to connect the well-established relationship between burnout and emotional labor to the concept of COVID-19 anxiety. Burnout refers to feelings of emotional, physical, or psychological exhaustion caused by prolonged work-related stress. Emotional labor refers to the way that people may fake or mask their emotions in order to portray the reactions that are expected of someone in their position. Finally, COVID-19 anxiety refers to feelings of stress or anxiety around the topic of COVID-19 as it exists in the present day (it is important to note that this does not refer to feelings of stress that someone may have felt during times of quarantine or restriction). As COVID-19 has been declassified as a health emergency and the psychological effects of the pandemic begin to die down, healthcare workers are caught in between seeing COVID patients regularly and wanting to return back to normal life. Therefore, it is important to study the psychological burden on healthcare workers as society moves forward beyond the pandemic, as this information will be vital to supporting healthcare workers in the future after such a long period of stress and unsafe patient ratios. Community health workers were hit particularly hard by this, as they are already under extra stress by working daily with struggling and vulnerable populations. The pandemic increased the number of patients coming to community health centers, and as restrictions are lifted, community health programs continue to work to return to normal. This study will survey community health workers at MHC Healthcare, the longest-serving community health organization in Arizona. The answers to the survey will be used to determine the correlations between emotional labor, burnout, and COVID-19 anxiety, along with the eight subscales that fall within emotional labor and burnout. Additionally, interviews will be used to determine more causal connections between these concepts, and provide a more qualitative look at this concept.

- **BASIS ADVISOR:** Amy Anderson
- **ON-SITE MENTOR:** Lisa Webster (MHC Healthcare) and Kylene Price (HonorHealth DVMC)
- **LOCATION:** HonorHealth Deer Valley Medical Center (site placement) and MHC Healthcare (research sponsor)



The teachers, administrators, staff, and executive leadership of the BASIS Charter Schools network **commend all of our seniors for their perseverance** in their research, and for their hard work throughout their BASIS Charter School journey. We give **our most heartfelt congratulations** to them for their achievements thus far, and these projects are only the beginning!



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