

Senior Projects

2022–2023

BASIS PRESCOTT



SENIOR PROJECTS

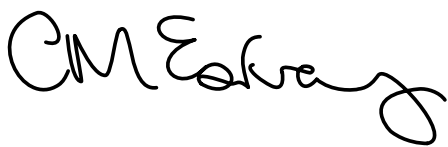
At this point in their senior year, BASIS Charter School students have completed a set of four BASIS Capstone classes to earn their BASIS Honors Diploma. In addition, many students are in the process of completing the prestigious College Board's AP Capstone Diploma™, a challenging, two-year sequence 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 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.

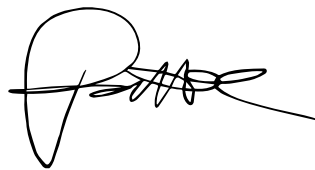
Under the guidance of an external advisor who is a professional in their field, as well as a faculty advisor from their school, students dedicate 10–15 hours per week to the completion of their Senior Project. To document their journey, students post weekly blog entries about their experiences, successes, 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 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 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
BASIS Ed AZ+



Patti Bezanson
Chief Executive Officer
BASIS Ed Texas

MEGAN C.



THE GREY FLESH FLY'S DEVELOPMENT AND ITS EFFECT ON CRIME

SUMMARY: Most of the time, people think crimes are clean-cut medical procedures. That's not the case. Before any forensic personnel arrive on the scene, insects have already infested the corpse, the most important being flies. Crime happens anywhere, in any temperature. Maybe the victim was found in the arid desert or snow of a mountain or inside a house. How does temperature change affect flies' ability to develop and decompose the body? A less studied—yet forensically important—fly, the *Sarcophaga bullata*, is the subject of my study. Using incubators and a miniature fridge, I simulated different temperatures for the fly to develop in. Each day, I went through the tedious, and quite odorous, procedure of removing the larvae from a piece of beef liver and recording their length, weight, and developmental stage. Then, I calculated the rate of the development of the flies and the adjacent decomposition rate of the liver. I compared the different developmental and decomposition rates from each temperature to see if there was a statistical difference between temperatures. From this information, I was able to provide valuable insight into the field of forensic entomology and how bodies decompose in varying temperatures.

- **BASIS ADVISOR:** Miles Hansen • **ON-SITE MENTOR:** Dr. Corraine McNeil
- **LOCATION:** Embry Riddle Aeronautical University, BASIS Prescott

KATELYN D.



DIFFERENT LENSES FOR THE SAME PICTURE: INTERNATIONAL PERCEPTION OF CHINA

SUMMARY: Many Americans are acquainted with local opinions on politics and world events, but not all are aware of the discrepancies between their interpretation and that of communities worldwide. Fewer still have a thorough understanding of how their beliefs came to be. How much do the views of global communities align? How deeply does one's background or culture shape even the most objective of observations? These questions do not have simple answers, but a proxy is found in the perspective of international students. My research among residents of the International Student House of Washington, D.C. analyzes their perception of China's presence in their country and what led them to these beliefs. After conducting a survey and an optional interview, I performed my own research of China's actions in each country and what the widely held opinion of the area was. I examined the contrast between the actuality and interpretation of China's presence worldwide, as well as how and perhaps why that contrast formed. Opinion is treacherous terrain. It is a subconscious experience amplified with the information available in modern day. Within it, facts can be lost, leading to poorly informed decisions that are particularly damaging at the level of international politics. Understanding the complexities of opinion and the way it affects action—especially in the case of international image—leads to a more holistic view of other governments that prepares policy makers for successful interaction and cooperation towards a better world.

- **BASIS ADVISOR:** Dr. Martin Norman • **ON-SITE MENTOR:** J. Elijah Bratton & Dr. Sherry Mueller
- **LOCATION:** International Student House of Washington, D.C.

DAXTON H.



WHAT IS LIGO, AND HOW IS THE EMBRY-RIDDLE CUBESAT TEAM USING IT TO DETECT CHANGES IN SPACE TIME?

SUMMARY: The purpose of a LIGO (Laser Interferometer Gravitational Wave Observatory) machine is to detect gravitational waves, but it will also allow us to further understand massive cosmic events happening millions of light years away. The machine works by firing a laser in a vacuum from one end of a machine to the other, bouncing it off a Cavendish mirror (a mirror that moves 10-23 meters when interacted with by a gravitational wave), splitting the laser into two with a beam splitter, and then detecting measurable discrepancies in the two split lasers with a photodiode to determine if noticeable changes in space time occurred. The problem with having these machines on Earth is how much noise is produced from the environment on a micro scale. These tiny vibrations cause the mirror to move, and because this movement is not due to gravitational waves, our data becomes inconsistent. Therefore, it would be advantageous to put a LIGO machine into Earth's orbit, far enough away from the disturbing vibrational waves on Earth, so we'll be able to detect more cosmic events and obtain more accurate data. With the observatories on Earth, we've already detected the merging of black holes many times larger than the sun. Now that we have improved our methods and practices and will have an observatory in orbit, we hope to detect even more events that will help us understand what goes on outside the Milky Way.

- **BASIS ADVISOR:** Drew Wasikoski • **ON-SITE MENTOR:** Dr. Michele Zanolin
- **LOCATION:** Embry Riddle Aeronautical University

JAY J.



AN INSIGHT INTO THE FUTURE: WHAT IT TAKES TO CREATE AN AUTOMATED FACTORY

SUMMARY: Have you ever wondered what the future holds? If you have, you have probably thought of automation. My goal for this project was to learn what it takes to create an automated factory and develop an understanding of the engineering required to build something like that. I interned at Bent River Machine in Clarkdale, AZ. During this internship, I worked on the Siemens Conveyor System Integration Project. I helped design and build parts for a conveyor system that will aid in assembling, labeling, and testing for 500lb circuit breakers that power city blocks. This conveyor system will span 10,000 sq ft. I worked with the lead engineer to design system hardware mounting and cable routing, and assisted with blueprints as well. I also aided in developing a mechanical and electrical installation plan. Finally, I assisted in creating a user manual for this automated conveyor system. Through this internship and these experiences, I learned what it takes to create an automated factory. I analyzed the labor, the engineering work, the design, and the integration process. This allowed me to see what is required to build something of this magnitude and the effects that come with it.

- **BASIS ADVISOR:** Drew Wasikoski • **ON-SITE MENTOR:** Jessica Eckman • **LOCATION:** Bent River Machine

IVAN M.



HOW TO UPDATE YOUR GAME

SUMMARY: In the modern era, games are all around us. These games often undergo many updates and revisions. Despite the prevalence and need for updates, no one has been willing to use any of their games to rigorously test how to get the most out of these updates. In order to figure this out, I created an .io game that will be available on itch.io and/or addictinggames.com for anyone to access. I asked people to play the game and leave a comment about their opinion of its current state. While the game was being played and reviewed, I worked on new updates. These updates were of varying levels of quality and frequency, from small stat changes used to balance various aspects to large changes to provide lots of content. I also designed some updates based directly or indirectly on player comments. From working on this game, I learned about the industry. Also, by looking at how the popularity and comments changed in response to updates, I was able to provide valuable insight into how others should be updating their games. My hypothesis was that the best updates will be indirectly responding to people's comments, while the worst ones will be just minor stat changes. Surprisingly, I have discovered that the most important part of a game is not the graphics. My core gameplay and mechanics have been left relatively unchanged since the game's creation and the few changes that have affected the core gameplay have been relatively unused and unmentioned. I have also learned that people are incapable of figuring out the controls of the game on their own or with a short written description. Only after I created a six-scene tutorial did I see any significant results in people actually being able to play and enjoy the game. Before that, most players found it confusing and unsure of what to do. Improving graphics and sound even slightly has greatly improved user satisfaction. By observing the update requests people provide, I have been able to determine what updates are needed and plan accordingly.

- **BASIS ADVISOR:** Josh Smith • **ON-SITE MENTOR:** Peter Tomasovitch
- **LOCATION:** Embry Riddle Aeronautical University

NICHOLAS R.



SHOULD STUDENT PILOTS RECEIVE ROUND GAUGE OR GLASS COCKPIT INSTRUCTION?

SUMMARY: When I began private pilot training during the summer of my junior year, the aircraft in which I learned how to fly was equipped with six primary analog (round gauge) flight instruments, commonly referred to as the "six pack." Consisting of the heading indicator, the altitude indicator, the turn coordinator, the airspeed indicator, the altimeter, and the vertical speed indicator, each of the six instruments provides specific and essential information for the pilot to use as reference in order to know the aircraft's current energy state and altitude. The energy state is the total mechanical energy of an airplane in flight, which is the sum of its potential energy from altitude and kinetic energy from airspeed, while altitude refers to the aircraft's position in space relative to the natural horizon. With the rising age of technology, many aircraft companies and flight schools have recently done away with the traditional six pack. Instead, these institutions have swapped over to primary and multi-functional-flight displays. These "glass" instruments provide the pilot with the same essential information, however, through different display formats found in two large, digitized screens. Many pilots and flight instructors have debated if student pilots should receive training in aircraft equipped with round gauge or glass instruments. Through conducting analytic surveys and undergoing Instrument Flight Training, I collected data and retaught myself how to fly. My goal was to objectively answer the question: Should student pilots be trained in aircraft equipped with round gauge or glass instruments?

- **BASIS ADVISOR:** Brent Weaver • **ON-SITE MENTOR:** Various Advisors Supported by Mrs. Smith and Captain Benjamin Reyes • **LOCATION:** ALPHA International Aviation

ROSHMI U.



DIFFERING TECHNIQUES TO ENSURE THE ULTIMATE SUCCESS OF SPECIAL EDUCATION STUDENTS

SUMMARY: Educators are expected to provide the best education to all of their students and to consider individual student needs. In a world that is so quick to accuse teachers of not being able to do their job correctly, have we ever stopped to consider all of the different methods and techniques that teachers must perfect in order to create an effective teaching strategy that caters to all students? Teachers have to learn while on the job, all while they are teaching their students. Special needs teachers have to develop even more extensive pedagogical methods for their classrooms. Special needs teachers have a plethora of disabilities that they must cater to in order to create the best possible learning environment for all of their students. In my project, I observed various methods utilized by special education teachers and personally witnessed several successful methods. I asked teachers questions about methods they found most effective for their classroom management, as well as for specific students. Teachers also have to examine the harms and benefits of incorporating a special needs student into a general education classroom, while considering student needs and teacher capabilities. As part of my project, I asked teachers about successes and failures they experienced with incorporating special needs students into mainstream education. The main goal of my project was to understand and research the techniques that teachers, physical therapists, and all involved in the special education system use to provide the best possible education to special needs students.

- **BASIS ADVISOR:** Danielle Longworth • **ON-SITE MENTOR:** Kristin Ott, PT
- **LOCATION:** Humbolt Unified School District

MARIO Z.



ENVISIONING, CREATING, AND UTILIZING DESALINATION: IS IT A SOLUTION TO SOLVING THE WATER SHORTAGE IN THE SOUTHWESTERN UNITED STATES?

SUMMARY: "The third world war is at our gate, and it will be about water if we don't do something about this crisis," Rajendra Singh, Indian water conservationist. In the arid Southwestern United States, this is already becoming a reality. With underground water resources already drying out, there must be a rush to solve one of the biggest issues that poses a threat to over 62 million people. In this project, I analyzed a potential solution to this crisis: desalination. Through my own independent research, I learned about the different methods of desalination, including how they are used in the present day and what can be improved from modern designs. Throughout the project, I taught myself to utilize advanced machinery and techniques, such as welding, woodworking, and designing. Using these techniques, I created small-scale, solar-powered desalination machines that are able to produce freshwater from saltwater. While the technology is already in practice, many low-income and underserved communities do not have access to the technology because of its cost. Therefore, my goal was to make my machine as cost-effective and sustainable as possible by using scrap materials for prototypes and testing different components. This project challenges the mind to think about ways to solve issues cost-effectively. It involved brainstorming multiple designs, methods, and ideas to find the most viable options. Through this hands-on experience, I gained insight into the design and construction process of sustainable technology and learned more about what I want to do in the future.

- **BASIS ADVISOR:** Miles Hansen • **ON-SITE MENTOR:** Katherine Rolle
- **LOCATION:** Embry Riddle Aeronautical University



Prescott

1901 Prescott Lakes Parkway | Prescott AZ 86301

