The Spring 2020 Celebration of Scholarship: Undergraduate Research and Creative Activity Forum will use a virtual platform due to the COVID-19 pandemic. This health crisis brought words to the forefront such as: social distancing, self-isolating, self-quarantine, coronavirus, essential, non-essential, personal protection equipment (PPE), and flattening the curve. Universities around the nation moved their faculty and students to online education, canceled group gatherings and asked students that could to move home and limit the resident halls capacity in hopes to flatten the curve and slow the community spread of COVID-19. We are all living in a time that is strange and unusual, and very uncertain. Knowing our students research projects have been ground to a halt, we still want to honor and celebrate the work they have done. This forum is a positive event that will elevate our spirits during this difficult time. It will provide an outlet where we can come together to share and learn and support our students and faculty.

You may access our virtual symposium at [http://symposium.foragerone.com/](http://symposium.foragerone.com/) and select Midwestern State University in the dropdown menu to easily view the content, as well as offer your feedback and insights. You will need to sign up using your institutional email. Please note that there are two Midwestern State University selections, one is Oral and Posters, which are Public and you may share with your family and community associates; the second one is Emerging Research, is set to Private—and may only be viewed by MSU Texas personnel. A full program may also be access at [www.msutexas.edu/ugrow/celebration-of-scholarship](http://www.msutexas.edu/ugrow/celebration-of-scholarship)
ORAL PRESENTATIONS
Presentations-15 minutes maximum.
Presenters are responsible for the recording and transmission of their presentations.
Suggestions are a slide show with voice over.

POSTERS
Presentations can be 8-10 minutes.
Presentation of a poster can be a PDF or a single slide format with a voice over.

CREATIVE ACTIVITY/FILM/ART-
Presentation-15 minutes maximum
Presenters are responsible for recording and transmitting their presentation.

EMERGING RESEARCH—
Presentations can be 5-8 minutes.
Presentation can be a PDF or a single slide format with a voice over.

The following abstracts represent hard work and dedication to research and creative work. The abstracts are grouped in like disciplines from each college. Please take time to read the abstracts while viewing the presentations! It is vital to offer constructive criticism and ask questions that promote good thought and offer positive support.

ORAL PRESENTATIONS

Art, Mass Communication, Documentary/Film, Performing Arts, Visual Arts

Darkness on the Edge of Town
Madison Davis, Alexis Rucker, Fain College of Fine Arts, Mass Communication
Mentor(s): Jonathon Quam
Darkness on the Edge of Town (working title) is a short documentary project (8-12 minutes) examining the impact of human trafficking in Wichita Falls, TX. Through interviews with survivors of human trafficking and law enforcement officers who have taken on the criminals who perpetrate this evil act, this documentary will highlight incredible stories of survival and recovery. The film will also help viewers understand how pervasive this issue is in Wichita Falls and how it manages to exist and thrive just below the surface of mainstream culture. This presentation would focus on the research, writing and goals of the film and not the presentation of the documentary itself. Our production was halted due to the COVID-19 pandemic. The students will present the research they put together as well as some of the media we shot before production went on hiatus. No human subjects were filmed during the production we had time for. Our production also falls into the category of oral history, which is an exempt category for IRB approval.

Biology, Chemistry, Plant Biology

Dietary Niche Overlap of Native and Invasive Anoles on Dominica
Chelsea Connor, McCoy College of Science, Mathematics, and Engineering, Biology
Mentor(s): Dr. Charles Watson
Invasive species can negatively affect a community by taking resources otherwise used by native species. Among the most direct forms of competition between such organisms is food. On the island of Dominica exist a native species of Anole (Anolis oculatus) and a relatively recent invader (Anolis cristatellus). In the
20 years since *Anolis cristatellus* first invaded Dominica, it has established breeding populations in all regions of the island except the most mountainous. This presumably puts them in direct competition with the native *Anolis oculatus* for prey. However, the extent of their dietary niche overlap remains undocumented. Some populations of the endemic native anole appear to be affected by the presence of the invasive more than others. This study uses molecular techniques and fecal samples to determine major groups of arthropods consumed by members of each species in multiple populations across the island. By documenting the extent of their dietary niche overlap, we can better understand competitive dynamics between species within communities and among populations.

**Computer Science, Mathematics, Physics**

*Evaluation of Performance in Cache Memory using Machine Cycles for Good and Bad*  
*Ravishka S Rathnasuriya*, McCoy College of Science, Mathematics, and Engineering, Computer Science  
Mentor(s): Dr. Nelson Passos  

Modern day computer processors are designed for high-speed computer performance. Due to the large numbers of system built and a possible low quality to allow minimum cost and time, the manufacturers may not test such systems for vulnerabilities such as hardware attacks that can take place inside the processors. This research presentation will discuss the computer cache memory system and how it is used for performance improvement purposes such as data accessing when user needs information through different architectural structures. Also, included is a study of the same principle to use the processor in negative ways such as hacking a system and accessing private information.

*Novel Prime Number Finding Algorithm*  
*Yujin Yoshimura*, McCoy College of Science, Mathematics, and Engineering, Computer Science  
Mentor (s): Dr. Eduardo Colmenares  

Prime numbers have been playing an important role in our daily life. The most commonly used cryptosystem today, RSA, is guaranteed secure by large prime numbers. On the other hand, prime numbers had been studied and fascinated humanity since ancient times. For example, during the 3rd century B.C.E., the Greek mathematician Eratosthenes of Cyrene created one of the most famous algorithms, known as the Sieve of Eratosthenes. It serves as a point of reference for more modern approaches, such as the Sieve of Sundaram and the Sieve of Atkin. This research proposes the study, comparison, and analysis of a novel prime number finding algorithm capable of competing with ancient and modern algorithms. The proposed algorithm is a geometric algorithm based on the Pythagorean Theorem and the Euclidean algorithm. This geometric algorithm puts effort in the generation of prime candidates, to sieve more efficiently than existing algorithms. Furthermore, this research exploits the power of parallel computation, such that the proposed algorithm is implemented in Pthread, and tested in a supercomputer cluster TACCStampede2 of the University of Texas. It takes advantage that the generation of prime candidates’ part is easier to parallelize than the sieving part. The testing results show that while this geometric algorithm is conditionally faster than other algorithms in the sequential approach, its efficiency increases nearly perfectly when it is parallelized. This research concludes that the geometric algorithm has an advantage over other algorithms in terms of ease of parallelization and efficiency by performance analysis.

**Business, Economics, Finance, Information Management Systems, Marketing**

*On the Determinants of OECD Foreign Direct Investment in Sub-Saharan Africa*  
*Zihao Wu, Kaushik Shah*, Dillard College of Business Administration, Economics, Finance, & General Business  
Mentor(s): Dr. Pablo A. Garcia-Fuentes  

This study covers the period 1991-2012 and uses an unbalanced panel data set for 157 country pairs due to matching 28 OECD countries with 25 SSA countries. It focuses on the factors that affect the location of OECD FDI in SSA. The econometric specification is

\[
\widehat{\text{FDI}}_{ij,t} = \beta_0 + \beta_1 \ln\text{RGDPpc} \_j,t + \beta_2 \ln\text{Open} \_j,t + \beta_3 \ln\text{Rer} \_j,t + \beta_4 \ln\text{Infla} \_j,t + \beta_5 \ln\text{Rir} \_j,t + \beta_6 \ln\text{Fexp} \_j,t + \beta_7 \ln\text{Pri} \_j,t + \beta_8 \ln\text{Pho} \_j,t + \beta_9 \ln\text{Sedu} \_j,t + a_j + \mu_t + \epsilon_{ij,t}
\]

where \(\text{FDI} \_ij,t\) is the FDI position of an OECD country i as a share of a SSA host country j GDP.
in year \( t \), \( RGDPpc \) is host country per capita GDP, \( Open \) is host country trade openness, \( Rer \) is the real exchange rate of the host country currency and the U.S. dollar, \( Infla \) is host country inflation as proxy for macroeconomic stability, \( Rird \) is the difference between the host country real interest rate and the U.S. real interest rate, \( Fexp \) is host country fuel exports as share of merchandise exports, \( Pri \) is the political rights index as proxy for host country risk (the index values are from 1 to 7, the highest, the worse), \( Pho \) is the percentage of phones per hundred people as proxy for host country infrastructure, \( Sedu \) is secondary school enrollment as proxy for human capital, \( a_j \) is the unobservable host country effect; \( \mu_t \) is the unobservable time effect; and \( \varepsilon_{(j,t)} \) is the idiosyncratic error which is assumed to be independently and identically distributed with zero mean and variance \( \sigma_{\varepsilon}^2 \). \( Ln \) is the natural logarithm operator. The results show that host country real per capita GDP, availability of natural resources, and infrastructure are important determinants of OECD FDI in SSA. The positive effects of host country natural resource availability and infrastructure suggest that SSA countries with relatively high levels of natural resources should improve their infrastructure in order to attract OECD FDI.

**Factors Influencing MBA Enrollment**

**Lexis Brickhouse, Issac Nunez, Jose Ramirez, Hongji Zhan**, Dillard College of Business Administration, Management, Marketing, & Legal Studies  
Mentor(s): Dr. Thuy D. Nguyen  
This study aims to answer the following four research questions regarding DCOBA MBA program: Who is our target market? How do we best serve our MBA students? What are the best ways to market our programs? What are our prospective students assumptions about our program? The study was conducted in two phases: qualitative (60 respondents) and quantitative (314 respondents). Using in-depth interviews, descriptive statistics, ANOVA, and regression analyses, the findings indicate that approximately 43% of prospective MBA students are international. Twenty percent of them do not have business undergraduate degrees, and 42% would consider DCOBA MBA as their first choice. Prospective MBA students indicated that low tuition and living costs, employment during and after graduation, faculty advisor, hands-on industry project, availability of concentrations, and flexibility of delivery are among the most important factors. Students seem to prefer 1.5 credit hours (vs. 3.0), 90 minutes class (vs 3 hours), and afternoon (vs morning and evening). Seventy-one percent planned to be part time students, taking two graduate courses or less. Thirty percent of the students preferred online classes, and 40 % preferred hybrid. Together, 70% of students preferred some online component in their courses. Lastly, most people do not have any impressions nor awareness of DCOBA MBA program. They believe that the program has high value for money, but too limited in terms of concentrations and elective courses. IRB# 20021403

**Forecast of the U.S. Unemployment Rate**

**Alyssa Dimmick, Kervelle Guiste**, Dillard College of Business  
Mentor(s): Dr. Pablo Garcia-Fuentes and Dr. Joseph Smalley  
The unemployment rate is defined as the percentage of unemployed workers in the total labor force. The total labor force includes the employed and unemployed. The unemployed are people without jobs, who are looking for jobs, and available for work. If employment increases, consumer spending increases which has a positive effect on the economy. However, there is a negative effect on the economy when unemployment increases. High unemployment means that the economy is not efficiently using its factors of production, so it is not producing at its capacity. Therefore, the unemployment rate is one of the key indicators of economic health. The unemployment rate is a lagging indicator that that is related to the business cycles such recessions and expansions of the economy. This suggests that knowledge of the future unemployment rate is important to policy makers and business managers. The Federal Reserve uses the unemployment rate to create monetary policy and predicting recessions. Investors look at the unemployment rate to determine which industries are losing or gaining jobs in order to make their investment decisions. People can use the unemployment rate to gauge how competitive the job market is, how likely they are to be employed, and gauge their future economic status. In the case of businesses, the unemployment rate can help them assess the behavior of aggregate demand and make decisions on hiring labor. This research forecasts the United States unemployment rate. It uses SAS and the Auto-regressive Integrated Moving Average (ARIMA) method. The data covers the period 2000-2019.
**Effects of Varying Frequencies of Positive Expectation Violations on Retention**

**Carl Alfert**, West College of Education, Curriculum and Learning

Mentor(s): Dr. Suzanne Lindt

Expectation violations can be defined as an unexpected stimulus that causes a raise of local awareness. In other words, using something unexpected, such as a noise or image to pull one’s attention back to the task or situation, may cause an expectation violation. Expectation violations increase arousal levels by engaging the sympathetic system, which heightens visual and auditory senses. Though expectation violations allow people or students to increase attention, expectation violations also cause a rise of anxiety associated with the arousal. To reduce anxiety in the college classroom or lecture hall, Positive Expectation Violations (PEV) may be used in which a stimulus is added to cause a positive emotional response for the student through the use of friendly or humorous imagery. Over two studies, we tested two control groups and five treatment groups for the effects of high and low intensity PEVs on retention (N=270). Study 1 did not show a statically significant difference in means between groups. This unexpected result lead us to modify the PEV to a lower intensity with the understanding that optimal arousal may have been overshot. In Study 2, significant moderate negative correlation was found between an increased frequency of PEVs and student retention (r=-.281, p=.001). Additional research in PEVs to seek an optimal level of arousals may be needed. IRB# 19041502

**The Sad Irony of a Young Heroic Socialist**

**Cassandra Dale**, Abilene Christian University, Language and Literature

Mentor(s): Dr. Mikee Delony, Dr. Cole Bennett, Dr. Shelly Sanders

Young adult novels have been a popular genre for feminist, postcolonial, and queer criticism, all notably addressing the issue of identity, the quintessential theme during adolescence. These critical approaches, while surveying specific categories of identity, neglect the individual's holistic progression and the common catastrophic catalyst that provokes zealous identification with mere categories. The individual, transcendent of labels, is lost to causes and, so, is not affirmed in his or her whole being as he or she is circumscribed to one identifier. Since the turn of the 21st century, young adults have simultaneously exhibited a strong predilection for dystopian novels illustrating socialism's destructive nature while also being the ideology's most ardent advocates. This irony reveals a psychological duality in the emotional throes of the young adults who take on the causes of 'marginalized others' due to their own disillusionment with fantastical ideals. Above all, they wish to preserve the lost ideal and often resort to losing that which they value most for the rosy idea of perfection. These dystopian societies they condemn in fiction and yet praise in reality preserve the ideal for the collective, but at the cost of the individual's autonomy, ensuring that choice does not threaten the society or empower the individual. However, this deprivation of choice is an imposition on the individual's identity that young adults do not abide in practice. This essay explores the issue of young adults' angst and self-deprecating altruism by psychologically analyzing the genre's The Giver and the Divergent series. IRB exempt

**The Question of Evil and Its Logic: Confucianism and Christianity**

**Nathan Conard**, Prothro-Yeager College of Humanities and Social Sciences, English, Humanities, & Philosophy

Mentor(s): Donovan Irven

The question of the nature and origin of evil is a significant feature of many diverse religious philosophies. Our project considers similarities between approaches to the question within the two religious traditions of Christianity and Confucianism. Our comparative analysis reveals that, despite the vast differences between the two, Christianity and Confucianism display remarkable concurrence regarding their treatment of the question of evil, although dissimilarities emerge as well. Our project gives special attention to the underlying conceptual or logical parallels that contribute to this concurrence of thought. For our project, representatives of Christianity include St. Augustine, Alvin Plantinga, and Paul Tillich, among others. Confucianism is represented primarily by Zhu Xi, Mengzi (Mencius), and Hsun Tzu, among others. IRB exempt
The Smart LED Table

Brandon Eakins, Clayton Masters, Kelcee Thompson, Tojya Vital, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Jeong Tae Ok and Dr. Zeki Ilhan

In our project The smart LED table, we have replaced the previous sensory array and various structured elements to improve the efficiency and lifespan of the apparatus. At the request of our professors, beginning last semester, our team has researched and implemented improvements to the system. The first of these is the updated sensor arrays. While the ultrasonic sensors previously implemented are sufficient for a rough estimate as well as being resistant to dirt and moisture commonly found in a greenhouse they are very inaccurate at longer distances and ineffective on softer surfaces like plants. Thus, we have implemented a camera imaging system, which will offer a much more accurate measuring system as well as not having the limitation of needing a more rigid object. In addition, the new cameras will allow for a much more adaptive control of the apparatus rather than simply by height. What we have implemented is a control program using calculated light intensity at the tops of the specimens. Will allow the system to observe and adapt to data collected from cataloging growth rates of different species of plants corresponding to different ‘critical distances’. The apparatus will have four cameras that will be mounted on each of the faces of the structure. This will cover every angle of the system and allow maximum coverage. These cameras will be poised in such a way as to capture a section of the platform and record changes to the dimensions of the plants placed in that section.

Energy Recovery Unit using Phase Change Material

Kelton Vidal, Rumelia Thomas, Thilanka Senevirathne, Saleh Almutairi, Joshua Lambright, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Mahmoud Elsharafi

Energy recovery can benefit from phase change materials. A phase change material is a substance with a high heat of fusion, melting, and solidifying at a certain temperature, which is capable of storing and releasing large amounts of energy. The objective of this research is to enhance the efficiency of a system using modeling and experiments of corrugated plates as a recovery unit and salt as the PCM (Phase Change Material). The research focuses on understanding Thermal Energy Storage (TES) at melting temperature for heating. This study starts to design a unique energy recovery unit that has the capability to charge/discharge energy using fundamental of phase change material using low melting temperature materials. This research uses corrugated plates which carry the thermal fluid (water) and channel in between was occupied using PCM or in this case salt. The experiment measures the temperature in and out from the unit to estimate how much kWh (power) that unit can save in the molten salt. Also, monitoring the temperature inside the PCM using implanted thermocouples. The approach of this work is to collect temperature as a function of time to find how much energy units use to reach the charging point (fully melted) and reverse the flow to retrieve energy from the unit. A follow-up of this project was to design and analyze the system to fit into our homes and merge with HVAC systems. The results of this work can help to increase the energy sources since the energy demands are increasing.

Non-Servo Pick and Place Robot used in Clamp and Drill Station with Hopper Feeder

Charles Whiting, Jonathan Granger, Arnold James, Sofia Rendon, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Jan Brink and Dr. Pranaya Pokharel

The purpose of the project is to design a non-servo pick and place robot, and a drilling and clamping station with a hopper feeder system for wooden blocks. An Allen-Bradley Compact Logix L24ER programmable logic controller (PLC) will be used to control the work cell. The programmable logic controller will be responsible for controlling the work cell, which includes feeding, picking up and moving, clamping and drilling wooden blocks. The work cell will simulate a manufacturing process where parts are moved from one location to another for machining to replace human labor in repetitive tasks. An Allen-Bradley PV Plus 600 Human Machine Interface (HMI) will be used to display various functions such as graphs, buttons, and counters. The components required for the work cell have been ordered and machined. The table, which houses the work cell, has been prepared and will have an acrylic glass enclosure mounted around the work cell. The robot will be put together and mounted at the center of the table. Finally, the program used to
automatically run the robot will be completed with both manual and automatic logic. The final phase of the project will require the group to plumb the pneumatics, wire the electrical components, and install the hopper feeder and clamp and drill station on the table. The goal of the project is to produce a clean, sturdy, and robust work cell that has potential for future expansion.

Search and Rescue UAV - Radio Direction-Finding

Bryan Heilman, Sharome Burton, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Yu Guo

This project has an overall aim of developing a light, aerial search and rescue platform by integrating a radio direction-finder (RDF) into a small unmanned aerial vehicle (UAV) using commercial, off-the-shelf (COTS) components. The finished platform will be able to locate emergency locator transmitter (ELT) beacons from the air. At this phase of the project, the RDF system is being built using a four-channel COTS software-defined radio (SDR) receiver, an open-source signal processing script, and COTS antennas. Data will be relayed between the ground station and the aircraft using LoRa (Long Range) transceiver modules operating on the license-free 915 MHz radio band. To estimate the angle or direction arrival (DOA) of a signal source, the RDF we build will use the method of phase interferometry. This method involves the arrangement of two or more phase-coherent receiving elements in a linear or circular array, tuned to the frequency of interest. Since each element receives the wave front at a marginally different time, the phase difference of the signal between each element can be calculated, and one of a number of signal processing algorithms (MUSIC, MEM, Capon, or Bartlett) can be applied to estimate the DOA. Using the GPS coordinates of the aircraft, its compass heading, and the DOA, lines of bearing will be plotted on a geographic map in real-time to indicate the estimated location of the ELT using software developed specifically for the project.

Hydraulic Braking Simulation

Alec Nichols, Josh Washington, Udes Malaviarachchi, Cory Carter, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Yu Guo

Our Senior Design project idea will be used for future McCoy engineering students as a measurements and instrumentation lab. Our project relates to many courses offered for mechanical engineering such as Measurements and instrumentation, Fluid Power Design, Heat Transfer, Dynamics, Machine Control Programming and Control Systems. We will begin by using a hydraulic motor that will rotate an aluminum disc at controlled variable speeds by using a hydraulic proportional valve. This will allow us to control the gallons per minute going to the motor which is a direct correlation with the rotational speed. We will then use a basic pneumatic cylinder circuit to apply an adjustable force with a brake attached to the end. All of this will be analyzed and controlled using a programmable logic controller. The reason for this experiment is to see how much heat is generated from the frictional force caused by the brake applying pressure to a disc. We will use different brake materials that will be easy to switch between and document the differences. In order to calculate the temperature of the disc while a braking force is applied, we will be using a non-contact infrared temperature sensor. This will allow us to get an accurate reading while not having to deal with mounting the sensor. We will then be able to plot the temperature against the different motor speeds and the different braking materials. Other possible practical applications could include brake pad testing or brake disk testing for frictional coefficients or durability.

Design and Implementation of an Autonomous Humanoid Robot

Don Wijesinghe, Jeremy Burris, Oluwatobi Olowofela, Craig Dublin, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Yu Guo

The objective of this project is to design and construct a 25 degrees of freedom humanoid robot with the ability to display gait motions while maintaining balance throughout its gait phases. Our primary task was to develop a design for the robot considering all mechanical aspects that would later describe the capabilities and limitations of this robot. Solidworks software was used to complete the design and the structural analysis for static and transient conditions was carried out on the ANSYS software. The final design was then used to machine and 3D print, the respective parts. The machined parts, 25 servos, and other purchased components were used to successfully assemble the humanoid robot. The servos were
wired corresponding to a diagram that allows 5 parallel connections with each connection allowing up-to 256 servos to be connected in series. The 25 servos, which govern its movement, will be controlled using an onboard raspberry pi 4. A camera that directly connects to the raspberry pi 4 has been attached to the frame of the humanoid robot, which will be programmed to provide a live feed when necessary. The gait algorithm will be developed to describe its motion in the three-dimensional plane using an adaptive trajectory that occurs in real-time. Accelerometers will be used to provide feedback during gait motions and the humanoid will be powered using a line power adaptor. The fundamental principals in design and construction, program and control, and power distribution, will enable us to develop a machine with many capabilities.

**FPAA-Based Implementation of Nonlinear Oscillatory Circuits**

**Tyler Cadette, Don Wijesinghe**, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor(s): Dr. Yu Guo

This research project aims to investigate the chaotic behavior of the Van der Pol phenomenon experimentally using circuit design. Chaotic generators generally comprise of various electronic components such as individual op-amps, analog multipliers and integrators. This process of building chaotic generators is typically difficult and time consuming. Due to these complexities encountered when hard wiring such a complex circuit, we used a Field-Programmable analog array (FPAA). FPAA is an integrated circuit device that offers field programmability. In recent years FPAA has gained traction in the electrical engineering research community due to its flexibility and simplicity. Utilizing this technology, we have designed the Van der Pol circuit for experimental observation. In our observations, we have come across some discrepancies when compared to the theoretical results and are currently investigating methods to rectify these errors. In parallel, we have designed the physical representation of the Van der Pol circuit using a breadboard and other key components. The observations from this method are identical to the theoretical results. To confirm the accuracy of these observations, we have designed a program using MATLAB that encompasses a numerical approach of solving the second-order non-homogenous non-linear differential equation. In this approach, we utilize the data acquired from our physical representation as our boundary conditions for our discretization algorithm. Our observations from this method are very similar to that of the physical representation's, but with slight discrepancies. We are focused on overcoming this problem. This program will be used to confirm the accuracy of experimental data.

**A Continuously Variable Gear Ratio Multistage Gearbox for Wind Turbines**

**Taris Major**, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor(s): Dr. Salim Azzouz

This research project has been a continued one over the past three semesters. It explores the possibility of increasing the amount of energy harvested by a wind turbine through the implementation of a multistage gearbox with a high number of adjacent successive discrete gear ratios. The multistage gearing system allows a variable speed at the input shaft and delivers a quasi-constant speed at the output shaft. The gearbox consists of a staged gear assembly spaced with controlled sets of magnetic clutches acting as gear shifters. The system is dimensioned to deliver a quasi-constant frequency very close to 60 Hz. The gearbox system is designed using the SolidWorks CAD software for modeling and simulation. The gearing theory is used to dimension the required staged gears. A mathematical model of a wind turbine rotor associated with Betz' Law allows the calculation of an optimal power coefficient that is used to determine the power absorbed by the wind turbine from the wind. The kinematic gearing theory is used to establish the adjacent successive discrete gear ratios of the gearbox. Various gearing configurations have been established to run multiple pole generators. A technical paper is currently being written to publicize the findings of this project.

**Arconic Engines-Universal Sprue Fixture with Powered Multi-Axis Rotating Synchronous Parallel Gripper for the AW Bell Cutoff Saw**

**Pamela Yvonne Kambabi, Clayton Hargis, Kyle Kidwell, Zack Jenkins**, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor(s): Dr. Salim Azzouz and Dr. Pranaya Pokharel

The MSU engineering department has a collaborative project with a local company Arconic Engines in Wichita Falls. Arconic is a manufacturing company that produces jet engine components for the aerospace industry using the investment casting process. A group of senior students, engineers from Arconic, and two
MSU faculty, leads the project. The purpose of the project is to design a universal fixture that holds tightly the sprue of the vanes casting so that the metal of the pouring cup can be cut, removed, and scrapped. The sprue-cutting fixture is to be implemented in a new cutting machine in a manner that offers the operator an ergonomic posture without stress, providing a safe work environment while increasing the rate of production. The group conducted many brainstorming sessions and came up with two design concepts. SolidWorks drawing software was used to create the drawings. The group made a choice that satisfied the Arconic engineers using the best parts of both designs. The project is still on-going, and the next phase is to finalize the design of the cutting machine with the fixture. The fixture has been already manufactured and tested. Some minor issues still need to be addressed, such as using new types of bearings, weight reduction, and sturdier mounting grips in the fixture to reduce vibrations during the cut-off operations. The next objective for the students is to motorize the clamping device of the fixture, while implementing safeguards to prevent operator injury before final testing.

**A Tranter Heat MaxChanger Fabricated Using Additive Manufacturing**

**Taris Major, Kimberley Telemacque, William Hendrix, Hunter Glenn,** McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor(s): Dr. Salim Azzouz

The purpose of this project is to 3D Metal print the Tranter MaxChanger, a plate heat exchanger (PHE) that is used in many industries for its efficiency. The current process of fabricating a single unit requires many manufacturing processes including shearing, punching, stamping, assembling, and welding. Using a basic design from Tranter, the MSU group was able to implement a dimpled pattern to increase the structural integrity of the MaxChanger and add a wavy internal boundary edge to create more turbulence within the flow. The MSU team has been able to 3D print a mocked model of the MaxChanger using the Stereolithographic 3D printing process. Based on the results obtained by the MSU team, the Tranter Company is planning to Metal 3D print the MaxChanger with the Powder Bed Fusion Technology. In implementing this process, the MaxChanger can be made with different types of metals, have a better surface finish, reduce the manufacturing operations, and minimize the fabrication time and the wasted materials. Additionally, in concert with a team of engineers from Tranter, the MSU team is building a mathematical model that mimics the thermal behavior of the MaxChanger. The MSU team is also planning to use the Software ANSYS to analyze the failure modes of the MaxChanger, and simulate the flow inside the heat exchanger. The MSU team is expected to conduct testing on the mocked model during the current spring 2020 semester.

**Automated Pencil Sharpener**

**Carlyse Wallace, Ijuani Stephenson, Landon Anderson, Luuk Teurlinx,** McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor(s): Dr. Jan Brink

The purpose of the automated pencil sharpening system is to highlight a robust, efficient automated operation to prospective students and the industrial advisory board of the mechanical engineering program at MSU. The equipment used in the work cell includes a Kawasaki RS005L robotic arm, sensors, pneumatic cylinders, two rotary actuators and a Cognex 7801 Vision System. The Vision Inspection Programming Language, In-Sight Explorer, and the Advanced Superior Language for Robotics are the programs that will be used. At the beginning of the robotics program, a user will be prompted to load the hopper with pencils, which can be randomly oriented inside the hopper. A mechanical and pneumatic fixture in the hopper will dispense the pencils, one at a time, to a tray that is capable of holding two pencils. The pencils will also be oriented in the correct direction by a fixture in the hopper system in case they were improperly loaded. The robotic arm will then pick up two unsharpened pencils from the tray and load them into a sharpening station. A random sharpened pencil will be tested by performing a writing sample. The vision system will then inspect a writing sample and determine if it passes or fails. If the pencil fails the test, the pencil will be placed in a bin designated for bad pencils. If the pencil passes the test, the pencil will be placed in a bin designated for good pencils. This good pencil bin will be capable of dispensing pencils for distribution.

**Design of a Rotating Assembly Fixture for Power Take-Off Units**

**Josh Gillis, Trace Hardee, Collin Palmore, Cody Park, and Ricardo Stuart,** McCoy College of Science, Mathematics and Engineering, McCoy School of Engineering

Mentor(s): Dr. Zeki Ilhan, and Bryan Schaffner (WPT Power Corporation)
Power Take-Off (PTO) units are widely used in the industry to transmit power from a prime mover such as a running engine to another equipment or machine. In this project, a rotary assembly fixture is proposed to aid in the assembly of the PTO units produced by the WPT Power Corporation, a local manufacturer for power transmission equipment in Wichita Falls, TX. In their current assembly of PTO units, WPT Power employees must lift and flip the units over with a portable crane. This process is slow and poses unnecessary risks to workers. As a safer and more efficient method of assembling the PTOs, a conceptual design of a rotary fixture has been proposed by the MSU senior design team in Fall 2019. This proposed fixture will be able to rotate and support 1,000 lbs. units without complicating the assembly. The conceptual design has already been approved by the WPT Team, and a series of efforts have been made towards the selection of the pneumatic parts along with the refinement of the mechanical design of the select components throughout the Spring 2020. ANSYS software is used to validate the theoretical design calculations in a simulation environment to provide evidence that the calculations performed were correct and satisfied the safety factor of eight, which is the criterion set by the WPT Power Team. The parts are already ordered, and the assembly operations are ongoing, with a planned delivery of the fabricated product to WPT by the end of Spring 2020 semester.

**Criminal Justice, Sociology, Psychology**

*Implicit Prejudiced Attitudes Towards Disability: Visible and Invisible*

**Mallory LeDoux**, Prothro-Yeager College of Humanities and Social Sciences, Psychology  
Mentor(s): Dr. Scott Frankowski

The purpose of this study is to test implicit biases of prejudicial personality traits (Authoritarian and Social-Dominant Orientation - SDO) towards disability - specifically visible and invisible disabilities. Visible disability is defined as a 'disability readily apparent when initially interacting with a person'. An invisible disability is defined as a 'disability not readily apparent when initially interacting with a person'. Experimental design methodology for the study involves collecting data from about 200 participants from the Midwestern State University undergraduate population as well as the Wichita Falls, Texas community. To test our primary hypothesis, we will correlate both Authoritarian and SDO traits to their implicit and explicit disability views. Implicit views will be measured through implicit association testing (IAT) and personality traits and explicit attitudes will be measured through self-report tests. We hypothesize that authoritarianism and social dominance will strongly and uniquely predict implicit and explicit biases toward disability. If the hypothesis is supported in this study, there will be evidence that authoritarian and social dominance orientation are strong predictors of implicit bias towards both invisible and visible disabilities, even more so than people's explicit attitudes toward disability. The proposed study would extend current knowledge on prejudiced attitudes towards disability by revealing the persistence of personality dimensions in predicting attitudes. Currently, there is little research on predicting implicit attitudes towards disability based on personality traits, so this study would be a significant contribution to the literature. IRB# 20030301

**POSTER PRESENTATIONS**

**Biology, Chemistry, Plant Biology, Life Sciences**

*Targeting Genes in Xenopus laevis using CRISPR*

**Natalie Ragland, Andrew Wolf**, McCoy College of Science, Mathematics, and Engineering, Biology  
Mentor(s): Dr. Jon B Scales

The frog *Xenopus laevis* has long been used in the study of embryological development because of the ease with which one can obtain eggs, fertilize them in vitro and observe early developmental events in a laboratory setting. Although they are good developmental model systems for experimental embryogenesis, they are not very accessible to genetic manipulation because this species has up to four copies of every gene and its breeding cycle is over 2 years long. To that end, we have designed CRISPR reagents that will allow us to target the gene XEphA4 and disrupt all allelic copies of this gene in frog cells. XEphA4 encodes a tyrosine kinase receptor that functions in the regulation of cell-cell recognition and migration. To date, we have generated a plasmid construct that will express a sgRNA targeting the XEphA4 genes. This sgRNA
together with mRNA encoding the Cas9 enzyme will be co-injected into single-celled Xenopus embryos to
determine what effect inactivation of the XEphA4 gene will have on early cell movements during
embryogenesis.

Antibiotic Resistance, Sugar Fermentation, and DNA Fingerprinting of Escherichia coli
Isolates from Resident and Migratory Waterfowl
Natalie McLaurin, McCoy College of Science, Mathematics, and Engineering, Biology
Mentor(s): Dr. James Masuoka
Migratory birds play a key role in the spread of pathogenic bacteria from one habitat to another acting as
vectors for disease. Previous work in the lab identified a collection of Escherichia coli isolates within the
fecal microbiota of local waterfowl and migratory gulls. Several isolates were shown to be resistant to one
or more antibiotic. This present work extends these studies by identifying additional E. coli isolates and
further characterizing the collected isolates. Fecal samples were obtained from individual Canada geese
(Branta canadensis) and Ring-billed Gulls (Larus delawarensis) and inoculated onto selective media. From
the selective medium, 3-5 potential E. coli colonies were subcultured for further evaluation. Isolates were
identified using API strips. These results also allowed us to compare carbohydrate utilization profiles.
Antibiotic resistance to four selected antibiotics was determined using the Kirby-Bauer method. Repetitive
Extragenic Palindromic elements and Enterobacterial Repetitive Intergenic Consensus sequences were
amplified by polymerase chain reaction to observe DNA patterns between the two species over time. Thus
far, API results show five different patterns for sugar utilization, with individual birds containing isolates
with different utilization patterns. Isolates also fell into groupings of DNA sequences amplified by PCR.
However, a simple correlation of DNA with sugar utilization or with antibiotic resistance is not immediately
apparent. Through these comparisons, we hope to identify common and unique strains. These comparisons
will help us better understand how resistant isolates are introduced to our local watershed and shared among
the various species of waterfowl.

Indications of Stress in Anolis oculatus and Anolis cristatellus Populations Two Years after Hurricane
Maria
Destiny Zinn, Chelsea Connor, McCoy College of Science, Mathematics, and Engineering, Biology
Mentor(s): Dr. Charles M. Watson
In September of 2017, Hurricane Maria struck the Island of Dominica and caused widespread destruction.
Among the animals effected by this major disturbance event are the endemic Anolis oculatus and the
invasive Anolis cristatellus. At that time, our research laboratory had been studying both Anoles on the
island for two years. This allows us the opportunistic ability to compare basic health indicators from before
and after. We compare a basic body condition index (Snout-to-vent length / mass) of lizards sampled prior
to Hurricane Maria to those sampled in the two years since to determine if the aftermath of the storm caused
noticeable deleterious effects. Some populations of Anolis oculatus were affected more strongly than others.
Among those populations most affected, we recorded increased instances of noticeable parasites and
generally poor body conditions. Additionally, specimens of both species sampled post-hurricane presented
multiple scars and healed wounds that were generally absent from populations sampled pre-hurricane.

Exploring Potential Roles of Bacterial Endophytes During Environmental Stresses
Mi’Kaila Billinger, McCoy College of Science, Mathematics, and Engineering, Plant Biology
Mentor(s): Dr. Magaly Zachary-Rincon and Dr. James Masuoka
Plant bacterial endophytes do not cause harm to their host plant. Published experimental evidence suggests
that endophytes possess plant growth promoting(PGP) properties that aid in plant survival when subjected
to environmental stressors. Previous EURECA students isolated and identified twelve distinct bacterial
endophytes from seeds of various plant species. Among the twelve, Exiguobacterium acetylicum, isolated
from white mustard (Sinapis alba L.), was chosen to further investigate its potential PGP properties. E.
acetylicum was chosen based on its ability to grow at temperatures ranging from 4 °C to 50 °C. A generation
of Arabidopsis thaliana seeds were sown in soilless mix and then inoculated with E. acetylicum, while the
other plants received a CaCl₂ inoculum control. After 76 days, endophyte and control plant seeds were
surface sterilized and stored at room temperature in sealed Petri dishes until use. Results indicated
successful vertical transfer. Thirty endophyte seeds and 30 control seeds were grown on 0.5% Phytoagar
Petri dish and stratified for 48 hours at 4 °C. Seeds were then placed under a light bank (132 µmol m⁻² s⁻¹).
Endophyte and control seedlings will be transplanted to pots containing soilless mix and acclimated at
27 °C for a week under the light bank. After acclimation they will be exposed to the environmental stress test for a week. Unstressed Endophyte and control seedlings will be grown at a constant temperature during the day/night photoperiod. Various plant characteristics will be recorded. We predict that \textit{E. acetylicum} inoculated plants will have a higher survival rate than the control plants.

\textit{Utilizing Membrane Protein Chaperone as Treatment to Ameliorate Tau Protein Aggregation}

\textbf{Dianna Daniel, Ryan Smith}, McCoy College of Science, Mathematics, and Engineering, Chemistry

Mentor(s): Dr. Fu Cheng Liang

Protein aggregation poses a special challenge to protein homeostasis and leads to several diseases. Alzheimer’s disease is an increasingly prevalent neurodegenerative disorder around the world, involving amyloid-beta (Aβ) and Tau aggregates and eventually causing neuronal cell death. Both polypeptides form neurofibrillary deposits, however, several lines of evidence indicate that it is the oligomeric species of Aβ and Tau aggregates causing neurotoxicity. Inhibiting or reversing such insoluble/hydrophobic aggregates could shed new light on therapeutic strategy. CpSRP43 provides the first proof-of-principle example to demonstrate that efficient reversal of protein aggregation can be attained by adequate binding between a chaperone and its substrate protein without the consumption of ATP. Unlike most ATP-dependent chaperone, cpSRP43 is highly specific to bind to hydrophobic amino acid residues, stabilizing the unique interaction between chaperone and its aggregation-prone substrates, thereby preventing its client protein from aggregation. This research will build on these findings and further apply cpSRP43 like chaperone as a model system to utilize its unique anti-folding and disaggregation properties to strategically develop an effective treatment for Alzheimer’s disease.

\textit{Business, Economics, Finance, Information Management Systems, Marketing}

\textit{Commercialization Development in Low-Earth Orbit: What Are the Keys to Sustainability?}

\textbf{Megan Widner}, Dillard College of Business Administration Management, Marketing, & Legal Studies

Mentor(s): Dr. Jeff Stambaugh

On June 7th, 2019, NASA announced it would allow commercial use of its portion of the International Space Station (ISS) with plans for development in low-Earth orbit (LEO). Its long term goal is to turn over operations to the private sector to become a consumer of the human spaceflight enterprise and spark a commercial demand in LEO. In this quantitative study, we examine the keys to sustainability by analyzing the attitudes of students. We created a survey to measure the relationships of openness to experiences, willingness to pay, prior knowledge of the space program, perceived risk, demographics, and importance level. We intend to distribute the survey to MSU students. We hypothesize that a willingness to pay for and accept the perceived risks of space tourism is positively related to the importance of a sustainable LEO ecosystem. We also hypothesize that prior knowledge is positively associated with the importance of a sustainable LEO ecosystem. We hypothesize that openness to new experience will positively moderate these relationships such that more open people will be more likely to participate in space tourism and see a sustainable LEO ecosystem as necessary. Although we don't hypothesize any relationships, we intend to collect demographics such as age, gender, and nationality to determine whether they affect any of the above links. This report provides conclusions and recommendations on these factors that play into creating value to the consumers of tomorrow, and that contributes to driving space flight costs down to make it more attainable. IRB# 20031103

\textit{Computer Science, Mathematics, Physics}

\textit{An Early Threat Detection System Phase 2}

\textbf{Shady Boukhary}, McCoy College of Science, Mathematics, and Engineering, Computer Science

Mentor(s): Dr. Eduardo Colmenares

In the light of recent mass shooting incidents throughout the US and the world over the past few years, the need for quick threat detection and fast response times has risen dramatically. The optimal way to respond to such incidents is by preventing their occurrence. This research aims to develop a smart early threat detection system that can detect openly carried weapons using live security footage and report them to the appropriate authorities in order to maximize the efficiency of responses. The research aims to develop the
system using Convolutional Neural Networks, a class of Deep Learning Neural Networks aimed at analyzing visual data. Phase 1 results showed that the system is viable, and several models were tested. However, the problem of noise in the images dramatically reduced accuracy. Phase 2 of this research aims to solve the problem of noise through the development of a Faster R-CNN model. In addition, proper communication channels between the JETSON Nano and a server is established using an ExpressJS server running NodeJS.

Education, English/Literature, World Languages

Reading Attitudes of College Students

**Madison Smith**, West College of Education, Curriculum & Learning
Mentor(s): Dr. SuHua Huang
The purpose of this study was to investigate college students' reading attitudes toward reading paper and digital texts. The study used a quantitative research method. A total of 1,453 students (811 female and 642 male students) voluntarily participated in this study by completing a self-reported survey. The participants included Freshmen (30%), Sophomores (24%), Juniors (25%), and Seniors (21%). All participants were asked to answer a 20 question survey by using a five point Likert scale (1-5 from very satisfied to very dissatisfied) to identify the type of reading materials they prefer to read: Academic Reading of Print Materials (AP), Academic Reading in Digital Settings (AD), Recreational Reading of Print Materials (RP), and Recreational Reading in Digital Settings (RD). The descriptive statistical results indicated that RD had the highest mean scores when compared with other categories. The ANOVA tests indicated there are gender differences (p<.005) on the four types of reading materials, and classification differences on RP and RD (p<0.05). However, there are no significant differences (p>0.05) when compared with ethnic groups and ages. The findings indicated that college students' reading interests in different genres have changed over the years and they have shifted their reading from traditional texts to screen. More specifically, modern mobile devices provide students with immediate, portable access to many of the same education-enhancing and leisure capabilities as an Internet-connected computer, such as searching for information, listening to E-books, and watching videos. IRB#13050201

University Students Suspected of Having ADD: Examining Self-Awareness and Diagnostic Instruments

**Krystan Springette**, West College of Education, Special Education
Mentor(s): Dr. Emily Rutherford
The purpose of this research is to examine the level of awareness among university students about the symptoms of ADD as well as to determine if there is an effective screening tool for university students suspected of having ADD. Results of this research will be used in coordination with the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) to create a new screening instrument for adults suspected of having ADD. Principal researcher will recruit participants for the research from Midwestern State University. The researcher will then set up a meeting time where participants will be given a short survey and self-reporting scales for adults with ADD to complete. Data will be analyzed to determine the level of awareness among students and the effectiveness of the scales used. This result of this study are expected to show that there are some students that exhibit a high level of awareness, however; the majority of participants will be unaware of their ADD symptoms. Based on these results, it is expected that the researchers will be able to identify key components that can be used in designing a new screening instrument for adults with ADD. Conclusion: The researcher will use the information gather from the completed survey to create more awareness among students and faculty members at the Midwestern State University. The researcher will also create an effective screening instrument for university students suspected of having ADD. IRB# pending

Effects of Literature Circles on Teacher Efficacy, Empathy, and Professional Responsibility

**Mackenzie Box**, West College of Education, Curriculum and Learning
Mentor(s): Drs. Christina Janise McIntyre, Emily K. Reeves, Daphney L. Curry
In the last decade, there has been a shift in teacher’s opinions of their efficacy in the classroom. While many teachers may feel that they can do a great deal to help increase student achievement, these teachers have typically come from high quality EEP programs that focus on preparation of their pre-service teachers to meet the diverse needs of K-12 public school students (Beasley, et al, 2013). However, not all pre-service teachers have access to the same high quality experiences and resources. The purpose of this research was
to explore the effects of literature circles on pre-service teacher efficacy, empathy, and professional responsibility. Online learning communities (e.g. threaded discussion forums, web communities, literature circles) provide platforms for pre-service teachers to reflect, communicate, collaborate, and support one another. Because communication is asynchronous, advancing technologies offer unique opportunities for creating supportive learning environments regardless of placement quality. Students in a semester long required methods course participated in literature circles focusing on fiction texts with diverse main characters. Transcripts of the asynch online discussions were coded allowing for themes to emerge indicating participant’s levels of empathy. Results of this study indicate that online literature circles can help pre-service teachers develop empathy and increase teacher efficacy and an understanding of professional responsibility. (IRB# 16022202).

Engineering, Mechanical Engineering, Petroleum Engineering

Robotic Soccer using Artificial Intelligence: A Study in Vision Processing
Kuwin Wyke, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Yu Guo and Dr. Jeong Ok

Artificial intelligence is a growing field with increasing uses in the world. The overall goal of this project is to get fully autonomous robots to play soccer against one another. Currently, the project is focused on object recognition with focus on recognizing a tennis ball, which we will be used as our soccer ball. We are using a micro-computer called a Raspberry Pi as the brain of our operation. Consequently, we are trying to find the fastest algorithm to detect the tennis ball as the decision making in later stages of the project is expected to take a great deal of processing power and we need the robots to react in real time. The algorithms we are comparing are OpenCV HAAR cascade detection and TensorFlow inference graphs. TensorFlow inference graphs, simply put, are obtained by taking a set of inputs (pixels in the case of images) and setting weights and biases to each input. These weights and biases are determined by the training algorithm through testing on a series of labeled pictures. Similarly, the HAAR cascade is trained using several photos, the difference is that the image is broken down into a series of smaller features that are obtained by getting the sum and difference of pixels in a certain region. The general pattern of the object is then saved in a cascade file for comparison later.

Darcy and Non-Darcy Flow through Packing Particles
Theo Rolle, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Mahmoud Elsharafi

Darcy flow means the velocity of a fluid flowing through a porous medium is directly proportional to the pressure gradient (difference in pressure over a finite distance), and also inversely proportional to the viscosity of the fluid. It uses a proportionality constant 'k', which we call permeability, to characterize the specific porous medium. Non-Darcy flow deviates from Darcy's law, and typically occurs in high flow rate (turbulent) systems. For this research, close analysis of different particles is undertaken, the goal being to determine the ability of a fluid to move through different experimental particles. The apparatus used to carry out this experiment were; a syringe piston pump (for injecting fluid), a plastic cylindrical tube (which would house the different particles to be tested), a sieve set with different mesh sizes (to separate different sized particles), and a container to hold liquid. The particles to be tested were humus filtered through the 35 and 60 mesh sieve, and charcoal. In order to calculate the pressure gradient through a particle, two pressure gauges are used (one at each end of the cylindrical tube), and the readings are observed as the syringe pump injects fluid through the sample. The variables considered were flow rate, viscosity, length of the tube, cross sectional area of sample, pressure difference experienced through sample, and time taken for each pressure reading. Using these variables, it is possible to determine the permeability of a particular particle sample using Darcy's equation. This study is useful in petroleum industries.

Parametric Study of a Convective Heat Transfer Coefficient Measurement System
Kyndal Diehm, Jacob Hawkins, Vincent Johnson, Jackson Strieby
McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering
Mentor(s): Dr. Jeong Tae Ok

The science of heat transfer through pipe systems is critical to innovation advancements in engineering. As fluid flows through a pipe system, it experiences different forces and exhibit behaviors depending on certain factors. According to the simplified form of energy conservation within the pipe system, in general, higher
Fluid velocities tend to accompany lower pressures. The goal of this project is to determine how cavitation affects the heat transfer coefficient. In this project, the convective heat transfer coefficient of water was estimated and cavitation was used to visualize heat transfer process. In order to understand this process, we studied the system and its properties using simulation software COMSOL Multiphysics and ANSYS along with using a testing system. Once the behavior was determined through simulation it could be created in a flow loop system. Our system mimics a plug flow model that is often introduced to relate pressure drop with the mass flow rate. The system used created cavitation through generating heat which creates a pressure difference that causes cavitation. We used an apparatus that consists of pumping, tubing, heating, and a data acquisition (DAQ) system. A LabVIEW program was used to calculate the temperature gradient from the DAQ system and estimate the convective heat transfer coefficient of water at various temperatures. Thus, cavitation was produced to visualize the heat transfer process, as we ran our system at different water temperatures. A direct relationship was established between the heat transfer coefficient of water and the rate of bubble cavities formed.

**Ion Removal from a Brine Solution**

Germiamah Junkere, Chad Simeon, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering  
Mentor(s): Dr. Salim Azzouz  
The purpose of this study is to explore new ways to desalinate water. This research work has been a continuing group effort that has led to the design of a novel desalination apparatus. The apparatus is designed to sequester sodium and chlorine ions and mechanically move them out of the brine water. The prototype apparatus requires a brine solution that is created from mixing sea salt into a 30-gallon tank of water. The water flows into two separate channels. Two cross channel charged turbines move the ions from one channel to the other. The less concentrated water from one channel is recycled until a satisfactory decrease in the salt concentration is obtained. The concentration of sodium and chloride ions on both channels will be measured as well as the conductivity and salinities of the two solutions. Notice that a 3 KV transformer currently being built with a variable voltage divider is used to charge the turbines. It delivered a gradual increasing voltage designed to test the efficiency of the apparatus. The collected experimental data is compiled using the graphic tools of the MATLAB software. It is expected that in channel 1, where the salt ions are removed, will have less salinity toward the completion of the experiment. It is also expected that channel 2, where the ions are moved to, will have an increased salinity. It is anticipated, in this experiment, that finding the minimum voltage that starts to move efficiently the ions across the two channels will be a challenging task.

**Design and Implementation of Linear and Nonlinear Controllers to Stabilize an Experimental Test Setup**

Justiz Baker, McCoy College of Science, Mathematics and Engineering, McCoy School of Engineering  
Mentor(s): Dr. Zeki Ilhan  
This work aims to demonstrate the use of a simple experimental setup for accurate position control, which will be used to supplement the “Control Systems” class taught in McCoy School of Engineering. The experimental setup is an unstable, double-integrator system, which consists of a freely rolling ball on an inclined beam. The control task is to keep the ball stable at a desired location by systematically changing the angle of rotation of the beam using a servomotor, which is commanded by the ARDUINO microcontroller based on the position measurements obtained from the ultrasonic sensor. The physical setup has already been built and used for initial control experiments based on the Proportional – Integral – Derivative (PID) control strategy as part of the EURECA Fall 2019 program. Although the initial performance was acceptable, the sensor noise and some physical limitations imposed by the brackets were detected as the main areas for further improvement. A series of efforts have been made in Spring 2020 semester to improve the tracking performance including the design of a nonlinear back stepping controller, addition of a low-pass filter to suppress the sensor noise, and the refinement of the physical setup to minimize the obstacles for possible sensor mis-readings. The Parallax Data Acquisition Tool (PLX-DAQ) is also implemented in the new system to ease the process to generate the performance plots. The proposed system with the added features provides an effective platform to benchmark the performance of the linear and nonlinear controllers in a simple, flexible test setup.
Effective Methods to Improve the Preceptor and Nursing Student Relationship

Rylie Simmons, Gunn College of Health Sciences & Human Services, Wilson School of Nursing, Mentor(s): Stephanie Baker, Terri Farabee

The relationship between student nurses and preceptors are developed during clinical rotations. This relationship is where the nursing students confidence in their skills are created. The experience can be effective or have damaging results to the students confidence depending on the interaction that takes place. The lack of students confidence in clinical skills can hinder the relationship from reaching its full potential.

An anonymous survey was released to the fall and spring second semester nursing students enrolled in basic nursing skills at Midwestern State University. The survey had students rank their confidence using the Likert’s scale on several different clinical skills. The results from the fall semester students reported being low in confidence, below a 5 on the Likert’s scale, in taking a history for a new admission (63.8%), performing and documenting patient health assessment (67.2%), and in educating patients (69%). The results from the spring semester students reported even lower confidence after talking through different preceptor interactions. The confidence was low in taking a history for a new admission (95.5%), performing and documenting patient health assessment (95.5%), and in educating patients (100%). These results demonstrate the lack in student confidence. The lack in the students confidence can cause a strain on the relationship. There is a need for increased education in foundational nursing skills and interaction with preceptors. With the increase in students competence in their skills, there will be an increase in confidence when stepping into the clinical setting. This confidence will have a positive effect on the nursing preceptor and student relationship. IRB# 20011701

Relationships between Grit, Academic Engagement, and High-Achieving Students

Brian Lang, Prothro-Yeager College of Humanities and Social Sciences, Psychology
Mentor(s): Dr. Scott Frankowski

Previous research shows that conscientiousness (being organized and thoughtful) is a personality predictor of academic success. We are investigating how the personality trait Grit relates to academic involvement, engagement, and self-efficacy in students. Grit is defined as the propensity to sustain the interest and effort needed to achieve long-term goals (e.g. passion + perseverance). We predict that Grit will be seen more in students who are highly involved on campus. These involved students will also show high academic self-efficacy, which could indicate grit is a moderating factor in the relationship between academic self-efficacy and campus engagement. Conversely, we predict that conscientiousness will uniquely predict academic success 'on paper' (i.e. GPA) but not necessarily campus engagement. Conscientiousness should moderate the relationship between academic self-efficacy and GPA. The researchers will give participants a survey containing a measure of conscientiousness, grit academic self-efficacy, and demographic questions that include a checklist of organizations at Midwestern State University that students could be a part of, and their self-reported GPA. To ensure a broad range of students and increase external validity, we will collect data through student organizations in which students are highly involved, and through courses that contain students at all levels of academic success. Data collection is pending IRB approval. If hypotheses are supported, we should see that grit moderates the relationship between academic self-efficacy and campus engagement. Similarly, conscientiousness should moderate the relationship between academic self-efficacy and GPA. This research will provide valuable insight into the personality mechanisms underlying academic success. IRB #2003102

Extrinsic Motivators for Individuals High in Dark Triad Traits to Accept Undesirable Tasks.

Carl J. Alfert, Kassidy M. Freeman, Carley Bronaugh, Prothro-Yeager College of Humanities and Social Sciences, Psychology
Mentor(s): Dr. Scott Frankowski

Many personality types are counterproductive to the workplace. They can alienate the team, lack empathy, and/or create a hostile work environment. Personality traits tend to stay consistent throughout a lifetime, so simply ostracizing people with undesirable personalities will not have positive long-term effects. What if these undesirable personality types can be motivated to do task that a typical person would deem undesirable? Someone has to do the mass layoffs, handle the screaming customer, or lay siege on rival
competition. The Dark Triad (D3) personality traits may be the solution. The D3 consists of three personality traits: Narcissism, Machiavellianism, and Psychopathy. D3 traits indicate extreme self-focus, calculated manipulation, and impulsive manipulation, respectively. We are investigating for correlations between extrinsic motivators and D3 personality traits. We are using a modified Dark Triad Inventory and a 9-item survey of undesirable task scenarios paired with three categories of extrinsic motivators in a digital format to access participants. The extrinsic motivators prestige, promotion, and monetary award are defined as admiration based on the perception of one’s achievements, increase in workplace power, and cash bonuses, respectively. We anticipate seeing moderate correlations between extrinsic motivators and one of the three parts of the dark triad: Psychopathy - Monetary Reward, Narcissism – Prestige, and Machiavellianism – Promotion. This information may be useful to employers and HR departments. Data collection will begin upon IRB approval. Results will be analyzed and ready to present before Celebration of Scholarship. IRB #2003102

Moral License to Discriminate against Disability in Workplace Settings
Elissa Duren, Yasmeen Gonzales, Georgia Magee, Rachel Stagner, Prothro-Yeager College of Humanities and Social Sciences, Psychology
Mentor(s): Dr. Scott Frankowski
With this project, we will continue our previous research about public perceptions of disabilities by determining how people’s public perceptions of individuals with disabilities translates to workplace environments. We aim to understand whether people’s perception of people with disabilities differs in workplace settings. Hypothesis: If people believe they have positive public perceptions of people with disabilities they will feel they have a moral license to have more discriminatory perceptions of people with disabilities in workplace settings. Pending IRB approval, we will carry out a survey through multiple social media platforms in order to obtain information from participants with diverse demographics. The survey will consist of situational questions as well as general perception questions that will aid in determining how the participants view people with disabilities in public situations. Participants will then be randomly assigned to view a message that says they have more positive perceptions of people with disabilities, or they will receive no message. Additionally, participants will complete a survey about their views of people with disabilities in the workplace. In the message condition, we should see a weaker correlation between public and workplace attitudes toward disability compared to the no message condition. Although people generally tend to view people with disabilities more positively in public situations, their views may become less positive when perceiving people with disabilities in the workplace, especially if they believe they have a moral license to have greater discriminatory attitudes. IRB #2003102

EMERGING RESEARCH
Emerging Research introduces ongoing research therefore final results may be inconclusive as these are the early stages of the research project. Research that involves human subject data that requires IRB approval pending may be included in this category. It is vital to offer constructive criticism and ask questions that promote good thought and offer positive support.

Biology, Chemistry, Plant Biology, Life Sciences

Using Membrane Protein Chaperone to Rescue a Phenotype in a Fly Model of Parkinson's Disease
Dirgha Vora, Porscha Weaver, McCoy College of Science, Mathematics, and Engineering, Biology
Mentor(s): Dr. Fu-Cheng Liang and Dr. Jon Scales
Protein homeostasis is essential for all cells and requires the proper control of the folding, localization and interactions of all proteins. However, protein aggregation and the associated neuronal death poses a special challenge to protein homeostasis and leads to several neurodegenerative diseases (e.g. Parkinson's disease). Intriguingly, these aggregation-prone proteins, like alpha-synuclein, are always associated or encompassed with hydrophobic membrane or vesicle. Inhibiting or reversing such insoluble/hydrophobic aggregates could shed new light on therapeutic strategy. However, little is known about how to utilize effective membrane protein chaperones to prevent protein aggregation in vivo. Membrane protein chaperone provides the first proof-of-principle examples to prevent hydrophobic region of membrane proteins from aggregation. Additionally, Drosophila melanogaster provides the excellent model organism to better
understand the effect of chaperone activity in living environment. In order to co-express the chaperone and alpha-synuclein gene in the genome of Drosophila melanogaster, transgenic fly model will be generated by using Gibson-Assembly method coupling with p-element transformation into the eggs of Drosophila melanogaster. The resulting phenotype will be further assessed by climbing assay to demonstrate neuronal expression of chaperone reduces the phenotype in the fly model of alpha-synuclein toxicity. This research will build on these findings and further apply membrane protein chaperone as a model system to utilize its unique anti-folding and disaggregation properties to strategically develop and characterize an effective chaperone to prevent protein aggregation in vivo.

**Interdisciplinary: Education and Mathematics**

*Developing Understanding through Cognitive Conflict in Pre-service Teachers*

**Kelly Carpenter**, McCoy College of Science, Mathematics, and Engineering, Mathematics and West College of Education, Curriculum and Learning

Mentor(s): Dr. Sarah Cobb and Dr. Dittika Gupta

Pre-service teachers (PSTs) enter their teacher preparation programs with knowledge of mathematics that is often characterized as procedurally-oriented, inflexible, and lacking in robust conceptual understandings (Browning et al., 2014; Ball, 1990; Yang, Reys, & Reys, 2009). One of the ways to accomplish development of PSTs conceptual understanding is to engage them in higher-order thinking tasks that foster cognitive conflict leading to meaningful learning of mathematical concepts and ideas. Motivated by this, researchers will design and implement new mathematical tasks that will introduce various types of cognitive conflict for PSTs. Data in the form of PSTs' work samples, journal entries, and semi-structured interviews will be collected. Using a qualitative methodology, open and axial coding and member checking will be used to analyze the data and inform the results of the study. The researchers hope that engaging in rich tasks that prompt cognitive conflict will support PSTs in developing conceptual understanding critical for teaching of those mathematical concepts. IRB pending

**Business, Economics, Finance, Information Management Systems, Marketing**

*Coffee Prices*

**RJ Sayler**, Dillard College of Business Administration, Accounting & Management Information Systems

Mentor(s): Dr. Pablo Garcia-Fuentes

The behavior of coffee prices is important for some industries in the United States and other developed countries. Coffee can be considered as one of the most important commodities in the world, it is second only to oil. Most developed countries do not produce coffee, and as a result import most of the coffee they consume. Forecasting the price of coffee can be very beneficial for managers of service industry businesses such as Starbucks and agribusinesses that have related coffee operations. Movements in the price of coffee have direct effects on sales and profits of businesses such as Starbucks other coffee shops. The goal of this research is to use econometric modeling and SAS to forecast coffee prices. We use the Auto-regressive Integrated Moving Average (ARIMA) method to forecast the price of coffee. The data covers the period 2000-2019.

**Engineering, Mechanical Engineering, Petroleum Engineering**

*Autonomous Control Systems in High Power Rocketry*

**Samuel Campbell, Henry Steele**, McCoy College of Science, Mathematics, and Engineering, McCoy School of Engineering

Mentor (s): Dr. Yu Guo

The study of rocketry involves propelling an object into the air with a rocket engine. Due to the high thrust and speeds associated with rocket engines, rocketry poses unique challenges not found in other fields, although many are closely related to traditional aerospace. During a rocket’s flight, it is subjected to many forces along with a changing center of gravity as it burns fuel. These variables make stabilizing or controlling a rocket's flight path particularly difficult. Our research seeks to explore these challenges in depth by using a microcontroller to measure the accelerations a rocket experiences in flight and make course corrections based on those accelerations by actuating fins. Through our research, we have purchased a
commercial rocket frame that will suit our purpose, servos to drive the guidance system, a microcontroller and digital instruments to measure acceleration and the atmosphere, as well as a rocket motor with propellant reloads. We are continuing work on developing a simplified model to form an efficient guidance law as well as safe, legal construction and launching of the rocket.

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The Wichitan

The UGRCA Forum would not be what it is today without most importantly the MSU Faculty Mentors who support and nurture undergraduate research daily.

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