

Senior Projects

2023–2024

BASIS FLAGSTAFF

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



Flagstaff SENIOR PROJECTS

AARON B.



BECOMING IRONMAN

SUMMARY: In my project, I plan to train for and complete an Ironman triathlon and while doing so, discover how an ironman will affect the mental and physical state of an athlete. As well as uncover what it takes to complete an Ironman triathlon. I also plan to learn what challenges and fears an athlete faces when training for one. An Ironman is one of the hardest endurance races ever and completing one gives insight into who you are and what you are able to accomplish. During this project I will be training for the Ironman in Flagstaff, which is an optimal place because of its high elevation. To learn about an Ironman triathlon, I will document the training that goes into it and the outcome of racing in Ironman Texas. Through this project I hope to learn about the challenges an Ironman presents and how to accomplish goals that at first may seem impossible.

• **BASIS ADVISOR:** Andrew Robarge • **ON-SITE MENTOR:** Deb Ledington • **LOCATION:** Flagstaff, AZ

NATHAN C.



MONITOR, MANAGE, EMPOWER: CARDIAC TELEHEALTH SENIOR RESEARCH PROJECT

SUMMARY: Over the past decade, telecardiology has been transforming medical treatment. From allowing for better patient monitoring to lowering costs, telecardiology provides benefits for all cardiology patients. But how can telecardiology benefit the Northern Arizona community? This research project will utilize Northern Arizona Healthcare's telecardiology pilot study to review how telecardiology may specifically aid Northern Arizona. This will be done by analyzing patient surveys, monitoring data, and faculty interviews. The results will help NAH understand how telehealth and telecardiology may improve patient health and satisfaction. My hope is that this project demonstrates the benefits telecardiology and telehealth may provide for Northern Arizona, bringing more necessary healthcare to the community.

• **BASIS ADVISOR:** Amy Green • **ON-SITE MENTOR:** Floye Bradford • **LOCATION:** Northern Arizona Healthcare

DELANEY F.



A DEEP DIVE INTO THE BLUE WRAP PROJECT: SUSTAINABILITY AND HUMAN CONNECTION IN MEDICINE

SUMMARY: Medical waste is no joke. Not only can the cost of waste disposal and single use materials be passed on to patients in the dreaded hospital bill, but the environmental impacts are also formidable. One of the most prevalent materials in hospitals is a plastic-based fabric called blue wrap. This blue wrap is used to protect the sterile field, so it can be found in most operating rooms. The issue is that after being used only one time, the blue wrap goes straight in the trash, adding up nationally to an estimated 1,045 tons of plastic every day. But what if we could change that? In 2019, Nurses at Northern Arizona Healthcare started collecting the blue wrap to sew into bags, calling their work "The Blue Wrap Project." Now, I get to work with those nurses to continue the project. I am working to educate the hospital leaders and Flagstaff community at large about the importance of the Blue Wrap Project, and hospital sustainability as a whole. This will be done through interviews with community members, and the creation of articles, potentially for the Arizona Daily Sun and The Arizona State Board of Nursing.

• **BASIS ADVISOR:** Rachel Joiner • **ON-SITE MENTOR:** Paula McAllister • **LOCATION:** Northern Arizona Healthcare

DIEGO H.



ASSESSING NUTRITIONAL KNOWLEDGE IN A NCAA DIVISION 1 PROGRAM

SUMMARY: For success in college sports and higher level athletics in general, training and nutrition go hand in hand. However, with the rise of social media there have been many misconceptions that one size fits all when it comes to an athlete's nutrition. Without guidance, misinformation leads to insecurity in athletes not reaching their goals. This is why it's important for a university to have a registered sports dietitian on campus. They can work with athletes on all levels and have personal programs with them to achieve whatever goals they have. This is a profession I want to follow one day and my internship project will help with this. I will be interning at Northern Arizona University's student athlete center for their sports dietitian. My goals for this internship is to one, learn more about nutrition and specifically sports nutrition to a level where I can comfortably talk about it and two, get experience with responsibilities a sports dietitian has. At the end of my internship I will take the knowledge I got and teach a lesson with my internal advisor about basic nutrition for people in general. This project will give me an opportunity to get a head start preparing for my career and I'm hoping it opens some doors for me in meeting people of the same profession.

• **BASIS ADVISOR:** Grace Eversaul • **ON-SITE MENTOR:** Joseph Gatewood • **LOCATION:** Northern Arizona University

REAGAN M.



HOMELESSNESS: A POLITICAL DIVIDE

SUMMARY: No matter where you go there will always be homeless individuals. The presence of these individuals tends to impact tourism and create what looks like an unsafe environment. Due to this, many cities are trying to solve homelessness and each city has a different way of dealing with the unhoused population. These ideas being passed by cities can be categorized into either punitive, which is more punishment based, or non-punitive, which is less punishing. By looking into the trends of each method we can compare it to the cities using the same versus the opposing method we can assume which way is more successful to get and keep the homeless population off of the streets. Examining both the short- and long-term impacts allows us to look more closely at other factors, such as rehabilitation, employment, and a criminal record. This allows us to gain a new understanding about what it really means to decrease homelessness and the varying success rates of previous attempts.

• **BASIS ADVISOR:** Andrew Robarge • **ON-SITE MENTOR:** Coral Evans • **LOCATION:** Mayor's Community Policy Trust

SEDONA O.



CPR QUALITY METRICS AFTER REAL-WORLD USE OF ZOLL DEFIBRILLATORS AND SIMULATIONS

SUMMARY: Great strides have been made in the field of medicine. We have gone from barbers performing amputations to robots acting as surgeons. Humanity's accomplishments come from people always seeking out further progress and refusing to settle. Flagstaff Medical Center (FMC), my hometown hospital, embodies this resolve. With more than half of in-hospital cardiac arrests ending in death, it is no wonder that they invested in the Zoll R-Series Defibrillator. Like normal defibrillators, Zoll can provide an electrical current to a patient in an attempt to restore heart activity. What makes Zoll unique is the added real-time feedback feature. CPR metrics are tracked and given to healthcare professionals as they attempt to help the patient, and are then stored for later review. Of course, even something as advanced as this means little without having the initial education. So FMC also provides its staff with the Resuscitation Quality Improvement (RQI) program: CPR training that believes short time intervals between lessons results in longer skill retention. To find out if Zoll was worth the investment and if RQI is working as intended, I will be performing data analysis on these two areas using information already stored by the hospital. My research could lead to improvements at FMC in CPR practice and training, as well as help contribute knowledge to the field of cardiology.

• **BASIS ADVISOR:** Jessica Buckley • **ON-SITE MENTOR:** Floye Bradford & Jessica O'Neil
• **LOCATION:** Northern Arizona Healthcare

AVERY P.

UNBLOCKING INNOVATION: REMOVING BARRIERS FOR PHYSICIAN SPONSORED INVESTIGATIONAL DEVICE EXEMPTIONS



SUMMARY: When faced with the decision of an invasive surgery versus modifying medical devices, physicians often choose to modify medical devices in off-label, or unapproved, ways. Due to this off-label use, companies, hospitals, and physicians face many legal liabilities and risks. To lower liability risks, physicians are able to submit a Physician Sponsored Investigational Device Exemption (PSIDE) for FDA approval. However, creating a PSIDE increases the physicians workload with what information needs to be supplied and approved. Creating a way to reduce barriers around PSIDEs is pertinent to allow for more immediate medical operation when there are no devices in a certain field. In order to find a way to make it easier for physicians to apply for PSIDE approval, I will be researching what companies can supply physicians for PSIDE approval on an individual basis and what consistent information can be provided overall for Investigational Device Exemption (IDE) approval. Doing research through W.L. Gore will allow me to create a meaningful solution in part with a company that supplies numerous medical devices. I am hoping to lower individual PSIDE requirements by creating a template on what information can consistently be provided and what companies can supply for individual cases while gaining experience working with W.L. Gore.

• **BASIS ADVISOR:** Bert Langmade • **ON-SITE MENTOR:** Roberta Bloss • **LOCATION:** W.L. Gore

LUKE P.

THE ROAD TO PILOT PROFICIENCY



SUMMARY: For my whole life I have desired to become a pilot, and recently I've been working on achieving that goal. For my project most of my effort will be spent on attaining a private pilot's certificate. My flight instructor is Fred Gibbs, a gold seal CFII who has received a NAFL master flight instructor award. Gold seal requires a good pass rate of students on checkrides, and CFII means he is qualified to instruct for both private pilot and instrument rating purposes. I will gain the legally required 20 hours of flight instruction, 10 hours of solo flying time, 3 hours of night flying, 3 hours of simulated instrument time, and 3 hours of cross country. The FAA requires 40 hours to be able to attain a license, however in the modern era of aviation with more complex aircraft and airspace, most pilots get their certification in 60 hours. Beyond attaining a license I will be working to find the qualities that make for a better pilot.

• **BASIS ADVISOR:** Luke Calhoun • **ON-SITE MENTOR:** Fred Gibbs • **LOCATION:** Flagstaff Airport

ISABELLE S.



EFFECTS OF CHUG+ARGININE ON METHICILLIN-SUSCEPTIBLE STAPHYLOCOCCUS AUREUS (MSSA) AND OTHER MICROBES ASSOCIATED WITH DENTAL CARIES

SUMMARY: Recently, more and more pathogens have been becoming antibiotic-resistant such as *Candida albicans* (*C. albicans*), *Streptococcus mutans* (*S. mutans*) species, and methicillin-resistant *Staphylococcus aureus* (MRSA)/methicillin-susceptible *Staphylococcus aureus* (MSSA). Thus, it is necessary to turn to alternative solutions to cure certain diseases or inhibit the further growth of these harmful pathogens. One solution that the lab, a biochemistry lab located at NAU, where I am interning, investigates is the usage of ionic liquids/deep eutectic solvents (IL/DES). Ionic liquids are molten salts known to treat specific antibiotic-resistant pathogen biofilms. My lab aims to use the IL that consists of choline, gerinate, arginine, and a hydro carbon (CAGE+Arg). Biofilms are a collection of microbial cells that are enclosed in an extracellular polymeric substance matrix. They are known to survive under many environmental stressors and initiate/progress the growth of dental decay. The overall goal of our project is to develop IL/DES formulations that are effective against microbial biofilms of oral pathogens that contribute to the decline of oral health. To achieve this goal, we plan to incorporate different concentrations of arginine (a molecule reported to affect positive oral health outcomes) into the new IL/DES (which are materials known to be very effective at reducing the viability of microbial biofilms) and investigate which concentration is most effective in eliminating the pathogen.

• **BASIS ADVISOR:** Tom Talasek • **ON-SITE MENTOR:** Andy Koppisch • **LOCATION:** Northern Arizona University

KEI S.



STOP THE BLEED: A SURVEY OF EFFICACY

SUMMARY: Trauma victims can bleed out in minutes, often before an ambulance arrives. After the uptick in U.S. mass shootings, programs like "Stop the Bleed" were created across the country, based on military tourniquet techniques. Such programs ensure that bystanders are trained to be able to stop bleeding when emergency personnel may take too long. Despite widespread training program installation, prior research reveals challenges in bystander efficacy during emergencies. I aim to build on that research and specifically work on implementing the improvements in my own city of Flagstaff. Because of my focus on "Stop the Bleed" programs in Flagstaff, I have decided to collaborate with the team at Northern Arizona Healthcare Trauma center who has a team currently providing training all across Flagstaff. This will ensure me direct access to resources and will aid in implementing research findings for immediate impact. I will also be partnering with my peer Sarah W., which allows us to broaden our goals; she'll handle survey design and distribution as an intern, while I focus on analysis and research. My research aims to identify obstacles and propose enhancements for program effectiveness based on the results of her survey. We have chosen surveys as our method of research as it will reach a large audience of trained and prospective individuals during our research period. Overall, I aim to identify ways training programs have fallen short in reaching their audience and contribute to a revised program, ensuring that bystanders feel prepared and confident in addressing emergencies.

• **BASIS ADVISOR:** Trent McDowell • **ON-SITE MENTOR:** Shawn Bowker & Paula McAllister & Floye Bradford
• **LOCATION:** Northern Arizona Healthcare

EDWARD W.



HUMANS VS. AI: CAN WE TELL THE DIFFERENCE MUSICALLY?

SUMMARY: With major advances in artificial intelligence, AI generated music is becoming increasingly difficult to distinguish from original human compositions, posing a threat to the livelihoods of composers across all genres of music. This project aims to answer three main questions: 1) Does increased knowledge of music theory facilitate the identification of AI music? 2) Can people tell the difference between AI music and manmade music? 3) Does AI music evoke weaker emotional responses in people compared to original compositions? I will be using ten sets of music from human composers from specific genres, paired with a composition of my own, and a composition of artificial intelligence, and participants will be asked to identify each composition. I will be working with my piano teacher, Dr. Borden, and my choir director, Dr. Martin, to pick out pieces and achieve a better understanding of the musical theory that applies to different genres and eras of music. I will be working with my former computer science teacher Dr. Winslow to use the MuseNet music model to generate pieces of music from specific eras. The following outcomes are expected: 1) Musical knowledge will facilitate the correct identification of AI music. 2) People will not be able to distinguish AI music from original compositions. 3) AI will provoke approximately the same emotional response in its compositions as manmade compositions can.

- **BASIS ADVISOR:** Jeffrey Winslow & Christian Martin • **ON-SITE MENTOR:** Dr. Rita Borden
- **LOCATION:** Independent Research

SARAH W.



ARE WE PREPARED TO STOP THE BLEED?

SUMMARY: People can die of uncontrolled hemorrhage in 5 to 7 minutes. It is the leading cause of preventable deaths so it is important that the public knows how to control bleeding. That is what Stop the Bleed hopes to achieve. In this project, I will explore how prepared "Stop the Bleed" training program participants feel after completing the training. I have decided to address the effects of the training through a survey that will be emailed out to previous participants in the Stop the Bleed training. This will be able to assess a wide range of participants due to the accessibility of surveys. I will be participating in the data analysis, however, my main focus will be creating and sending out the survey. I will be partnering with Northern Arizona Healthcare where the team in charge of Stop the Bleed in Flagstaff is. By the end of this, I hope to contribute to a survey that will be used for a long time at the hospital.

- **BASIS ADVISOR:** Trent McDowell • **ON-SITE MENTOR:** Shawn Bowker & Paula McAllister & Floye Bradford
- **LOCATION:** Northern Arizona Healthcare

AIYANA W.



ANALYSIS OF TRAUMA INFORMED CARE SCREENING

SUMMARY: Trauma-Informed Care (TIC) is an approach to healthcare that acknowledges how traumatic events and experiences all impact an individual mentally and physically. It focuses on making the medical environment into a safe place where individuals can receive help to reduce the effects of trauma, while taking into consideration that retraumatization can happen during an appointment. This is what health care personnel want to avoid and is one of the reasons why personnel use screening tools. If the screening turns up positive, then personnel can then take the appropriate steps to help the person as the screening provides a sort of safety barrier for patients and personnel. Because of this, the risk of retraumatization for patients and Secondary Traumatic Stress (STS) for healthcare personnel is decreased. Now that Centers for Medicare & Medicaid Services (CMS) as of 2023 is requiring screenings for Social Determinants of Health (SODH), TIC also falls into the screenings as Safety, one of the parts of the required screening, focuses on abuse. However, the SODH screenings don't necessarily match up with the standards of TIC since some of the questions asked aren't really "trauma-informed", which is a big issue when dealing with patients who have a traumatic history. This also becomes an issue as the hospital is currently working to get TIC screenings as part of primary care, and if the SODH screening questions are not up to those standards TIC has set in stone, then retraumatization or a new set of trauma can occur. This is why the hospital wants to push for their TIC screenings to primary care personnel rather than the SODH screenings. Through the help of Northern Arizona Healthcare (NAH), I will be analyzing the TIC screenings that they provide for individuals and its benefits, and compare that to the SODH Screenings. With this analysis, my end product will be helping put together an article to publish to the Healthcare Quality and Safety Journal.

• **BASIS ADVISOR:** Tom Talasek • **ON-SITE MENTOR:** Floye Bradford • **LOCATION:** Northern Arizona Healthcare

AIDEN W.



BIOMECHANICS AND KUNG FU: BRINGING TRADITIONAL MARTIAL ARTS AND PROSTHETICS TOGETHER

SUMMARY: In Chinese, the word for kung fu is 功夫 (gōng fu). While translators often assign the meaning of 功夫 to be "martial arts" or even the Romanized "kung fu," that is not the most accurate definition of 功夫. 功夫 can be translated better to something akin to "skill acquired through hard work." The most common way that 功夫 is applied is through martial arts. Martial arts are for everyone, everyone should have access equally. Unfortunately, people with lower limb prostheses are at a significant disadvantage in practicing martial arts due to balance and flexibility challenges with their prosthetics. This creates a barrier to entry that makes training kung fu and gaining the associated physical and mental health benefits a challenge. This study will attempt to develop adaptations to prosthetics that could lower this entry barrier. Specifically, the project will investigate ankle mobility in kung fu practitioners and compare it to prosthetic limbs to see where the prosthetics are lacking. Hopefully, the information gathered can be used not only to increase the accessibility of kung fu but also to improve the quality of life of prosthetic users who may need a more flexible prosthetic limb.

• **BASIS ADVISOR:** Sheri Jordan • **ON-SITE MENTOR:** Mike Kayser • **LOCATION:** Next Step Prosthetics



DAIN Y.

**LANGUAGE BARRIERS AND BIAS IN COURT;
HOW DO WE DISPEL LINGUISTIC BIAS?**

SUMMARY: As an intern at the Coconino County Attorney's Office, my research focus delves into the pervasive issue of language bias within the legal system. In the realm of law, each word holds immense significance, serving as the building blocks to provide a comprehensive understanding of a case and aiding jurors in reaching informed decisions. However, this intricate process poses significant challenges for individuals who do not have English as their first language or lack fluency in the language. While interpreters may be available, the translation of every word may not always be precise, exacerbating the need for effective solutions to address this systemic issue. Moreover, the presence of linguistic bias further compounds the complexity of legal proceedings. A notable example is the George Zimmerman case, wherein the testimony of the primary prosecution witness was undermined due to her African American Vernacular English (VVAE) accent, ultimately influencing the jury's decision and deeming her account to be not credible. These inadvertent biases underscore the urgency to scrutinize and rectify linguistic and translational challenges within the legal framework. Throughout my internship, I aspire to investigate and propose remedies for these inherent biases, with the ultimate goal of fostering a fair and equitable legal system for all individuals, irrespective of language or accent.

- **BASIS ADVISOR:** Amy Green • **ON-SITE MENTOR:** Elissa Gonzalez-Olson
- **LOCATION:** Coconino County Attorney's Office





Flagstaff

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