BASIS FLAGSTAFF SENIOR PROJECTS 2021–2022



At this point in their senior year, BASIS Charter School students have completed a set of four BASIS Capstone classes to earn their BASIS Diploma with Honors. In addition, many students are in the process of completing the prestigious College Board's AP Capstone DiplomaTM, a challenging, two-year sequence of AP SeminarTM and AP ResearchTM, 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 their senior year, the Senior Project is unique, self-designed, and reflective of the students' 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 student 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 as they develop investigative skills and their own individual scholarly pursuits. The abstracts 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 and learning. 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

Lohre

BASIS.ed AZ+

Peter Bezanson Chief Executive Officer

BASIS.ed Texas



MARIAN M.

PRIDE AND POWER: AN EXAMINATION OF FEMINIST REPRESENTATION IN GEORGE ELIOT AND JANE AUSTEN



ABSTRACT: Can a novel that requires women to marry to gain any power and displays men as the superior sex have deeply feminist messages? This is a question modern readers struggle to answer when reading classic novels written by women. Too often authors such as Jane Austen and George Eliot are dismissed as complacent or condemned as misogynistic for their traditional portrayal of women. Yet, when studied on a deeper level and in consideration of the social constraints of the time, it is clear that both Austen and Eliot were adherents to proto-feminism, a philosophical tradition that anticipated modern feminism. My project sought to find these proto-feminist messages in four novels written by Austen and Eliot using historical research and an examination of action in the texts. I compared how certain female characters acted in the novels to what was socially acceptable for them considering the restraints of the time. I contextualized my research with internships at The Flagstaff Literacy Center and the Flagstaff Shakespeare Company. Through my in-depth examination of these novels, I found that these authors displayed proto-feminist and rebellious messages through a plethora of ways, whether it was having their female characters manipulate a marriage proposal, or just by allowing them to have flaws and display basic humanity. I hope my project allowed for a better understanding of concealed social messages in classic novels, and shed light on the compromises that female authors of earlier times had to make to maintain their positions of power.

- BASIS ADVISOR: Heather Bigley ON-SITE MENTOR: Corina Roche
- LOCATION: The Literacy Center & Flagstaff Shakespeare Company

PARTHIV P.

USING FIRE MOSS ENCRUSTATION TO MEASURE THE EFFECTS OF ARTIFICIALLY INTRODUCING NUTRIENTS TO SOILS AFTER FOREST FIRES



ABSTRACT: Considering the increasing frequency and magnitude of forest fires in Arizona, there is a greater imperative to find more efficient soil restoration treatments. My project drew upon the basic ecological cycle that soils undergo post-fire to speed up the recovery process. After a forest fire, the first form of organic matter that establishes itself in a soil body is mosses. Mosses are essential to improving water retention and preventing erosion, enabling other life forms to take hold in the ecosystem, and rebuilding the environment's biodiversity. My project artificially established "fire mosses" (Funaria hygrometrica, Ceratodon purpureus, and Bryum argenteum), which are the initial colonizers in a post-fire soil body, in a greenhouse environment. Growth methods were manipulated to see which were most effective in producing a substantial biomass and soil coverage of these mosses. There was a total of 192 experimental groups which varied by treatment components including the species of fire moss established in the soil samples, live versus sterile soil, and use of fertilizer. I collected and analyzed moss coverage and biomass data from these samples to look for significant trends. Soil restoration teams can use this data to efficiently establish moss colonies in soils to accelerate ecosystem growth.

- BASIS ADVISOR: Carla Roybal ON-SITE MENTOR: Anita Antoninka
- LOCATION: Northern Arizona University, School of Forestry

AELIANA R.

TEACHING AN EXOSKELETON ROBOT TO STAND, WALK, AND CLIMB STAIRS



ABSTRACT: Cerebral palsy is a disease that affects adults and children and leads to reduced walking ability. In recent years, however, the development of wearable robotic devices that assist with movement, i.e. exoskeletons, has aided in making standing and walking possible. At Northern Arizona University's Biomechatronics Lab, the lab team is working on an Ankle Exoskeleton that helps individuals with cerebral palsy by attaching to an individual's lower body and providing walking assistance. The device, which is equipped with motors at the ankle, responds to the individual's walking movement by providing the torque necessary to adjust the individual's foot assisting in muscle control. Although there have been benefits to the use of this exoskeleton, such as better walking posture and increased stride length, it can currently only be used in a laboratory environment. Part of this problem stems from the fact that the exoskeleton is unable to detect "state changes," such as standing, walking, and climbing stairs. This requires experts in the lab to control the machine and stop the device when necessary. Because of this current issue, I worked on developing a code using an Arduino Nano BLE 33 Sense, a complex computer chip with computing power, to detect different state changes. Uploading this code onto the Arduino Nano located on the exoskeleton will allow the exoskeleton to detect these state changes on its own. Accomplishing this goal will make a positive impact in helping individuals with cerebral palsy live their lives freely and independently.

- BASIS ADVISOR: Erick Gonzalez ON-SITE MENTOR: Zachary Lerner
- LOCATION: Northern Arizona University, Biomechatronics Lab

BRADY S.

CALCULATING CHANGE IN WIND SPEED IN FLAGSTAFF TO USE FOR WIND LOAD ON BUILDINGS



ABSTRACT: Buildings must be able to withstand the forces of nature, including wind, to prevent damage or even collapse during dangerous storms. There is already an abundance of wind in Flagstaff, and as the climate warms and storms become stronger, this issue becomes even more pressing. The current wind speed models used by contractors in the Flagstaff area are very generic and based on national wind speed averages. This project, conducted at Hubbard Merrell Engineering, looked into what future wind changes may occur by using historic National Weather Service data to examine changes and patterns in wind speeds. This was accomplished by testing various statistical methods and taking those that work best with the data so that they can be applied to the future. I also created a computer program through Python that can be used by structural engineers everywhere. It takes the statistical methods used for the Flagstaff area and applies them to new data from any geographical area to create a forecast of future wind trends.

• BASIS ADVISOR: Jessica Buckley • ON-SITE MENTOR: Dave Merrell • LOCATION: Hubbard Merrell Engineering

TAYLOR S.





ABSTRACT: There is a problem with LGBTQ+ housing discrimination within Flagstaff because the city does not have any legislation in place to protect LGBTQ+ renters. The Human Rights Campaign, the largest LGBTQ+ advocacy group in the United States, gave Flagstaff a score of 88/100 on their 2021 Municipality Equity Index ranking. One of the biggest ways to increase the score is to add LGBTQ+ housing protections, which would increase our score by 10 points. My study focused on the root of why Flagstaff doesn't already have LGBTQ+ housing protections. By examining the causes of discrimination, the push to fully solve these problems and debunk some faulty but popular reasons for discrimination can continue. Simply creating bills to "solve" problems is ineffective because the manifestation of the problem may change. I selected five other municipalities similar to Flagstaff in population and region. I then completed a comparative case study that compares Flagstaff's overall LGBTQ+ inclusivity to these other municipalities. I then determined the likely causes of the lack of LGBTQ+ rights within Flagstaff in regard to housing. For my internship at the City of Flagstaff, I focused on community outreach, especially during Fair Housing Month, as well as created resources centered around fair housing. For my final product, I presented to the Flagstaff City Council a proclamation reaffirming the city's commitment to LGBTQ+ inclusivity in regards to housing, for their Fair Housing Month proclamation.

- BASIS ADVISOR: Evan Martin-Casler ON-SITE MENTOR: Kristine E. Pavlik
- LOCATION: City of Flagstaff, Department of Housing





GRACE A.

CRAMCRAMCRAM: THE EFFECTS OF CRAM SCHOOLING ON JAPANESE STUDENTS' MENTAL HEALTH: A RETROSPECTIVE STUDY



ABSTRACT: The prevalence of cram schooling (supplementary education involving intense test preparation for high-stakes entrance exams aimed at placing into more prestigious universities, high schools, or middle schools) has been growing in many countries around the world, though it remains understudied, particularly in Japan. This study used an explanatory sequential mixed method to look at the effects of Japanese cram schools (i.e. shingaku juku) on students' depressive symptoms. The first phase of my project included an online survey (Beck's Depression Inventory), distributed to Japanese college students. By comparing the survey results between groups that have attended varying amounts of cram school, this study was able to assess the longterm impact of cram school on depressive symptoms. The second phase included qualitative data from several sources. Themes were then pulled across the responses and analyzed accordingly. Utilizing a mixed method allowed for a holistic understanding of the shingaku juku experience's impact on former students. This study hypothesized that shingaku juku will negatively affect the mental health of Japanese students. The results from the quantitative Phase 1 were not statistically significant, and the qualitative data from Phase 2 showed evidence for juku exerting both positive and negative influences on students' mental health. Though the results were insufficient to support the hypothesis, it did have several important implications, including the necessity for further research. Considering that the affected population is particularly vulnerable (children and adolescents), it seems especially pertinent to study the possible negative influences that shingaku juku may have on mental health as soon as possible.

- BASIS ADVISOR: Corey Hartman ON-SITE MENTOR: Nora Dunbar
- LOCATION: Northern Arizona University, Psychology Department

BRIAN H.

ASSOCIATIONS BETWEEN GAMBEL OAK AND BIRDS IN NORTHERN ARIZONA



ABSTRACT: Birds in Northern Arizona must find scarce food, endure sub-freezing temperatures, and evade predators to be able to survive through the winter. In order to meet these needs, they must find suitable habitat that contains food, water, and shelter. My study considers if birds in Gambel oak-ponderosa pine mixed forest exhibit a preference for one of the two habitat types and which species are present more often in each. Although this habitat is well-studied in other times of year, it is not fully understood how birds interact with this ecosystem in the winter. I surveyed birds in the Kaibab National Forest to answer this question. I conducted point counts on twenty stations in the forest from January to March, recording what bird species are in each and where they are foraging/spending time and found that while diversity is similar between the two habitat types, different bird species use the habitat differently. This study gives a more complete picture of how birds in Northern Arizona use pine and oak habitat and informs conservation of this important ecosystem. Because pine-oak forests face threats from fires, fire suppression, grazing, logging, and human encroachment, it is important that we understand how damage to this ecosystem may also affect its inhabitants.

- BASIS ADVISOR: Corey Hartman ON-SITE MENTOR: Tad Theimer
- LOCATION: Northern Arizona University, Department of Biological Science

NAOMI K.





ABSTRACT: Sustainable architecture is an architectural design that is built to suit the surrounding environment and preserve resources. Arizona will be taking an 18% water allotment cut in the upcoming year with Lake Mead's water levels being at an all-time low. In Coconino County, water is a resource that is becoming increasingly scarce, so local architecture and residential buildings need to take water into closer consideration. There are two types of sustainable building methods, passive and active. In water conservation, passive examples are rainwater catchment, greywater use, or stormwater diversion while active examples are water monitors, pumps, and low flow systems. I compared whether passive or active designs are more effective for water conservation in sustainable buildings and hypothesized that both are needed to create a successful system. To answer this question, I did a case study at two sustainably built houses in Coconino County with preexisting water conservation methods. This further knowledge about sustainable methods will help make water conservation easier to add to homes in the future. My internship was with the Coconino County Sustainable Building Program, helping consult prospective homes. The program is also where I received water information from the two homes for the case study to compare to city water use averages. I found that homes with both passive and active water saving methods used less water than the city of Flagstaff's water averages and work together as a system in the home.

- BASIS ADVISOR: Corey Hartman ON-SITE MENTOR: John Bereda
- LOCATION: Coconino County Sustainable Building Program

MIA O.

"PAIN, THOU ART NOT AN EVIL": ALBERT DE MORCERF'S TRANSFORMATION FROM EPICUREAN TO STOIC IN THE COUNT OF MONTE CRISTO



ABSTRACT: Despite The Count of Monte Cristo's popularity and persisting cultural and literary influence, there are still gaps in our literary understanding of the novel. Although the principal protagonist Edmond Dantes is usually the main subject of analysis, it is supporting character Albert de Morcerf's fascinating character arc that should be more thoroughly examined. His presence in the novel is unique as a complex journey of redemption and growth in a novel fraught with prominent themes of retaliatory vengeance. Overlooking Albert's moral significance in the novel has negatively affected our ability to understand The Count of Monte Cristo's underlying revelations about human nature and philosophy. I conducted a philosophically-oriented close reading literary analysis on Albert's character development, specifically arguing he transitions from espousing Epicurean ethics to espousing Stoic ethics. This study helps illuminate an understudied character, and demonstrates the viability of a comparative philosophical lens in literary analysis. It may contribute to and possibly reframe popular and literary understandings of The Count of Monte Cristo.

- BASIS ADVISOR: Corey Hartman ON-SITE MENTOR: George Rudebusch
- LOCATION: Northern Arizona University, Philosophy Department

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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