



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



CHRISTOPHER A.



SOJOURNERS OF THE DESERT: AN ANALYSIS OF THE MIGRATION EXPERIENCES OF FRANCOPHONE ASYLUM SEEKERS

SUMMARY: The asylum process often begins with an interview of credible fear where an asylum officer determines whether an asylum seeker will remain in the country or be deported. If deemed deportable, an asylum seeker can appeal their decision to an immigration court where their case will be reviewed by an immigration judge who also determines whether they can remain in the country or be deported. Up until their court decision, asylum seekers are allowed to legally remain in the United States and have the documents that attest to their release. Immigration more generally has become a politically decisive issue as Americans debate whether more rights and protections should be given to asylum seekers and others against the backdrop of demands for reducing the number of migrants entering the country and imposing restrictions on documented and undocumented immigration. This paper will overview the challenges migrants face in legally immigrating to the United States, the differences between the Biden and Trump administrations' immigration policies, and the importance of culturally aware communication in the legal system. The paper culminates in an ethnographic survey of eight Francophone and Anglophone asylum seekers on their motivations for leaving their home countries, their journeys to the United States, and their means of supporting themselves en route.

• BASIS ADVISOR: Caitlin Bothman • ON-SITE MENTOR: Diego Pina Lopez • LOCATION: Casa Alitas

STEVEN A.



READING BETWEEN THE VERSES: USING NATURAL LANGUAGE PROCESSING TO EXPLORE THE CONNECTIONS BETWEEN JAZZ AND HIP-HOP

SUMMARY: In the past century, the influence of African-American music on American and global society has been indelible. In particular, jazz and hip-hop have become integral parts of American popular culture in their respective eras. Jazz is characterized by complex chords, polyrythms, and improvisation. Hip-hop, on the other hand, is an inherently rebellious genre, characterized by percussive rhythms, poetry, and various other forms of expression, including DJing and graffiti. When discussing the history of these two genres, it is important to look at how they are connected to each other. In particular, jazz has manifested itself in hip-hop through the subgenre of jazz rap, as well as through various samples, references, and motifs. This paper will examine the interrelations of these two genres through a linguistic and computational lens. Using natural language processing (NLP) techniques, namely topic recognition and sentiment analysis, we will be examining corpora of hip-hop lyrics to determine how jazz influences lyrical and topical themes within hip-hop. Conducting research within the University of Arizona's School of Information, we will be using various NLP packages to preprocess, tokenize, and analyze our data. The goal of this paper is to successfully use computational techniques to track the cultural evolution from jazz to hip-hop. In doing so, we hope to expand upon previous research in using NLP to analyze music as well as previous research on the cultural relationships between these two genres. Obtaining a greater understanding of these relationships is essential in gaining insight into the broader progression of American culture as a whole over the past century.

• BASIS ADVISOR: Dr. Matthew Coleman • ON-SITE MENTOR: Xuan Lu • LOCATION: University of Arizona

AUDREY A.



HUNTING FOR BIAS: TESTING AN ALGORITHM TO FIND BIAS BETWEEN DIFFERENT NEWSPAPERS

SUMMARY: Bias in the news is something that has been becoming more relevant in recent years, and this research project hopes to find a different model for analyzing bias and to show how consumer preference affects a newspaper. This model could also become a tool for consumers to be able to have more information on a specific newspaper. In previous research, bias is frequently looked at from either a political standpoint or is analyzed using specific word choice, however, I hope to see if I can find a more holistic form of bias, specifically in the topics used. This has led to the question: Can bias be shown by the statistical analysis of the difference in story subjects between different newspapers? I will use statistical analysis to look for a difference between the distribution of topics between newspapers, and then compare these differences to other information about the paper, to see where the difference stems from. Although I will not be at a site, I will be working with a mentor in order to write a program to collect and analyze data, to show the information found. In all, I hope to find a difference in the distribution of the topics of stories between newspapers and connect that to some form of bias, as well as create a program that can show the distribution of story topics between newspapers to give people an idea of the focus of the newspaper.

• BASIS ADVISOR: Amy Smith • ON-SITE MENTOR: Sean Finn • LOCATION: Asynchronous Programming

SYDNEY A.



I CAME, I SAW, I CURED: VEGETIUS ON ROMAN MEDICINE

SUMMARY: Veterinary medicine is an important and fascinating field to help care for the welfare of pets and animals that humans interact with. However, the roots of veterinary medicine are not well researched or written about, especially in the Roman Empire. Vegetius, in particular, has not been researched very much as a veterinary writer, and is better known as a military writer. Vegetius' Digestorum Artis mulomedicinae libri, a book that deals with Roman veterinary medicine, has only been translated into English once (in the 1700s) and has only a couple articles written concerning it. My research will take place with the assistance of Dr. Phillip Waddell, a classics professor at the University of Arizona. After I read the entire text in English, I will center on the part of Vegetius' Digestorum Artis mulomedicinae libri that focuses on the proper procedures of bloodletting, which Vegetius thought was an important part of curing animals. Although I am mainly concentrating on Vegetius, I am looking into other Roman authors who were concerned about the care of animals. Furthermore I am shadowing a modern day veterinarian to get a sense of veterinary medicine today.

• BASIS ADVISOR: William Slattery • ON-SITE MENTOR: Philip Waddell • LOCATION: University of Arizona

IBRAHIM B.



CAREFUL WHISPER: THE DEVELOPMENT OF SAXOPHONE COMPOSITION AND PERFORMANCE THROUGH AVANT-GARDE JAZZ, 1955–1975

SUMMARY: The saxophone is one of the most culturally prominent instruments not only in jazz, but in popular music as a whole. Invented by Adolphe Sax in 1846, its role evolved from being played in military bands, to its introduction to jazz and big bands in the early 20th century, to its roles in experimental free jazz or easy-listening smooth jazz. The saxophone owes its versatility to its fusion of brass and woodwind sound, creating a unique tone and timbre. Its versatility is enhanced by the range in pitch and performance role between the soprano, alto, tenor, and baritone models. The development of free jazz/avant-garde jazz was influenced by concepts of atonality and developments in contemporary classical music around that time, as well as increased musical experimentation driven by the counterculture and interest in Eastern philosophy. The role of the saxophone in the genre, as a conduit for this aforementioned musical experimentation, came to influence the instrument's image as a soloing instrument. This project will analyze the works of famous saxophonists Wayne Shorter, Ornette Coleman, John Coltrane, and Albert Ayler (namely their solos and improv sections) to paint a picture of the common techniques in saxophone performance and music theory during this time, and to use this information to ascribe their influence on jazz and how the saxophone functioned in jazz going forward.

• BASIS ADVISOR: Dr. Matt Timman

LYDIA B.



USING MRI FOR EARLY ALZHEIMER'S DIAGNOSIS: DEVELOPING A MICROSCOPY ANALYSIS METHOD TO ACCURATELY CALCULATE BRAIN MICROSTRUCTURAL ANISOTROPY

SUMMARY: Alzheimer's disease is a severe, irreversible neurologic disorder that alters memory and leads to death. It damages the brain's microstructure and reduces the coherency of fibers in the brain. Alzheimer's is frequently misdiagnosed or not diagnosed at all, so investigating the changes the brain undergoes is key to working towards early diagnosis. One way to accomplish this is to improve brain imaging methods, such as diffusion magnetic resonance imaging (dMRI), which reveals microstructural features such as cell shape and size. The overall goal of my research is to validate microstructural abnormalities seen in dMRI scans of Alzheimer's brains to see if they can be imaging markers for early diagnosis. I will be researching in the Multi-Scale Brain Imaging Lab of Dr. Elizabeth Hutchinson at the University of Arizona, which specializes in traumatic brain injury and Alzheimer's research. The abnormalities seen in dMRI scans of Alzheimer's brains can generally be validated by analyzing the true orientation of the brain fibers under the microscope. However, there is no proven method to process microscope images that accurately shows the microstructure of the brain tissue. So, the goal of this project is to find a microscopy analysis method that outputs microstructural anisotropy, which is the directionality of cells and their features. Ultimately, this method will be used to accurately validate the abnormalities seen in dMRI scans of Alzheimer's brains by showing what is occurring at the cellular level and how degradation progresses with the disease.

• BASIS ADVISOR: Kristen Sanders • ON-SITE MENTOR: Dr. Elizabeth Hutchinson • LOCATION: University of Arizona

NITISH B.



THE CANCER IN THE ROOM: DESIGNING AN ARTIFICIAL INTELLIGENCE ALGORITHM TO CHARACTERIZE ARCHITECTURAL DISTORTIONS ON DIGITAL BREAST TOMOSYNTHESIS

SUMMARY: Breast Cancer (BC) is the most common type of cancer among women and the second-leading cause of cancer-related death among women of all ages. Additionally, BC screenings are one of the most common imaging tasks performed, with over 39 million yearly exams. Currently, mammography is the foremost screening technology. However, in recent decades, a new and likely more accurate technology has been developed and expanded worldwide: Digital Breast Tomosynthesis (DBT). For diagnostic screenings, performed as a preemptive measure before BC has been detected, there is a substantial excess in unnecessary, expensive follow-up imaging. The recent rise in the use of Artificial Intelligence (AI) in medical imaging presents an opportunity to apply it to recognize a prominent feature of breast imaging that literature shows is a strong predictor of BC risk: Architectural Distortions (AD). In this project, I will work on a research project with Dr. Srinivasan Vedantham, a medical imaging and biomedical engineering professor at the University of Arizona, to develop an accurate AI model to characterize ADs on DBT imaging and provide an analysis of cancer risk factors based on the scale and intensity of potential cancer findings. I will utilize an open-source, vetted data set of DBT imaging from Duke's medical imaging department to find accurate data to train this model. Ultimately, this project aims to improve BC prediction and risk assessment through an algorithm that can hopefully be further expanded on and packaged as a resource for the academic and medical community.

- BASIS ADVISOR: Matt Johnston ON-SITE MENTOR: Dr. Srinivasan Vedantham
- LOCATION: University of Arizona Vedantham Lab

KYLA C.



FOLLOWING IN MY PARENTS' FOOTSTEPS: ENTERING THE FIELD OF PHYSICAL THERAPY

SUMMARY: Living with a family of physical therapists, I was exposed to the career at a young age. Physical therapists work to promote wellness, health, and function in order to either prevent or rehabilitate injuries or physical limitations. One of the most easily attainable jobs to enter the field of physical therapy is the physical therapy technician (PTT). Techs work under the supervision of a physical therapist and help prepare patients, assist them through light exercise, and organize the workplace. My senior project will document the process of becoming a PTT as a high school student. I will be studying anatomy, physiology, and sports medicine. To complement this curriculum, I will be practicing a myriad of clinical skills including KT tape, electrical stimulation, thermal modalities, aquatic therapy, sports massage, ultrasound, and therapeutic exercise through Pima JTED's PTT program. I ultimately aim to become a certified PTT by the end of my senior project through the American Medical Certification Association. With a PTT certification, I can immediately apply for a job at rehabilitation centers, outpatient clinics, hospitals, and nursing homes.

• BASIS ADVISOR: Mark Pincus • ON-SITE MENTOR: Conny White • LOCATION: JTed

MINDY D.



WHO AM AI?: THE PORTRAYAL AND STEREOTYPES OF CHINESE, VIETNAMESE, AND FILIPINOS IN AI ART

SUMMARY: All art is a relatively new form of technology that has become viral across social media, threatening artists' livelihoods. All processes thousands of art pieces to learn patterns and create new pieces of art based on text or image prompts, and it generates art in minutes. Taking advantage of the vast knowledge of these All art programs, specifically Stable Diffusion, this study investigates whether or not there are trends when art of Asian individuals (specifically Chinese, Vietnamese, and Filipinos) are generated. This study seeks to determine what kind of stereotypes are prevalent in art and the All program itself, gaining more insight on what beliefs are built into technology and people's ideologies.

• BASIS ADVISOR: Avery Conrad • ON-SITE MENTOR: Joseph O'Connell • LOCATION: Creative Machines

JULIETTE D.



BUZZING ABOUT CONSERVATION: A LOOK INTO THE EFFECTS OF PYRIPROXYFEN ON THE HYPOPHARYNGEAL GLANDS IN HONEY BEES

SUMMARY: Honey bees are extremely important pollinators, yet mass pesticide use has been drastically reducing their population size. To fix this, many companies began switching to pesticides known as insect growth regulators. Insect growth regulators are seen as better for pollinators because they don't massively wipe out populations and cause mass dying among adult bees. Taking place at the Carl Hayden Bee Research Center, this project will be looking into the effects of pyriproxyfen, a widely used insect growth regulator, on the hypopharyngeal glands in honey bees. The hypopharyngeal glands incorporate lipids into royal jelly, the food fed to the larvae and queen bees by worker bees, and play a crucial role in the time of task transitioning for worker bees. After dissecting flash-frozen bees that have been fed pyriproxyfen, the size of the hypopharyngeal glands will be measured and compared to those of worker bees under normal conditions. The ideal outcome for this project would be showing that pyriproxyfen has a significant impact on the lipid levels in worker bees seen by a notable size decrease in their hypopharyngeal glands. This would provide just one more reason against mass pesticide use, even with insect growth regulators that are considered to be "safe" for pollinators.

• BASIS ADVISOR: Kristen Sanders • ON-SITE MENTOR: Dr. Vanessa Corby-Harris • LOCATION: Corby-Harris Lab

HANNAH F.



HORSES, HAY, AND HUMAN CAPITAL: THE STRATEGIES THAT NON-PROFITS USE TO REMAIN AND STAY SUCCESSFUL

SUMMARY: In my senior project, I will do a three-month internship at the local non-profit, TROT (Therapeutic Riding of Tucson). TROT serves those with special needs in the Arizona community through equine therapy. During my internship, I will shadow in the fundraiser-making process, work tabling events, and provide other outreach services to experience and observe how TROT makes its services known and how they thrive.

• BASIS ADVISOR: John-Paul Mann • ON-SITE MENTOR: Laura Bissing • LOCATION: TROT

DEZSTANY G.



FACTORS THAT ENCOURAGE LEGAL ASSISTANCE: EXAMINING WHICH SPECIFIC QUALITIES ARE VALUED WHEN SEARCHING FOR LEGAL AID ON A BUDGET

SUMMARY: The purpose of this project is to study which factors encourage members of the low income community to reach out to legal agencies regarding family law. Oftentimes, members are discouraged to search for assistance considering the high cost and end up in a more stressful situation compared to if they would have initially had legal support. It is important for legal agencies to be aware of these factors so they can highlight these aspects when marketing. Additionally, if members of the low income community are aware of these specific aspects then it could potentially relieve the legal anxiety that exists within this group due to misinformation and lack of resources. The project will be conducted at McCarthy Family Law which is located near downtown Tucson and is one of the largest firms that specializes in family law throughout Southern Arizona. The placement of this firm is particularly significant because of the fact that the south side of Tucson has a high amount of low income members. The topic will be addressed through personal interviews with clients of a legal paraprofessional from the firm that deals with clients who have a more of a financial stressful situation compared to other clients taken on by the firm. Overall, the project aims to discover methods that ease the legal search process for members of the low income community while also providing a closer look in which family law cases are processed at the firm.

• BASIS ADVISOR: Caitlin Bothman • ON-SITE MENTOR: Alejandra Gerardo • LOCATION: McCarthy Family Law

AYLIN K.



A JOURNEY THROUGH JTED: THE PATH OF AN EMT

SUMMARY: My senior research project focuses on the rigorous process it takes to become an emergency medical technician (EMT). From reviewing the anatomy of the human body to performing spinal immobilization, the EMT Program at JTED prepares you to pass the certification exam given at the end of the program, giving you the necessary skills to be a competent EMT in the field. JTED is a public career district that trains students in a specific career of their choosing at a young age, allowing the ability to explore different career options. While taking this class for the entirety of my senior year, my project will be measured via my performance in class and will be concluded when I complete my National Registry for Emergency Medical Technicians (NREMT) exam. I will be prepared through the numerous study materials my teacher offers, along with what the American Academy of Orthopaedic Surgeons (AAOS) publishes online. My goals are to be able to work as an EMT at Banner Hospital UMC, while going to the University of Arizona.

• BASIS ADVISOR: Linda Swango • ON-SITE MENTOR: David Richter • LOCATION: JTed

MASON K.



THE STORY A WALL TELLS: THE PROCESS AND SIGNIFICANCE OF CREATING A CULTURALLY REPRESENTATIVE MURAL

SUMMARY: Throughout all of our lives, regardless of where you are or where you have been, we all have seen murals in different sizes, places and most importantly in different contexts. Throughout modern society murals are used not only as decorative or sometimes promotional mechanisms, it is used as a means of identification and representation for different cultures. In this project, I explore the process of mural making and the different techniques in doing so, as well as the significance of this mechanism of representation. Looking at the different murals and different movements throughout different periods in history. Specifically I will explore the culture represented in Tucson related to Hispanic and Mexican American culture. Due to the cultivated art scene here in Tucson, you can see diverse representation throughout the city touching on different cultures and different means of representation. Utilizing these amazing murals touching on these cultures in such beautiful ways, I will identify the different elements and the most important factors in creating a culturally representative mural and be able to execute this process myself.

• BASIS ADVISOR: Porter McDonald • ON-SITE MENTOR: Porter McDonald

JET L.

SUPERMAN: LASERS AND METAL



SUMMARY: Laser imaging is a segment of optical science that has seen substantial levels of research and progression in recent years due to its potential in visualization and identification. This project is based around laser imaging and its ability to identify variations in materials and highlight that which is invisible to the human eye. To further research and achieve the goals of this internship, an advanced microscope and imaging system capable of shining multiple specific wavelengths of light on the target will be utilized. This system, by shining multiple wavelengths of light, is able to illuminate and thus distinguish objects of differing qualities and forms. My task is to employ this to photograph samples and analyze their 3D images through a computer program. I will be collecting a variety of 3D images of different samples, at first for practice and later on to assist university students in their projects. If the multiphoton laser imaging system proves to be effective in visualizing the microscopic and normally indistinguishable aspects of samples, it may see use in other fields of study. For instance, in the medical field, being able to use this imaging system to identify cancerous cells would open up a far more efficient system to quickly react to cancerous formations, potentially saving lifes. All work on this project will be performed at the University of Arizona Wyant College of Optical Sciences.

• BASIS ADVISOR: Dr. Marie Rex • ON-SITE MENTOR: Dr. Khanh Kieu • LOCATION: University of Arizona Optics Lab

JUDE P.

"I DID THAT": HOW UNDERGRADUATE RESEARCH OWNERSHIP IMPACTS SCIENTIFIC IDENTITY ACROSS RACIAL DIVIDES

SUMMARY: With a growing pressure for undergraduate college students to have participated in original research before graduating, we must understand how undergraduate students can actually build passions in their fields of interest. Recent literature in the field of educational psychology has revealed that undergraduate research programs that focus on self-driven, original research (typically manifesting in Course-based Undergraduate Research Experiences, or CUREs) can foster excitement and exploration in STEM fields among undergraduates. Project ownership is an important aspect of undergraduate research, as there is a growing body of research suggesting that undergraduates who lead their own project typically build passions for their areas of interest more than undergraduates involved in typical research internships. My research, supervised by Dr. Adriana Cimetta at the University of Arizona's Department of Educational Psychology, will investigate how project ownership impacts scientific identity among a sample of University of Arizona undergraduate students involved in CURE classes across racial divides.

- BASIS ADVISOR: Dr. Bin Lin ON-SITE MENTOR: Dr. Adriana Cimetta and assisted by Dr. Rebecca Friesen
- LOCATION: University of Arizona College of Educational Psychology

MARITZA R.



SOY UN CIENTÍFICO: DESIGNING A HYBRID SCIENCE FAIR PROJECT CURRICULUM AND PRIMARY EDUCATION STORY BOOK FOR ESL HISPANIC STUDENTS

SUMMARY: How can we increase STEM engagement among Latino youth in Arizona and across the Mexican border? With less than 8% of Hispanics represented in science, and 1 in 4 Latinos experiencing discrimination in their science careers, facilitating STEM (Science, Technology, Engineering, and Mathematics) immersion for Hispanic students is essential in promoting diversity and inclusivity within the realms of science and technology. The lack of representation in STEM continues to widen as Diversity, Equity, and Inclusion (DEI) efforts remain largely focused on secondary and higher education. Though, primary education is where most children develop their special interests, socialization skills, and cognitive abilities. As a National Youth Civic Impact Fellow for the Civics and Scholars Foundation, a non-partisan non profit focusing on strengthening future citizens, I attend bi-weekly community practice sessions to learn, practice, and network. Here, I am tasked with the development of a project to further innovative solutions for local challenges, specializing in the education materials development area. Authoring the book ¡Soy un Científico! I will develop a comprehensive guide on how to create a primary education science fair project, illustrate, and write a 50-page-long story book on the experience of a 10-year-old character discovering curiosity in the ordinary. The book will be written in Spanish and English, breaking language barriers that prevent ESL Hispanic students from enrolling in local STEM programming. Finally, the project will culminate through the distribution of over 300 book copies across Tucson, Phoenix, Puerto Peñasco, and Yuma libraries and ESL classes located in literary deserts.

- BASIS ADVISOR: Juliana Lucero Alvarez ON-SITE MENTOR: Pragya Upreti
- LOCATION: Institute for Citizens and Scholars

SOPHIA T.



DOES THAT SOUND FAMILIAR: THE INFLUENCE OF COPYRIGHT INFRINGEMENT ON MUSIC SALES

SUMMARY: As copyright cases become more documented and popular, there has been more information on the background or reasoning for decisions. Particularly in copyright cases, there are different categories that have been made to decide what is considered copyright. These copyright case aspects and reasonings have not been evaluated deeply on which aspects might help or hurt an artist in the position of a copyright case. Hence, I hope to research how copyright issues from rock and roll, hip hop, and pop music may differ between cases in that genre, and between the different genres. The research can strongly influence how artists view copyright laws. If the consequence or reasoning is not straightforward or strong, artists may limit their creativity or production because of the fear of copyright laws. Additionally, if they have limited resources, they could be more restricted in checking their work for plagiarism or catching those copying them. I will examine the cases of each genre and determine the aspects that influenced the decision, and I hope to then compare results between cases within genres and between different genres. Hopefully, the research can caution or assure artists of their interactions with copyright laws.

- BASIS ADVISOR: Kevin Mathews ON-SITE MENTOR: Jay Rosenblatt
- LOCATION: University of Arizona, College of Fine Arts



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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