

Participant Abstracts

EMU Academic and Creative Excellence Festival 2022

Listings are in alphabetical order by the last name of the presenter. In the case of group projects, the entry is alphabetized under the name of the student who submitted the entry.

Oral Presentations

Reducing Carbon Emissions at EMU Through RECS, Offsets, and Changes in Energy Consumption and Source

Isaac Alderfer with Luke Short, Felicity Zimmerman, Rodrigo Barahona

Faculty Mentor: Doug Graber Neufeld

EMU's climate action plan has established a goal of carbon neutrality by the year 2035. Emission tracking has indicated that the vast majority of our emissions are the result of several main factors, including purchased energy from Harrisonburg Electric Commission as the largest factor at 41.44% of total emissions, and the third-from-largest factor of natural gas usage on campus at 14.34% of total emissions. The next benchmark date with proposed reduction goals is approaching in 2025, and range from an estimated 15% reduction at the most modest level up to a 24% reduction at the higher end. There are several areas of campus emissions where this reduction will come from, but as energy production constitutes greater than half of total campus emissions, decreasing emissions in this area will have an outsized impact. Proposed methods of addressing both the short and long term goals approaching in 2025 and 2035 respectively from an energy perspective include campus electrification, installation of photovoltaic cells on campus, improving building efficiency, and diverting facilities away from natural gas usage. Another potential approach to offset some of the emissions produced through energy purchase and production on campus is through purchasing Renewable Energy Credits (RECS) and carbon offsets. When a college purchases RECS and Offsets, they invest in sustainability efforts around the world that reduce carbon through projects such as tree planting and expanding renewable energy. The purchase of RECs and Offsets has helped many colleges achieve carbon neutrality and could play a large role in helping EMU reach the 2025 and 2035 goals.

Photographic Documentation of Old Growth Stands in Proposed Skidmore Fork Wilderness

Isaac Alderfer

Faculty Mentor: Steven Johnson

The Shenandoah Mountain National Scenic Area proposal with embedded wilderness areas is an important step in local conservation efforts in the Shenandoah Valley. As a designation by congress, a high degree of protection would be extended over this 90,000 acre area encompassing a wide variety of different ecosystems and wildlife and offer opportunities for many types of outdoor recreation. One of the embedded wilderness areas, Skidmore Fork Wilderness, is a 5,228 acre patch located within Rockingham county. There are several sections of forest in the proposed Skidmore Fork Wilderness classified as old growth. Old growth forest is

generally uncommon in the whole Appalachian region, and supports a very different community structure than younger forests, making them critical to protect. As part of the effort to protect these unique areas, this research utilizes photography to document the wildlife and environment of old growth stands in the Skidmore Fork Wilderness. Photography is an important tool for conservation because it forms a connection between the viewer and the images and location it represents. Mountain biking was the primary mode of transportation in the proposed wilderness area, a passion of the researcher as well as the most appropriate choice for the distance and terrain required to access the stands of old growth forest.

The Significance of Shame in Child Welfare Social Work

Amelia Anderson

Faculty Mentor: Debbi DiGennaro

This project will focus on the literature regarding shame in the specific field of Social Work. Shame is a universal feeling of intense unworthiness which all humans experience at some point. However, shame left to fester is intrinsically linked to the rupture of prosocial behavior, attachment, and social bonds. Shame has been identified as a breeding ground for public health problems such as suicide, intimate partner violence, depression, and general violent acts of aggression (Brown, 2006). As such, it is inevitable that social workers will encounter shame in cases of child abuse and neglect, particularly in public child welfare systems. Strikingly, the effects of shame in the delivery of child welfare services have not been well studied (Walker, 2011). Child welfare services are by nature intrusive and intimate, frequently intersecting with and perpetuating experiences of shame. Yet, social work research has been slow to study the effects of shame on individual, familial, and institutional levels when compared to other professions, such as psychology and psychotherapy (Walker, 2011). The significance of the emotion shame has been largely absent from social work research, particularly in the United States (Ferguson, 2016, 2018; Morrison, 2007; Walker, 2011). This project aims to explore the effects and manifestations of shame, as they occur in relation among the child welfare social worker and client, both from the social worker and client's perspective, and the public child welfare system itself.

References

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SNL, But For EMU ;)

Isaac Andreas

Faculty Mentor: Kevin Seidel

Introducing, for the first time, Saturday Night Live not from New York but from Harrisonburg, and not completely live! Skits include a scooter rap, a hymn cult meeting, a rusty car ad, Weekend Update with Kate Szambecki, a host Monologue, and more! You don't want to miss it. It'll hopefully make you laugh. A lot.

Prevalence of Housing Insecurity and Perceptions of Homelessness on a College Campus

Sabrina Bellar

Faculty Mentor: Jenni Holsinger

Homelessness continues to be alarmingly prevalent in the U.S.. Social researchers have worked for decades to understand the root of this issue. Most often this research has taken the form of large scale surveys, which capture the perceptions of the general public. Less is understood about college students' direct experiences with housing insecurity and the impact this has on the formation of their perceptions of homelessness. Understanding the perspectives of predominantly young adults is important, for it can be telling of what needs should be addressed on college campuses and what policies would be supported by this voting population. Using survey data, I examine the extent of housing insecurity experienced by undergraduate college students and their perceptions of, and beliefs surrounding, homelessness. I conclude with a discussion of policy implications.

Applying Conflict Theory to Social Work

Cassidy Bush

Faculty Mentor: Debbi DiGennaro

According to the National Association of Social Workers, the primary focus of social work is “to enhance human well-being and help meet the basic human needs of all people, with particular attention to the needs and empowerment of people who are vulnerable, oppressed, and living in poverty” (NASW, Preamble, 2021). However, Conflict Theory “states that society or an organization functions so that each individual participant and its groups struggle to maximize their benefits, which inevitably contributes to social change such as political changes and revolutions” (New World Encyclopedia, 2021). Conflict Theory proposes that exploitation is inherent to capitalism because the very nature of the system puts profit over people. This is relevant to the profession of social work because one of the main purposes of our government is to provide enough resources for its people so that they can effectively have life, liberty, and the pursuit of happiness. In theory, our government should provide its people with their basic needs like food, water, and shelter, so that people can effectively live. However, it is clear from the very existence of the social work profession (or even just paying attention to the news) that the

United States government is failing that goal. Therefore, I would argue that the primary purpose of social work is to fill in the gaps where the government has failed. The enormity of the social work profession is indicative of the size of the problem. After all, people wouldn't be vulnerable, oppressed, or living in poverty if the government actually took care of its people instead of allowing them to be exploited. Therefore, the very profession of social work should not exist because the government should take care of its people and not require a profession to do their job for them. This is true because power, false consciousness, exploitation, and free trade are key elements of capitalism, and social work has bought into those very ideas instead of deciding to change them.

Environmental Racism in Emelle, Alabama

Jessica Chisolm

Faculty Mentor: Jenni Holsinger

Emelle, Alabama currently contains the largest hazardous waste landfill in the U.S. with the waste facility, owned by Waste Management Inc. (WMX) and managed by Chemical Waste Landfill (CWM). Unhappy workers were the first civilians to protest against WMX, which brought the first instance of public attention to Emelle. Since then there has been a complex web of relationships between the groups opposed to the landfill with racial tensions being one of the biggest challenges. These groups ultimately failed to shut down the hazardous waste facility. Even so, they progressed awareness of the Environmental Justice movement and the potential of grassroots EJ activism.

Documentation of Student Learning - 4th Grade Math

Emma Cordell with Anna Smith

Faculty Mentor: Barbara Wheatley

This project focuses on a 5-day unit implemented while student teaching in cooperating 4th grade classrooms. By first analyzing the demographics, backgrounds, and cultures of the school district, elementary school, and classroom, we planned a data-driven math unit instructing students in the skills involved in adding and subtracting fractions. After completion of the unit, we analyzed the data that was collected during implementation and reflected on the effect pedagogical choices made on student learning.

Quantum Computers and The Future of Cybersecurity

Duncan Ferency-Viars

Faculty Mentor: Stefano Colafranceschi

The goal of this project is to learn more about modern cybersecurity and its inner workings, quantum computers and how they might work, and the intersection between these two in whether or not quantum computers will play a role in the future of cybersecurity. Research was largely done online, and a wide range of sources will be considered, possibly including, but not limited to: technical summaries of standard concepts, articles published by tech giants and top technology websites, and published papers and essays by various reputable sources.

Beyond Evil

Lesly Garcia

Faculty Mentor: Kirsten Beachy

Beyond Evil is a fiction collection of short stories that talks about monsters and gods from Greek Mythology. In this project, I particularly wanted to emphasize how humans can be driven by many emotions like anger, jealousy, and love. The characters of this project are well known and have appeared in works by other authors which also served as inspiration for this collection. The author Madeline Miller and her books Circe and The Song of Achilles served as inspiration for my own collection. The author Ramon Amaya Amador and one of his books, Prision Verde, were what made me want to write and tell the stories of those who remain in the shadows. Greek Mythology is generally considered known by a lot of people, and it is something that I'm passionate about. In my own collection of short stories, I mainly focus on the monsters of Greek mythology and who should be considered a monster, the humanity of both monsters and gods, and the impact of being different. The goal of this project was to develop my writing style, to put what I have learned so far at EMU in use, to draw from my personal upbringing, and to create something meaningful to me. I wanted to write something that I would love reading and this particular collection of fictional short stories allowed me to create something with sharing.

Fanny Mendelssohn: Both Hurt and Helped by Cishet White Men

Indigo Gott

Faculty Mentor: David Berry

History is filled with the stories and successes of cisgendered, heterosexual, white, men. There are so many others who were buried in their shadows. Many people have heard of the famous composer Felix Mendelssohn, but his sister, Fanny Mendelssohn Hensel, was just as much (if not more so) a genius composer and musician. As with all human societies, the social structure of 19th century Germany was a complex system to navigate. Fanny was in a unique position as she was not only a woman, but an upper class Jew. Because her brother's gender and class worked in his favor and pushed him to fame, Fanny was able to ride the wave and be present both in her own time and in history. Her story gives us a unique look into the glass ceilings of centuries past and how they might still be present today. We'll look into Fanny Mendelssohn's life story, her family dynamics, the complexities of being an upper class Jewish woman in 19th century Germany, and what her story can teach us going forward.

An Examination of Colonization in Three Transnational Contexts

Jill Heine with Anne Coyne and Iman Shabazz

Faculty Mentor: Timothy Seidel

Our overarching theme or issue is colonization, and we offer a critique of analyses that refer to the world as "post-colonial," or claim that colonization was a one-time, historical event. We will be using the terms, "coloniality," and "colonization," interchangeably, because we see colonization as an ongoing process and matrix of control. Other scholars use the term

“coloniality” for this process, but we think it is important to use terms that a broader audience is familiar with, and colonization is already an expansive and well-known term. We define coloniality as shown below. Coloniality of power = control of economy, authority, nature and natural resources, gender and sexuality, and subjectivity and knowledge. Source: Ballestrin 2017 <https://emu.idm.oclc.org/login?url=https://www.jstor.org/stable/90013338>

We will focus on three specific manifestations of colonization. Iman will explore how sexual violence against women of the Democratic Republic of the Congo (DRC) serves global capitalism in a modern context. His research will examine sexual violence as an ongoing tactic imitating Belgian barbarity during their conquest of the DRC and in part why it's used to control labor and access to mineral resources; without which the modern technological world would cease to exist. Anne will look at historical links between child welfare and colonization, as well as how the system still enacts coloniality in Aotearoa New Zealand. Jill will explore how coloniality plays out in Mennonite Central Committee (MCC)'s current work in Philadelphia, PA USA. She will examine the relationship between MCC staff, its partners and the communities served including how these relationships were created and their outcomes. Our format will be a Voice Thread, roughly 30 minutes in length. Each of us will present individually on our topic covering Narration, Manifestation, Inspiration and Imagination, and then we will all come together for a conversation describing an application to address one of the manifestations.

Documentation of Student Learning: A Climate Change Unit Case Study

Tasia Hoover

Faculty Mentor: Paul Yoder

The Documentation of Student Learning project I created shows examination of a climate change unit. This unit was carried out in a 9th grade environmental science classroom in the spring of 2022. The unit covered concepts including weather versus climate, the greenhouse effect, causes of climate change, and results from climate change. There were a number of projects and assignments created for this unit so that the students could learn about climate change through inquiry. There was a lack of standards for this course, but the content taught was used to develop environmental standards for the state of Virginia. I spent the majority of this unit with the goal of flipping the original instruction method so that students could learn about environmental science through investigation. Some of the activities done in this unit include the designing and creation of solar ovens, animal posters, simulations, and research projects. Student learning was assessed formatively through discussions, worksheets, and interactive notebook assignments. By using the pre-test that I created on climate change, I was able to understand the prior knowledge of the students, which then guided my teaching for the remainder of the unit. Data was collected through assignments, quizzes, and a final assessment. By completing this project, I have learned about alternate methods of classroom management, instructional technology, and the importance of collaboration between teachers around you. After experiencing this project, I have become more aware of my students' learning as well as many ways to assess as I teach. I feel a great teacher is one that can reflect regularly, adjust in the moment, and differentiate to support all learners. I am and will continue to grow as an educator thanks to the different perspectives from this project.

Exploring Gender Implications of Reentry

Anya Kauffman

Faculty Mentors: Mary Sprunger and Kevin Seidel

The United States has the highest prison population in the world due to the tough-on-crime and war on drugs policies that were implemented in the 1980s and 90s and persist in today's legislation. 95 percent of those who are incarcerated will eventually return to their communities. This project aims to raise awareness about the collateral consequences these individuals face after their release from jail or prison and determine whether women are more or less successful in reentering society after being incarcerated than men.

The Effect of Journaling on Stress in College Students

Stephanie Kniss

Faculty Mentor: Jenni Holsinger

College is a time of an abundance of stress in students' lives that comes from different factors: academic pressure, financial struggles, relationship issues, and more. There are many ways to cope with stress, some being harmful to one's physical and mental health. One alternative to harmful practices involves writing and artistic expression, which can help students process difficult situations and emotions. Journaling is a simple and accessible practice that allows people to cope with stress in a healthy way. In my study I use an experimental design to examine the effects of journaling on level of stress for undergraduate college students. After presenting the results I end with a discussion of journaling as a practice to reduce stress in the daily lives of college students.

Design of an Integrated Laptop Computer System

Joel Kornhaus with Trajon Brown, Riley Gonzalez, Jacob Hess, See Hla, Ethan Klassen, Hebron Mekuria, Caleb Oesch, Levi Peachey-Stoner, Cedon Yoder, Nathaniel Yoder

Faculty Mentor: Stefano Colafranceschi

Design II team will present a modular computer design and implementation. The internal components of this prototype laptop revolve around the use of a Raspberry Pi 4 single board computer. This choice was based on the low cost and power consumption and high modularity offered by the Raspberry Pi. In choosing components, availability was also an important consideration. Components were ordered from Amazon if possible as reproducibility was a primary goal and people in many different communities have access to Amazon. Lastly, integration with an Arduino or ESP32 board is being pursued to provide oscilloscope-like capabilities to the device. The power portion of this project is to figure out a way to provide cheap and reliable power that is strong enough to power a screen and a Raspberry Pi 4 at the same time.

Extended Life Span with Respiratory Chain RNAi Correlated with Increased Sleep and Decreased Activity in Drosophila.

Jessie Landis

Faculty Mentor: Jeff Copeland

Aging has been a well studied topic in biology for its direct implication to human health and the desire to lengthen life expectancy. Previous literature has shown a connection between the mitochondrial respiratory chain and extended lifespan. This study addresses the question if specific tissues or cell types are capable of extending life span. We used the GAL4/UAS drivers to target the expression of two respiratory chain genes specifically in motor neurons. RNAi targeting the Complex I gene CG9172 and the Complex V gene CG5389 in motor neurons and glutamate neurons led to significant life span extension. Interestingly, life span extension was correlated with increased sleep.

The Effects of Student Loan Debt on College Students' Academic Performance and General Well-Being

Rachel Loyer

Faculty Mentor: Jenni Holsinger

For many young adults in the United States, student loans are becoming a more necessary and commonplace avenue for financing higher education. This topic has garnered significant research concerning the consequences and outcomes of financial burden and debt on college graduates' long-term success. In comparison, the impact of debt on academic performance and other behaviors of current college students has not been studied extensively. This study explores relationships among debt, academic performance, and undesirable behaviors and cognitions, through surveys of undergraduate students at a private university. The findings suggest that steps to ensure college affordability should be established at the federal and institutional levels to relieve debt and its burdens.

DOSL: Review of Shapes and Positional Words in Preschool

Rachel Lute

Faculty Mentor: Cathy Smeltzer Erb

The Documentation of Student Learning Project follows a preschool class reviewing shape identification and positional word knowledge. The six-day unit focused on Virginia Mathematics Foundation Block 4: Geometry

- a) Match and sort shapes (circle, triangle, rectangle, and square)
- c) Recognize and name shapes (circle, triangle, rectangle, and square)
- d) Describe the position of objects in relation to other objects and themselves using the terms, next to, beside, above, below, under, over, top, and bottom.

According to the preschool curriculum pacing guide, preschool students were introduced to all math standards by January. In February, the unit goal was to review and strengthen students' knowledge on shapes and positional words. The unit began with re-introducing the four basic shapes: rectangle, triangle, circle, square, including shape identification and matching and sorting shapes based on an attribute (color, number of sides, etc.). Students were also reintroduced to four positional words: beside, above, and below. By the end of the unit, shapes

and positional words were taught and reviewed together, as students used positional words to describe the position of their shapes. Students were engaged in various hands-on activities throughout the unit, such as playdough, tangrams, Book Creator, educational “board games,” and a shape scavenger hunt to engage the concepts of shape identification and positional word knowledge. Data were collected from pre and post assessments and daily observations. The findings focus on student learning growth of shapes and positional words, teacher reflection, and the implications of instructional practice to improve student learning.

Sites of Environmental Externalities: The Hidden Realities of our Extraction

Tibby Miller with Elizabeth Eby

Faculty Mentor: Timothy Seidel

This project focuses on environmental extraction of resources and human and environmental health in two different sites of violence: El Salvador and China.

Mining in El Salvador, in combination with many other activities including agricultural, industrial, and personal use, has negatively impacted the quality of available water resources so that only a fraction of water in the country can be processed for human use. Community organizing, use of media, mobilization of intersectional local, regional, and international groups formed to block mining in several sites in the Department of Cabañas. This movement culminated in 2017 with El Salvador becoming the first and only country in the world to have banned mining.

Recycling in China has negatively impacted the environment and also the health and safety of the workers who process the materials. China eventually refused to process recycling, much of it coming from the US, a global leader in consumption and waste production.

These two situations are analyzed in critical tools such as feedback loops and a critical approach to neoliberal economic policies. The project then goes on to imagine different responses that could address these and other similar locations of environmental exploitation. What would a world without these negative systems look like? This analysis is more concretely applied to the case of mining in El Salvador and with the context of ongoing challenges of the water privatization crisis.

Mass Killings and The Escalation Process: The Guatemalan Genocide (1980-1983) and El Mozote Massacre in El Salvador (1981)

Ariel Morales Bonilla

Faculty Mentor: Ji Eun Kim

This paper looks at the escalation process in Mass Killings events, focusing on the implications and particularities of mass atrocities. Examining and comparing two similar cases, the Guatemalan Genocide and El Mozote Massacre in Central America, this research explores the conditions and settings that produced a rapid hostile and destructive posture in the Guatemalan regime against its Mayan population. Also, considering the socioeconomic and geopolitical similarities shared by the Guatemalan and Salvadoran military governments, this study looks at the reasons behind the ceased in the violent escalation after the El Mozote Massacre in the Salvadoran territory. The study finds that the escalation process in El Salvador halted because

the military government lacked a killing bureaucratic structure and a clear targetable enemy. In Guatemala, despite the weak strength of the state, these two conditions were met.

Reducing Carbon Emissions at EMU Through Food, Campus Culture, and Curriculum

Jake Myers with Lily Dodson, Levi Geyer, Anna Paetkau, Molly Piwonka, Andrea Troyer

Faculty Mentor: Doug Graber Neufeld

This presentation will explore two components of the EMU Climate Action Plan that the Environmental Capstone class addresses: Food and Campus Culture/Curriculum. Food consumption on campus is a major part of EMU's greenhouse gas emissions, with animal products, such as meat and dairy, contributing at an especially high rate. These foods also contribute to environmental problems in other ways by requiring large areas of land for production and causing pollution. By decreasing consumption of animal products, EMU can thus address greenhouse gas emissions and other aspects of the university's environmental footprint. We have two proposals for decreasing meat and dairy consumption in the cafeteria: through an education campaign displaying prominent figures endorsing a plant-based diet and through decreasing meat and dairy purchases in the cafeteria. For the Campus Culture/Curriculum aspect, the group will propose how topics of sustainability can be incorporated into three areas of the newly proposed CORE curriculum revisions: Bible, Religion and Theology, through the Race, Gender, and Power course, and through the Introductory EMU Portfolio course, or previously known as Transitions. Each of these sections can explain how topics like environmental justice, stewardship, and individual impacts on the planet are important for EMU students to understand and be able to apply into their future vocation. By proposing how we believe sustainability should be incorporated into the curriculum, we hope to highlight ways this will impact overall campus culture and how students view environmental initiatives.

Noticing on Paper: Drawing to Practice Observation

Jake Myers

Faculty Mentor: Cyndi Gusler

Birding is one of my hobbies, or perhaps it is more rightly called an obsession. Everywhere I go, I notice the birds living in the neighborhood, flying about or skulking, silent and singing. One way to practice this noticing is through drawing. When you draw a bird, you become more aware of its behavior and appearance. These drawings are practical. But they can also be a work of art. Science and art have a lot in common. Both fields often feature a search for patterns in the world around us, as well as relying on attention to detail to implement those patterns in the outputs created. As an Environmental Science major, and more specifically, a birdwatcher, I have practice looking for patterns to help me identify species of birds and other organisms, but it can be difficult to share these insights with others. Drawing is one way to communicate the beauty and intricacy of birds to others. By observing birds in the field, then drawing them based on field observations and photographs, I will provide an example of art and science working together. I will also read some poems on other nature observations, written while birding.

Resistance at the Roots: an Exploration of Militarism, the Impact of Settler Colonialism, and Local Resistance

Amber Oda with Keren Kandel and Tarini Nagasaila Suresh

Faculty Mentor: Timothy Seidel

Present-day militarism poses complex and interconnected issues that impact the daily lives of communities in diverse parts of the world. While it is possible to point to the corruption of individual leaders and foreign policy, a crucial link that is often overlooked is the long-term legacy of settler colonialism, structural dependence, and systemic, institutionalized oppression. This oral presentation will explore how militarism and settler colonialism impact local settings within the contexts of Palestine, with specific regard to forced expulsions of Palestinians from their homes; Sudan, with the intention of looking at the current military takeover and women's role within the protest movement; and military occupancy in Kashmir, India. This research also analyzes the imaginative vision and active resistance of women, youth, and other marginalized communities to the systemic roots of present-day militarism and settler colonialism.

The Rohingya Crisis: A Crisis Fueled by Democratization, Security Dilemma, and Illiberalism

Angelo Olayvar

Faculty Mentor: Ji Eun Kim

The ongoing ethnic cleansing and genocide of the Rohingya people in the Rakhine state of Myanmar caused by systematic persecution, state-sanctioned violence, and discriminatory policies have produced one of the worst humanitarian crises in today's world. The magnitude of the Rohingya crisis and its devastating effects suggest critical policy implications regarding political reforms and international standing of the Myanmar government. In order to explain and better understand the Rohingya crisis, this research paper aims to (1) clarify key misconceptions regarding the Rohingya crisis; (2) provide a shrewd explanation of the persistence and worsening of the crisis using Barry Posen's concept of "ethnic security dilemma"; (3) analyze past historical events wherein the sense of "security dilemma" amongst the different ethnic groups has worsened; and (4) evaluate how Myanmar's democratic backsliding has sustained and exacerbated the conflict. This paper argues that the materialization of the security dilemma and formation of an illiberal society, through its recent political transition, have fueled the current Rohingya crisis.

Teaching the Bible in Communities of Faith

Steven Pardini

Faculty Mentor: Nancy Heisey

A Bible study curriculum on the Sermon on the Mount was written and taught to an adult Sunday school class in a Mennonite church. Transformative learning theory and brain science were used to guide the creation and teaching of the curriculum. Class dialogue stimulated disorienting dilemmas in cognitive, affective, behavioral and spiritual learning domains. This research project attempted to assess the impact of the curriculum on learner faith and faithfulness development.

The Polluted and Forgotten Anacostia River and the Fight to Bring it Back to Life

Partha Roy

Faculty Mentor: Jenni Holsinger

Originating in the suburbs of Maryland, the Anacostia River flows through our Nation's Capital, Washington D.C. For over several hundred years, many types of pollution occurred in the river, changing a shimmering beautiful river into a forgotten flowing mess. The most serious pollutants are toxins and the raw sewage being dumped into the river causing environmental and public effects. Over the years, activists, environmental groups, community members, and politicians have worked to slowly control the dumping of these harmful substances.

Engineering Capstone

Andrew Schunn with Jonas Beachy

Laura Troyer

Faculty Mentor: Esther Tian

A robotic hand was designed to be remotely controlled by a user worn glove. The glove uses flex sensors to detect the position of the user's fingers, and then sends those positions to the equivalent fingers of the robotic hand using microcontrollers. The microcontrollers regulate the servo motors in order to move the robotic hand into a position mimicking the user. The robotic hand was modeled after the human hand with only one degree of freedom for each finger, meaning the finger will only move from fully extended to fully curled without movement in any other direction. Only one degree of freedom decreases the complexity of the project to guarantee completion in the allotted time. A wrist was attached to the robotic hand with only the front to back motion included. The robotic hand was completely 3-D printed and a tendon-servo system was used to flex the fingers. Elastic was used to extend the fingers back into the outstretched position when the servos relax the tendons. Several joint types for the hand were modeled and tested including ball and socket joints and several revolute joints. Haptic feedback was included in the design by adding vibrational motors to the user-worn glove, and pressure sensors to the robotic hand, allowing hand to glove feedback. An additional hand to hand feedback system was included to stop the hand from squeezing once a pressure threshold is detected by the pressure sensor. The hand was designed to be able to hold items ranging from the size of a golf ball to a tennis ball as well as hold objects up to five pounds.

Quantitative Analysis of Plastic Circles

Joseph Seitz

Faculty Mentor: Stefano Colafranceschi

Ever since the Pandemic, the sport of Disc Golf has provided me with recreation, physical activity, and a way to pursue skill in something. Statistics is an area that has fascinated me ever since high school, and the way it puts the world into numbers has given me the idea to intersect this interest with my involvement in Disc Golf. By spending time in a field throwing and recording distance, alongside the flight characteristics of each disc, I've made statistical models that give

me a clear idea of where I'm at and progression I've made over time. This has been an exercise in data collection, processing, and modeling in an effort to further prepare myself in these fields, as well as a chance to spend time doing Disc Golf for a school project!

Veto vs. Abstain: Comparing the 2011 UN Security Council Decisions Regarding Libya and Syria

Allison Shelly

Faculty Mentor: Ji Eun Kim

Horrendous human rights violations in the 1990's such as the Rwandan Genocide and the Balkan Wars were catalysts to the United Nations adopting the "Responsibility to Protect (RtoP)" doctrine in 2005. RtoP stipulates that if a government cannot or will not protect its citizens from human rights violations, it becomes the responsibility of the international community to do so. When the Arab Spring began in the Middle East in 2011, multiple countries became candidates for RtoP intervention. Two of these countries were Libya and Syria. Despite both countries enduring similar human rights violations from their respective governments, the UN Security Council voted to intervene in Libya but not in Syria. This presentation asks, "Why did the RtoP doctrine apply in Libya but not in Syria?" To answer this question, an analysis of the structures of the UN Security Council is essential. The Security Council's decision was deeply influenced by the recency of intervention in Libya, what felt like a slippery slope to military intervention, less perceived clarity in the midst of the Syrian uprising, and Bashar Al-Assad's similar characteristics to some of the P5 leaders.

Introduction to Tall Tales: Documentation of Student Learning

Bethany Shultz

Faculty Mentor: Kathy Evans

This Documentation of Student Learning project follows a local 4th grade classroom's language arts instruction during the month of February. Over the course of two weeks, this unit focused on VA SOL 4.5: "The student will read and demonstrate comprehension of fictional texts. More specifically, the student will identify genres and describe how the setting and characters contribute to the development of plot." Within the unit, students learned the characteristics of a tall tale, identified those ideas in stories that they read, and then used that learning to write their own tall tale. The unit allowed students to support one another through frequent partner check-ins, as well as small group collaboration. Students engaged with the unit through Flocabulary videos, word sorts, a group project/presentation, and an individual writing assignment. To analyze student growth, a pre-assessment and post-assessment were given to determine how many students were able to meet the unit objectives. Ultimately, this project allowed the educator to reflect over their instructional procedures and delivery and to analyze what went well and what areas could be improved in the future. In summary, the DOSL outlines the classroom environment, unit objectives, how lessons were planned and implemented, and documentation data on how well students met the instructional objectives.

Documentation of Student Learning Project

Anna Smith with Emma Cordell

Faculty Mentor: Barbara Wheatley

This project focuses on the assessment data collected from a five-day math unit on adding and subtracting fractions taught in a fourth grade classroom.

The Theory Behind Modal Jazz

Will Stutzman

Faculty Mentor: David Berry

Modal Jazz opened up a world of possibilities for jazz music and gave musicians a different approach to music that altered the history of jazz. Improvisation superstars such as Miles Davis and John Coltrane found new uses for chords that were unlocked through a modal approach. Following a performance of Miles Davis' "So What," this presentation will explore the theory of the modes of the major scale. Topics covered will include how the different modes are derived from the major scale, explain how each mode brings its own unique quality and sonic flavor, and showcase how other songs would sound in the different modes.

Pressed Flowers: Short Stories on the Perception of Women

Katherine Szambecki

Faculty Mentor: Chad Gusler

This project, my senior thesis, is a collection of short fiction pieces that are tied together by the theme of perception. The stories address this issue by looking at the ways in which fictional female characters address expectations placed upon them themselves, others, and society.

Bringing Aid to Asylum Seekers

Karen Valdez

Faculty Mentor: Ji Eun Kim

Asylum seekers from Central America have travelled to the United States, fleeing for their lives—increased sharply in 2014 (Dominguez, Lee, & Leiseron, 2016, p. 1). Asylum seekers came from the North Triangle Countries (NTC) of El Salvador, Honduras, and Guatemala. These states have endured violence through gangs that have led to high homicide rates. Asylum seekers are individuals that want to reside in the United States as they fear persecution in their home countries. The violence in NTC countries has caused migrants to flee their homes, which the U.S. government must deal with. Central Americans travelled to the United States in migrant caravans in 2014 and 2018. Central American children trekked to the U.S. and Mexico border in 2014 seeking asylum as violence perpetuated in their countries. The U.S. government had to intervene as asylum seekers from NTC states reached the U.S. and Mexico border to petition for asylum in 2018. This was accomplished through the enactment of "zero-tolerance policy" and deployment of troops to the southern border. The United States negotiated with Mexico on an agreement that allowed Central American asylum seekers to reside there as a "safe third country" to await their case hearing. The United States has to grant refugee status to asylum seekers that demonstrated a credible fear of persecution. The United States must uphold international

human rights laws and enactments such as: The UN High Commissioner for Refugees (UNHCR), International Covenant on Civil and Political Rights (ICCPR), and U.S. Refugee Act of 1980. This would allow asylum seekers to remain in the United States and not fear to return to violence in their nations. This presentation will argue that the U.S. government must protect asylum seekers in compliance with international human right laws nowadays.

Childhood Maltreatment and Symptoms of Illness Significantly Predict Psychopathology in College Students

Joshua Wenger

Faculty Mentor: Susannah Moore

Childhood maltreatment (CM) and psychopathology are associated with a wide range of negative physical health outcomes. The current study examines the relationship between childhood maltreatment, various dimensions of psychopathology, and symptoms of physical illness in college students. Young adults in college (N = 72) were recruited from Eastern Mennonite University; demographic information (age, gender, socioeconomic status), physical health measures (self-reported symptoms of illness, BMI), symptoms of psychopathology, and CM data were collected from each participant. CM and symptoms of illness significantly predicted symptoms of psychopathology. These two factors remained significant independent predictors of psychopathology even when controlling for age, gender, BMI, and socioeconomic status. This predictive effect was even stronger when examining somatization as a specific type of psychopathology. These findings support an integrative model of health, highlighting the close relationship between physical, social, and psychological health factors.

Untitled

Claire Whetzel

Faculty Mentor: Chad Gusler

In this creative nonfiction essay, the writer reflects on her flawed relationship with her father and subsequent reliance on male approval. As she begins to navigate romantic relationships with men, she slowly learns about the power of rejection and the important difference between choosing and being chosen.

The Cast Iron Skillet

Thoreau Zehr

Faculty Mentor: Chad Gusler

My senior thesis is based off of my experience with kitchen work and life in general. Far too often I see young writers focusing on tragedy as a way to move their stories forward and I wanted to break the mold. My story does not have tremendous tragedy as its driving force, rather it is driven by realistic aspects of life. The protagonist is a normal man living a normal life with normal struggles, nothing more.

Poster Presentations

Innate Immune Responses of C. elegans to the Emerging Pathogen Elizabethkingia anopheles

Wesam Albayati

Faculty Mentor: Kristopher Schmidt

Caenorhabditis elegans (*C. elegans*) is an invertebrate soil nematode that has been extensively utilized as a model organism to study a variety of pathological mechanisms ranging from aging to innate immunological response. An emerging pathogenic bacterium, *Elizabethkingia anopheles* (EA), has been found to cause significant potential infection among isolated human populations, yet little is known about its pathogenesis and mechanisms of infection. To observe the innate immune responses to the EA bacterium, *C. elegans* were exposed to their relatively non-pathogenic bacterial food source, *Escherichia coli* OP50 (EC), in addition to the EA bacterium, and were observed in different conditions for subsequent response. Nematode worms exposed to EA exhibited impaired fecundity, slower development, reduced lifespan, and an aversion response to the emerging pathogen. Additional experiments utilizing mutant *C. elegans* with impacted chemosensation and immune function showed impaired ability in recognizing the pathogenicity of EA, leading to less repulsion by the bacterium and even greater reduction in survival probability. Upon chemical analysis of the two bacteria, indole, a potential chemoattractant, was found in greater quantities in EC, while S-methyl thioisovalerate, a repulsive agent to worms, was detected in higher amounts in the EA. *C. elegans* serve as an invaluable and inexpensive model organism that can illuminate the pathogenesis of novel and emerging pathogens, demonstrated here with *Elizabethkingia anopheles*.

Stream Water Quality and Nutrient Loading along Low to High Order River Transects in the Western Shenandoah Valley

Isaac Alderfer with Zach Bauman

Faculty Mentor: Doug Graber Neufeld

River water quality is generally more studied in higher order streams because these are located in proximity to more people and often provide more opportunities for recreation. The mountainous headwater streams of the western Shenandoah Valley are no exception to this testing shortage. This study measured metrics including phosphates, nitrates, bacteria, conductivity, and sediments along river transects as river order increases from headwaters on the mountain into larger rivers in the valley. The rivers included in this study were the North River as well as major tributaries Dry River and Briery Branch. Most metrics generally increased in the agricultural valley bottom as compared to the national forest; however, streams in the National forest showed signs of not being as 'pristine' as previously thought. In the national forest and valley respectively, we found mean nutrient levels of 0.026 ppm and 0.036 ppm for PO₄, and 0.548 ppm and 1.195 ppm for NO₃. Numerous sites in the valley crossed the EPA thresholds for impaired and severely impaired streams. To fully understand the implications of these values, we measured nutrient and sediment loading by water volume at several sites on the North River. Numerical quantities of nutrient and sediment loads in the river system is of importance for determining the impact of these streams on the broader Shenandoah, Potomac,

and Chesapeake watersheds. Our results generally aligned with past land use research that show water quality decreases in agricultural and developed zones, but it also suggested that there may be other impacts on water quality in the more 'pristine' regions.

How Copper affects Ivy

Emily Alger with Natalye Graham

Faculty Mentor: Matthew Siderhurst

Natalye and I are taking ivy clippings and testing them to see how they grow in different concentrations of copper. This is also referred to as phytoremediation.

Importance of mental health among teens and college students not taken seriously enough

Lene Andrawas

Faculty Mentor: Matt Tibbles

Spatial Analysis of Coronavirus Case Rates in Northern Virginia

Nick Arnold

Faculty Mentor: Jim Yoder

I will be working on a project that will show the trends of coronavirus cases in northern Virginia. Many things will be compared within each other to find the best correlation that would explain to as why covid took over the area.

The Conflicts with War on Resources

Zyeasha Ba

Faculty Mentor: Matt Tibbles

My poster is going to talk about how people (mainly governments) don't have negotiations, but instead they just take. This poster is going to talk about how resources are too thin for people to start wars over not having the basic needs. Many known wars were started because of the other country having what that country wants. This poster is also going to talk about how human beings as a whole have been taught that "sharing is caring" while at the same time there are countries that chose to steal from the other country. Another thing would be that people lose their special person because a war that is being fought over because of natural resources. People who are often affected are the people that are getting attacked but the people that is also throwing bombs and guns are also in pain because they have no choice but let it happen.

The Impact of Social Media on College Students' Mental Health

Malak Bani-Hani with Alcinda Brubaker and Joy Parakuo

Faculty Mentor: Joohyun Lee

The digital age and rise of social media has impacted society in a myriad of ways. Communication has improved exponentially thanks to social media networking sites such as

Facebook, Instagram, Twitter, YouTube, and TikTok. The world wide web and social media applications have created an online community where users can connect, yet there is some disconnect because of its impact on user's mental health, especially youth and adolescents. Recent studies have shown that teens and young adults who use social media heavily, have experienced mental health issues such as depression, anxiety, suicidal ideation, decreased self-esteem, loneliness, and increased risk of cyber bullying. This research will explore the impact of social media on college students' mental health at a small, private, religious university. The method of research is a questionnaire that will be given to a focus group of college students aged 18-22. In addition to demographic questions, the questionnaire will ask about the frequency of social media usage, type of usage, and its effect on mental and relational health. The importance of this research is to determine the correlation between social media usage and mental health issues. Data will display the relationship between social media usage and mental health issues based on subjective, personal ratings from a one to five scale, based on past and current experiences. The Likert scale will be utilized in the data collection process.

Student Satisfaction with EMU Fitness Center

Cole Bashinski with Anna Filipkowski

Faculty Mentor: Joohyun Lee

Many campuses have issues with retaining students on campus for several reasons. One of the main reasons is due to students' satisfaction with the on campus gym. To help retention a study of student satisfaction with the EMU on campus fitness center was conducted. This will be conducted through a questionnaire to see student satisfaction in different dimensions of the EMU fitness center. These dimensions include cleanliness, condition, and amount of equipment to show if students are satisfied with the EMU fitness center. Based upon these dimensions, we hope to find out what our EMU campus gym needs to improve on and what it is doing well. If the gym were to make many improvements in all the different areas then more students will end up using the gym. The gym is already free to students. If the gym were to make the improvements then more students would be more likely to use the campus gym rather than buy a public gym membership.

A Spatial Analysis of the Housing Availability and Prices in Harrisonburg Virginia Over the Last 20 Years

Zach Bauman

Faculty Mentor: Jim Yoder

GIS is used to compare the change of apartment zoning and housing density to the average pricing of apartments. GIS will be used to create a map of Harrisonburg showing the total apartment zoning and unit within the city limits over a 20 year period in order to calculate correlations between apartment zoning over time and the average price of an apartment.

Portrait of a Leader

Ani Beitzel

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Hematocrit and Resting Heart Rate Levels in EMU Varsity Soccer Vs Non-athletes.

Cindi Boyer with Alex Deiongh

Faculty Mentor: Kristopher Schmidt

Hematocrit is the proportion of red blood cells in one's blood. A normal hematocrit level is extremely important due to the oxygen-binding proteins found within red blood cells that transport oxygen to all tissues throughout the body. Measuring resting heart rate will show how well the heart is circulating the blood and, therefore, delivering oxygen to appropriate tissues. It has been widely documented that athletes tend to have lower resting heart rates. However, existing research pertaining to hematocrit levels of athletes shows conflicting results. This study will measure both the hematocrit levels and resting heart rate of traditional athletes among Eastern Mennonite University's Varsity soccer team as well as non-athlete students with little or no daily physical activity. We hypothesize that athletes will have lower hematocrit levels and a lower resting heart rate. By conducting this study, we hope to better understand the relationship between hematocrit levels, heart rate, and efficiency of oxygen delivery as a result of an active lifestyle.

Comparison of phosphate limitation susceptibility between two yeast types.

Cindi Boyer with Morgan Bradley

Faculty Mentor: Stephen Cessna

Like many microorganisms, yeast is a phosphate-hungry bacteria that need specific levels to function. Yeast is a very active bacteria that grows easily. We want to know if this trait will continue just under the changing variable of phosphate. We will be testing the levels of two types of yeast and their production under limiting phosphate levels to see the minimal amount needed to grow. If yeast is starved of phosphate we believe that at a certain point it will not react or grow at all. We are curious to see if this is the same between both types.

Portrait of a Leader

DaiJordan Brown

Faculty Mentor: Alyse Lehrke

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Physiological Impacts of Light Therapy

Garrett Cash

Faculty Mentor: Susannah Moore

This study gave a deeper insight into the impacts of an acute light therapy intervention, potentially generating a fast-acting treatment for depressive episodes. This focused on a 5-minute light therapy intervention's impact on blood pressure, heart rate, and heart rate variability and the physiological, mood, and neurobiology implications of these findings. 32 participants aged 18-22 participated in this study.

Impact of Light Therapy on Mood and Social Engagement

Garrett Cash

Faculty Mentor: Susannah Moore

The study utilized a facial expression recognition bias activity and a brief mood inventory to determine if light therapy positively impacted mood and the ability to identify positive facial expressions. The study compared these findings for participants in a light therapy condition and in a neutral light condition, with 5-minute administrations for each. 32 participants aged 18-22 participated in this study.

EMU Athletic Training Room

Dylan Cassell with Cam Earles

Faculty Mentor: Joohyun Lee

The purpose of this study is to determine whether or not student-athletes at EMU think the Athletic Training room is efficient or not. We want to know how student athletes feel about trainers social skills, available equipment, service speed, and other things. The more we learn about how students feel about our facilities, the better we'll be able to change the way it is run to make it more efficient. Knowing what sport the person plays is important to our study so we know which trainer they work with. To gather the data, we plan on using a stratified sampling method by posting our surveys on QR codes and print and hang them around the school and in the ATR. We also want to create a survey that is compatible with Instagram. We want to make sure we reach out to athletes from each sports team, so we have data on how everyone feels, not just a small group of people. Finally, we wanted to know where the person is from so we know if the area they are from are more likely to have athletic training at the high school they went to. The survey will be easy for student athletes to take and they will be able to complete the survey quickly.

Xenopus Laevis as a model for pharmacological effect on the cardiovascular system

Erin Clayton with Skylar Lacks

Faculty Mentor: Kristopher Schmidt

In this study, we use frogs as a model organism for the effects of various substances, including nicotine, caffeine, and energy drinks, on the cardiovascular system. This will measure the heart rate and force of the heart at normal compared to exposure to various substances. This will allow for more informed use of the various substances as well as a better understanding of the short-term reaction of the cardiovascular system to these substances.

Verbal abuse and its Relation to Low self-esteem in College students

Tahj'ae Coleman

Faculty Mentor: Susannah Moore

The focus of this study examines how verbal abuse in childhood relates to low self-esteem in college students. Studies have shown that college students that have endured verbal abuse as a child tend to struggle with low self-esteem. Studies also have shown that due to low self-esteem, college students tend to lack a sense of belonging, disinterest in school, and or drop out of school. Additionally when verbal abuse is paired with other forms of abuse (sexual, physical, malnutrition) students may develop poor social skills, which can also produce a lack of sense of belonging. This study is currently collecting data from 85 participants in an anonymous 30-minute self-report survey, where they will be asked questions regarding their self-esteem, depression, anxiety, and different form of abuse (malnutrition, sexual, verbal, and physical). The goal of this study is to examine the relationship between childhood verbal abuse and low-self esteem in college students. This study is still under examination and data is currently being collected.

The Relationship Between Black Bears and Whitetail Deer Populations in Virginia

Braydon Collier

Faculty Mentor: Jim Yoder

This project focuses on comparing data from the Virginia Department of Wildlife Resources of harvest of black bears and whitetail deer in each county in Virginia. Using an index of antlered bucks harvested per square mile by hunters for deer and a population reconstruction zones for black bear. Comparison of this data will be used to track general trends in the populations of each species and explore possible affects of one species on another.

The Effect of Copper Contaminated Soil on the Growth of Plants

Mayra Cruz with Luz Belen Hernandez Rosario

Faculty Mentor: Matthew Siderhurst

The purpose of this project is to analyze the growth of plants in copper contaminated soil and compare that to a control group without copper. With this we can also see how much copper from the copper contaminated soil is absorbed by the plants.

A Spatial Analysis of Endangered Salamanders in Virginia

Lily Dodson

Faculty Mentor: Jim Yoder

The purpose of this project is to map known locations of endangered salamanders in Virginia, including Mabee's Salamander, the Eastern Tiger Salamander, and the Shenandoah Salamander. Correlations between endangered salamander ranges and factors such as land ownership, anthropogenic disturbance and conservation land management will be explored.

Impact of Salt Consumption on Kidney Absorption and Secretion

Morgan Evans with Megan Miller

Faculty Mentor: Kristopher Schmidt

Understanding kidney function can be used as an indicator for certain cardiovascular health factors including blood pressure. High salt diets can lead to negative effects, such as high blood pressure, so it's important to determine healthy levels of salt consumption. This study looks at how the body regulates different physiological parameters when it is exposed to various concentrations of saltwater (NaCl). The kidneys are responsible for regulating water and salt concentrations throughout the body through reabsorption and secretion. Urine volume is inversely related to blood pressure. Salt can impact urine pH which can also reflect the pH of blood in the body and knowledge of that relationship can be gained through this experiment. Upon consumption of various NaCl concentration levels, a subject's excretion is collected. Volume, specific gravity, solute concentration, and pH levels will be measured to determine kidney function. In addition, blood pressure will be measured to determine the contribution of kidney function to blood volume and cardiac output.

Portrait of a Leader

Jaylen Flesher

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Differences in Plant Trimmings' ability to use Phytoremediation on Copper Concentrated Solutions.

Abigail Forrest

Faculty Mentor: Matthew Siderhurst

Plants can be used for phytoremediation techniques by removing toxins or pollutants from soil, water, and air. Plants have complex vascular systems that are able to remove certain toxins, like copper. Some plants are more efficient at completing this task than others. In an attempt to determine the differences between certain plants' ability to use phytoremediation, trimmings were made of each plant and were then placed into test tubes containing known concentrations of copper solution. The plants were set in the tubes for a period of time and after their removal the concentration of the copper solution was measured again and subtracted from the original copper concentration to determine the amount of copper that was absorbed by each plant.

Customer Satisfaction in Common Grounds

La`akea Fujita with Nate Yoder

Faculty Mentor: Joohyun Lee

This study examines quality, service, price, and atmosphere as it relates to student satisfaction with Common Grounds. Determining the influence of the four variables listed on student satisfaction is especially important during this time because the shop will be moving locations over the summer. While it is beneficial to see what areas Common Grounds currently excels in, the information from this research will give insight on ways to improve after the move. A survey will be distributed to the Spring 2022 Marketing Research class. This survey will first determine which students go to Common Grounds. It will then ask more in depth questions that explore the four main points that relate to student satisfaction with Common Grounds. These questions will address the menu, the furniture, the music, the value of the menu, and many other important factors. With the data collected from these surveys, Common Grounds will have a better understanding of what their customers want when they move to the new location.

Working Memory and Second Language Acquisition

Lesly Garcia

Faculty Mentor: Susannah Moore

This project focuses on how working memory and second language learning have connections that allow us to store and manipulate information by cognitive operations that refer to both processing and storage. Learning a second language comes with many challenges like language comprehension, oral performance, reading, and writing. Working memory has the ability to store and manipulate information related to a particular task, and it refers to both processing and storage. The goal of this project was to explore the contribution of working memory to second language acquisition science. A bilingual system has the task of accommodating the storage of multiple languages. The ability to acquire and use a second language, allows the speaker to improve their ability to encode novel information, improve working memory processing and inhibitory control. Learning two languages, therefore, can improve the architecture design of working memory.

This study focused on different bilingual speakers with different proficiency levels, who all have English as their second language, and used monolinguals as a comparison group. Participants in the study had a lab visit where they all filled out a survey asking for demographic information, then they participated in a cognitive task. Additionally, participants who identified as bilinguals did an additional step where they took an English test to measure their proficiency level. This study is still under examination and data entry is currently being collected.

Comparing the Different Absorbances of Copper in Ivy and Forsythia

Vanessa Gardiner with Betty Debebe

Faculty Mentor: Matthew Siderhurst

The purpose of this project is to investigate how well plants can absorb copper from water or soil. Ivy and forsythia are usually good at absorbing copper so we will also compare between the two to see which is better.

Influence of Recent Burn History on Residential Property Values in San Diego County, CA

Levi Geyer

Faculty Mentor: Jim Yoder

Property values are influenced both by internal characteristics and external phenomena. This project explores the influence of recent wildfires on residential property values in San Diego County, California. Previous literature indicates that both inclusion of a property in a recent burn perimeter and views of a burned area can affect property values. This project will use GIS systems to identify residential parcels intersecting recent wildfire perimeters and compare their values to parcels at different distances from the fire.

Portrait of a Leader

Ann Ghally

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Portrait of a Leader

Juliana Ghally

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Examining a Role for Autophagy in the Pathogenic Response of *Caenorhabditis elegans* to *Elizabethkingia anophelis*

Hannah Giagnocavo

Faculty Mentor: Kristopher Schmidt

Autophagy plays an important role in pathogen defense, development, starvation adaptations, and aging. Autophagy is an important molecular process that responds to physiological changes like cellular stress; this can also be shown in the form of lipid droplet formation. In response to pathogenic bacteria, lipid droplets are formed as a process of autophagy. *C.elegans* were used to help further understand the mechanical processes of autophagy and how it affects certain physiological processes within the organisms. *C. elegans* make wonderful research organisms as researchers can stain certain anatomical structures fluorescent to visually and analytically measure differences between control groups and experiments. *bec-1* (ok691) is a genetically mutated strain of a worm that is missing the *bec-1* gene. Beclin-1 is an autophagy protein that promotes normal development in *C.elegans* and acts as a mammalian tumor suppressor in humans. This study will compare lipid formation between wild type (N2) and *bec-1* worms on dishes of *E.coli* and *E.anophelis* using visual observations and Oil-red-o staining. With the *bec-1* strain missing, these experiments should show the role of pathogenic bacteria in promoting

autophagy within N2 worms; while the bec-1 (ok691) should have no lipid formation due to the missing gene. These experiments will test the hypothesis that autophagy directly influences lipid metabolism as a physiological response to certain intrinsic stressors.

Impact of Musical Activities on the Social and Emotional Behavior of Children

Lindsey Green

Faculty Mentor: Susannah Moore

This study examined the impact of four weeks of musical activities on the social and emotional skills of preschool children in a pre-post experimental design. The musical games in this study are designed to promote empathy and prosocial skills. 18 children (ages 3-4) participated in this study at a daycare center in a small town in northern Virginia. The Social Behavior Questionnaire was answered, pre-post by 18 parents and four teachers. Data collection is currently in process.

Portrait of a Leader

Maggie Groetsch

Faculty Mentor: Alyse Lehrke

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Portrait of a Leader

Robert Guenther

Faculty Mentor: Alyse Lehrke

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A Spatial Analysis of Bigfoot Sightings in the United States

Reese Hooper

Faculty Mentor: Jim Yoder

My project will investigate bigfoot sightings across the United States by plotting bigfoot sightings per capita and per unit area by county. Correlations between bigfoot sightings, possible habitats, and weather conditions will also be investigated.

Blacks Run Water Analysis

Reese Hooper with Nick Arnold, Nate Lehman, and Gabe Nafziger

Faculty Mentor: Stephen Cessna

In our project we will attempt to analyze Blacks Run at a few different points of where it runs through. We will attempt to measure things such as Ph, turbidity, and alkalinity. We will then

analyze our results and present them in conjunction with known healthy water types in order to see if the water of Blacks Run is safe.

Nitrogen Concentrations in Major Tributaries Entering the Chesapeake Bay

Anika Hurst

Faculty Mentor: Jim Yoder

This project uses GIS mapping software to determine correlations between agriculture and tidal nitrogen inputs into the Chesapeake Bay. The focus is on the Susquehanna River Basin watershed in Pennsylvania. The percent of agricultural land is compared with the tidal nitrogen inputs for each sub-watershed in the River Basin. This data can inform people about the effect that agriculture in the Susquehanna River Basin has on the tidal nitrogen input in the Chesapeake Bay.

Corn Rootworm Beetle Attractants from Sprouting Seeds

John Jantzen with Aaron Moyer

Morgan Bradley

Faculty Mentor: Matthew Siderhurst

Our goal in this research is to identify the volatile compounds present in sprouting seeds in order to discover a highly effective lure for the Corn Rootworm Beetle. Our method includes using an aromatic collection system with parapak Q to collect volatiles from various freshly sprouting seeds, then running the volatiles through GC mass spec for identification.

Portrait of a Leader

Karson Jennings

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Plants' Ability to Filter Copper

Adesola Johnson with Ruth Abera and Meredith Lehman

Faculty Mentor: Matthew Siderhurst

The goal of our research project is to determine plants ability to filter out copper. We would be able to determine the amount of copper in a soil using BCA or AAS methods. By using one of those methods, we would be able to determine the copper concentration in the soil.

Utilizing ArcGIS to Analyze Forest Cover History in the Shenandoah Valley

Jaden Jones

Faculty Mentor: Jim Yoder

This project aims to examine land usage changes in and around Harrisonburg. By examining data from Rockingham and Harrisonburg impervious surface data sets, the amount of change from 2001-2019 are determined.

GC/MS Analysis of Cucumber Lures

Abby Kaufman with Will Blosser and Caleb Wesbey

Faculty Mentor: Matthew Siderhurst

We are analyzing a synthetic cucumber lure using GC/MS. We fabricated lures using a plastic matrices, and analyzed these over time. The purpose of this experiment is to determine the longevity of these lures under field conditions. These lures have the potential to help control the agriculturally-important pests, the melon fly (Hawaii) and cucumber fly (Australia).

Spatial Correlations Between Agriculture Land Use Types and Water Quality Issues in Virginia

Catherine Kirby

Faculty Mentor: Jim Yoder

Agriculture land use types throughout Virginia will be explored in relation to streams and rivers classified as impaired due to quality issues. This data analysis could show if there is a correlation between density of agriculture and diminishing water quality.

The Quality of Water Systems in the Harrisonburg Area

Catherine Kirby with Lily Dodson and Jaden Jones

Faculty Mentor: Stephen Cessna

The goal of our project is to assess the water quality of different water systems around EMU, such as the EMU pond, the creek in park woods, and other nearby water systems. We will assess the quality by measuring the Ph, DO, turbidity, E. coli, and EC.

Portrait of a Leader

Bradley Kirkdorffer

Faculty Mentor: Alyse Lehrke

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Phytoremediation of Copper-contaminated Soils

Imari Knight with Chidubem

Faculty Mentor: Matthew Siderhurst

The purpose of our project is to see how copper affects a plants growth. The growth of our plans have no copper, a lot of copper, or a little bit of copper. We wanted to see the growth in the plant.

The Effects of Transplanting Forsythia Bush Cuttings Grown in Copper-infected Solutions

Kate Krabill with Evan Kauffman and Christina Louk

Faculty Mentor: Matthew Siderhurst

Phytoremediation is a potential new path to cleaning our environment. Plants have the ability to extract toxic materials from the soil, but we do not know exactly how it affects these plants and if they will spread it further to other plants around them. In this experiment, we used cuttings of a Forsythia bush to determine if plants that have been in copper-infected solutions can be transferred to clean water without polluting it. We had four different test groups. One group was a clean control transferred to clean water, one group was a copper control transferred to a copper solution, the third group was a clean group transferred to copper, and the final group was clean transferred to copper. This experiment allows us to see if transferring plants involved in phytoremediation is a feasible way to 'discard' the contaminated plants.

The Effects of Fruit Based Antioxidants on Albumin in Presence of H₂O₂

Jessie Landis with Sarah Grossen and Anna Paetkau

Faculty Mentor: Stephen Cessna

Human serum albumin is a plasma protein that carries various molecules including fatty acids, ions, and drugs through the bloodstream (Moman et. al, 2017). Its presence in the plasma also makes it a crucial component of regulating oncotic pressure, or the balance of fluid in the blood vessels. According to Kocha et. al, in the presence of copper, hydrogen peroxide will cause the fragmentation of albumin (1997). Hydrogen peroxide is a well known reactive oxygen species (ROS), that in the case of albumin is capable of destabilizing the molecule and leading to pathology. The degradation of albumin has significant physiological implications as it is crucial for delivering many necessary biomolecules and maintaining blood pressure, low levels can lead to a variety of diseases (Moman et. al, 2017). To protect proteins from fragmentation or denaturation, compounds called antioxidants act as electron acceptors, removing the toxic ability of ROSs. Blueberries are well known for their antioxidant properties (Maya-Cano et. al, 2021), and will be studied alongside other common food items in their ability to protect albumin from fragmentation by hydrogen peroxide. To identify the effectiveness of specific compounds, several phenolic substances that are particularly prevalent in blueberries will be analyzed in this way as well.

EMU Students' Caffeine Consumption

Matthew Leavy with Wyland Jobe and Nate McGhee

Faculty Mentor: Joohyun Lee

Over the past few decades, caffeine has become a heavily consumed drug across the globe. More than 90% of adults around the world consume caffeine daily. Out of the 90% of caffeine consumers, caffeine is consumed in a variety of ways, but the majority of people consume caffeine in the form of beverages that are mass-produced throughout the marketplace. With that being said, caffeine is known as a stimulant that can give energy boosts as well as a boost in

a person's mood. As part of a marketing campaign, the researchers are conducting a study to determine the caffeine consumption behaviors of students at Eastern Mennonite University. The study is designed to find out how many college students consume caffeine, how often they consume caffeine and the reasoning behind specific beverage choices. A survey will be conducted with around fifteen questions that also include demographic questions to check for any irregular correlations. All in all, this research will provide information to public health officials, marketers, and many other fields that utilize consumption behavior for certain work purposes.

GIS Analysis of Wildlife Rehabilitation Efforts in Southwest Virginia

Nate Lehman

Faculty Mentor: Jim Yoder

In this project, I used GIS to create a map of patients that are brought to the Southwest Virginia wildlife center in Roanoke, Virginia. The goal of this project is to make a visual representation of the locations, species, and numbers of the animals. This was combined with a raster map of land cover from MRLC. I am interested in which areas bring in the most animals, what species are brought in the most frequently, and why. I interned for the center last summer, so I was able to get access to their database. Finally, I hope to share this map with the wildlife center in hopes that they will find it helpful or interesting.

Portrait of a Leader

Katelin Martin

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Super Mileage Car

Sean McClary with Ben Bontranger-Singer, Riley Gonzalez, Jacob Hess, Caleb Hostetler, Ethan Spicher, Lleyton Stutzman, Noah Swartzentruber, and Luke Wheeler

Faculty Mentor: Esther Tian

The objective of the Super Mileage Car project at EMU is to better understand and appreciate the design principles for high-efficiency vehicles. We, the Super Mileage Car team, design and construct the Super Mileage Car and hope to compete in the Shell Eco-Marathon to compete with other teams, who are trying to obtain the highest fuel mileage. During the 2020-2021 school year, we achieved 204 miles per gallon during our tests. This year, 2021-2022, we are completely redesigning the body and chassis of the car in an attempt to double our mileage! We have put much thought and effort into reducing weight, air-resistance, and loss of efficiency in the drivetrain of our vehicle.

Varying Sodium Intake on Urine Production

Aldred Mendez with Jeremy Williams

Faculty Mentor: Kristopher Schmidt

The focus of this study is to investigate how different drinks affect the volume of urine. Sports drinks like gatorade and powerade have varying amounts of sodium even though they are meant to serve the same purpose of replenishing electrolytes. Even energy drinks and alcohol have varying amounts of sodium, which many individuals in the general public seem to be unaware of. The current research in this field suggests that high dietary sodium can cause an increase in urine production, however urine production is also affected by many other factors such as macronutrients and electrolytes. The quality of current data is inconsistent. In this study our experimental design will consist of a subject consuming 1 of 4 drinks: Gatorade, Powerade, Bang Energy, and wine and compare against a control group that drinks water. We will then measure urine production over the course of 3 hours.

Applying a Quantitative Genomics Approach to understand the Role of unc-53/Nav2 in Innate Immunity.

Megan Miller with Abby Kaufman

Faculty Mentor: Kristopher Schmidt

The nematode *Caenorhabditis elegans* (*C. elegans*) is a well understood model organism. Nematodes possess many of the physiological processes of humans and are often used to study relevant human diseases. In this study, we will use RNA-sequencing (RNA-Seq) in *C. elegans* to compare the differential mRNA expression patterns observed between worms lacking the gene *unc-53* and wild-type N2 worms both grown on their normal laboratory food source (*Escherichia coli*) and the human and nematode pathogen *Pseudomonas aeruginosa*. RNA-seq studies can tell us what potential innate immunity pathways *unc-53* may contribute to, as well as other gene expression changes that might be physiologically relevant when *unc-53* is lost. We are currently extracting and purifying total RNA from wildtype and mutant worms and have so far produced samples that are sufficiently concentrated and pure for downstream analysis using RNA-seq.

Copper Phytoremediation in Plant Seed Sprouts

Megan Miller with Kaden Schrock

Faculty Mentor: Matthew Siderhurst

The goal of this experiment is to look at the ability of plants to remove toxic metals, such as copper, from the soil through a process called phytoremediation and determine the rate at which they can do so. This can be used as a sustainable way to remove toxic metals from the environment that have the potential to destroy vegetation and harm ecosystems. Metals in soil is an environmental and human-health related concern that needs to be addressed. Seeds were sprouted and treated with different concentrations of aqueous copper. After some time, measurements were done using either BCA or AAS to determine the concentration of copper that was removed from the solution by the plants. The absorbance of the resulting solutions were measured and the concentration of copper in the plants was subtracted from the original concentration that the plants were treated with. The results can be used to determine which

plants are most effective at phytoremediation in order to be used in future research projects. Copper can be toxic to plants so their growth over time will also be monitored to look at the effects of copper on plant growth.

Determination of the Effectiveness of Hydrilla verticillata for Phytoremediation in Freshwater using AA Spectroscopy.

Elaine Miranda Perez with Hannah Dellinger

Faculty Mentor: Matthew Siderhurst

The harmful effects of coal mining are widely known. They range from erosion and pollution to the dissolution of heavy metals in the substrate and surface waters, causing irreversible damage to the environment. These effects pose a threat to the state of Virginia given its proximity to West Virginia, a state whose fundamental economic activity was coal mining for many years. The efficacy of *Hydrilla verticillata* for phytoremediation, specifically its ability to absorb copper from the water and substrate, will be determined using AA Spectroscopy.

Well Water Quality in Linville and Daphna, Virginia

Jake Myers with Levi Geyer

Isaac Alderfer

Faculty Mentor: Stephen Cessna

Drinking water for most residences in Rockingham County is sourced from private wells located on individual properties. Located in agricultural areas over karst topography, these wells are at risk of contamination from land use either directly above or in the local region. Specifically in the neighboring communities of Daphna and Linville there are many cattle and poultry operations that may contribute to contamination of surface and groundwater sources. This research tested water from several different wells in Daphna and Linville, VA to measure indicators of potential agricultural pollution in the groundwater as well as to evaluate the general water quality. Metrics measured were phosphate, E. coli bacteria colonies, conductivity, and pH.

Gentrification and Population Dynamics in Charlottesville, VA

Gabe Nafziger

Faculty Mentor: Jim Yoder

This project explores the effects of changing property values of coastline and coast adjacent real estate on the demographics of people who live there over time. The project pays special attention to areas that have undergone construction or been remodeled in that time. The goal of the project is to obtain a clear understanding through the use of GIS mapping of census data of who is moving to and away from the beachfront and where those leaving are able to go.

Portrait of a Leader

Arianna Nixon

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

The Role of Antioxidant, Bilirubin, and Fatty Acids in Protecting Albumin Against Cu/peroxide-induced Oxidative Stress

Graciella Odelia with Erin Clayton

Faculty Mentor: Stephen Cessna

Albumin is a multifunctional, highly soluble protein that is present in human plasma and has several significant pharmacological and physiological functions. For instance, it acts as a transport protein for metals, drugs, cholesterol, fatty acids, and bile pigments. It also helps to regulate osmotic pressure and fluid distribution throughout different parts of the body. Further, the cells produce powerful oxidants, such as hydrogen peroxide, when highly stressed and during heavy respiration. The accumulation of these oxidants can then damage DNA and proteins, and albumin has been found to be one of the proteins being damaged. In general, albumin represents the major antioxidant in plasma, destroying most potent oxidants present in solution. In fact, it has been found, from previous lab activity, that albumin is potentially oxidized and damaged by hydrogen peroxide in the presence of copper, fragmenting into smaller pieces and falling out of solution, through SDS and Native gel electrophoresis analysis. Therefore, we set out to test whether antioxidants, fatty acid, and bilirubin can protect albumin from oxidative damage through SDS gel electrophoresis analysis. Based on other's findings, the role of antioxidant, bilirubin, and fatty acids should be to protect albumin against Cu/peroxide-induced oxidative stress.

Portrait of a Leader

Kendra Oguamena

Faculty Mentor: Alyse Lehrke

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Student Satisfaction of Study Spaces at EMU

Nathan Oostland with Yeong Ahn and Conrad Yoder

Faculty Mentor: Joohyun Lee

This study aims to evaluate students' satisfaction of the available study spaces on campus at a university near the east coast of the US. Along with satisfaction, this study looks at what factors make up popular study spaces, as well as a few study habits of the student body. As this university undergoes renovation of a major common space, they must consider what the student body would like pertaining to spaces to work and study. One study showed that when students were given a space with minimal distractions, paired with a desire to study, they were predicted to have a higher GPA (Collings, 2021). Data will be collected through a survey to collect

information about course work, study habits, and satisfaction of study spaces. We expect that roughly four out of five students will be generally satisfied with the spaces on campus because there are a variety of locations on campus to satisfy a wide range of students' preferences. But we also believe that some students will find room for improvement from the university.

Examining the effects of over-the-counter Vitamin C and B2 supplements on urine composition with Jessie Landis, Nuha Reza, and Sarah Patsell: Kristopher Schmidt

Sarah Patsell with Jessie Landis and Nuha Reza

Faculty Mentor: Kristopher Schmidt

In recent years due to increased marketing measures, vitamin supplements have gained popularity as entities that can improve health. In reality, these supplements are not always sufficiently regulated or the effects of the vitamins are not as substantial as users perceive them to be in marketing. As urine analysis can reveal a multitude of implications regarding health, in this project, we aim to observe the effect of vitamin supplements on urine composition. As it is well known, water-soluble minerals and vitamins that remain unused by the body are secreted in the urine, which would alter the results of urinalysis. Water-soluble vitamins that we will be implementing in our experimentation include vitamin C and vitamin B2 (riboflavin). Parameters including color, specific gravity, clarity, volume, pH and a variety of other measurements found on reagent strips for urinalysis.

Portrait of a Leader

Bri Rodriguez

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Investigating the Feed-Forward System Through the Perspective of the Heart

Natnael Seifu

Faculty Mentor: Kristopher Schmidt

The feed-forward system is an important response system in the body that allows the human body to prepare for an upcoming activity. This response system primarily requires the activity of the sympathetic nervous system, and one of the major consequences of the activity of the sympathetic nervous system is an increase in heart rate and the general activity of the heart. The goal of this experiment is to measure to what extent the body 'prepares' itself for an upcoming strenuous physical activity primarily through the perspective of the heart. This will be done using an ECG (Electrocardiogram) measurement that will provide information on the waves of the heart, the heart rate and other dimensions of the activity of the heart. Other miscellaneous information will also be collected using methods such as simple observation and EEG (Electroencephalogram) measurements.

Spatial Analysis of Commercial Airports Impacts on the Local Community

Luke Short

Faculty Mentor: Jim Yoder

This project takes a look at the environmental and social implications different classes of airports have on a community. This will take a look at things such as air quality, housing prices, and noise pollution.

Campus Parking

Yuliya Siminenko with Rachel Jennings and Zachari Munoz

Faculty Mentor: Joohyun Lee

Many students on Eastern Mennonite University's (EMU) campus drive motor vehicles. Since the number of vehicles on campus has increased you have a decrease in parking spots available. Since EMU has many commuters, they can have problems finding parking spots in lots they are allowed to park in. Student satisfaction of parking lots and parking spots available to them were studied. How safe students felt parking on campus and walking from the parking lot to their class/housing was also studied. There are many factors that can change how safe students feel parking on campus. Especially with last year's, 2021, tire slashing that happened to too many student's vehicles. We will state and define all factors that could be improved with EMU's current state of on-campus parking.

Portrait of a Leader

Natty Solomon

Faculty Mentor: Alyse Lehrke

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Synthesis of a Potential Spotted Lanternfly Attractant Using Aldol Condensation

Isaac Spicher with Laura Craft, Matthew Siderhurst, and Julie Weaver

Faculty Mentor: Matthew Siderhurst

The spotted lanternfly, *Lycorma delicatula*, is an emerging invasive insect in the United States which has proven detrimental to vineyards and drupe orchards in the Mid-Atlantic region. Trapping this insect with the use of chemical lures is thus paramount to the preservation of these agricultural operations as the SLF broadens its non-native range. One chemical suspected to attract the SLF is 2,6-dimethylnona-4,6-dien-2-one. To synthesize this compound, we plan to use the mixed aldol condensation of 3-methyl-2-butanone and 2-methyl-2-pentenal.

Are There Admission Issues at Universities?

Ethan Spraker with Kobi Alexander and Joshua Chiquillo

Faculty Mentor: Joohyun Lee

One third of all college students in America change their major within their 4-year college experience. This puts students behind and delays their graduation date. Studies show that less than 60% of college students graduate on time in 4 years. Our research was done to see how many college students change their major in their 4 years of college. Our observations are to see what the main causes for students are to change their major. The main goal of this research is to find the main causes for major changes so universities can improve the way students are advised and what majors need the most improvement. Universities can reduce the number of major changes and save college students time and money. The information we observed was from students at Eastern Mennonite University. We collected this by an online survey taken by the students in the marketing research class at the university.

Investigating the Role of Heart Rate Variability in Childhood Maltreatment

Avery Trinh

Faculty Mentor: Susannah Moore

Childhood Maltreatment (CM) puts young adults at significant risk of poor physical health outcomes. Research shows that (Heart Rate Variability) HRV serves as a moderator between early-life adversity and physiological factors such as greater body mass index and metabolic syndrome risk factors. This study seeks to observe the relationships between CM , HRV, and metabolic syndrome risk factors among college students (n=80). Data is collected and analyses are underway.

Sense of Belonging: The Need for a New Survey

Avery Trinh

Faculty Mentor: Susannah Moore

At Eastern Mennonite University, a 2021 survey revealed that 33% of first-year respondents reported a low sense of belonging to the institution. When solely focusing on individuals of African, Hispanic, Asian, and Native American (AHANA) descent, 35% agreed with the item and 15% strongly agreed. These statistics identify the absence of sense of belonging in the EMU student population, a key predictor of student retention and academic success within the research of higher education. Despite the importance of belonging in college and the low reports of belonging on campus, there is no survey that adequately measures belongingness within the current higher education climate. This study created an instrument that was completed by 79 EMU students and will be sent out to 275 first-year students, and a focus group will gather qualitative data on belongingness. Data collection is underway.

Analysis of Benthic Macroinvertebrates in the Bergton, VA Watershed

Andrea Troyer

Faculty Mentor: Jim Yoder

This project analyzes accumulative benthic macroinvertebrate data from the Bergton Watershed of Rockingham County, VA. This multidisciplinary project by Jim Yoder and Doug Graber Neufeld conducts research on stream health and biodiversity through nitrate and phosphate water

sampling along with identifying macroinvertebrates. This specific project accumulates all the macroinvertebrate data from 2014-2019 and compares each site using ArcGIS Pro software. Seasonality comparisons are made between each site throughout the years by noting the changes in the VSCI scores. Forest and agriculture percentages were also determined for each watershed delineation.

The Effects of Rotational Grazing on Soil Health

Andrea Troyer with Faith Manickam, Luke Short, and Felicity Zimmerman

Faculty Mentor: Stephen Cessna

Cedar Heights Farm is a cattle, hog, chicken and goat farm in Harrisonburg, Virginia focused on regenerative agriculture through rotational grazing and other measures. We will be collecting soil samples with different cropping and grazing histories and comparing the humic and fulvic acid, water and organic content, phosphate, texture, pH, EC, and potential ions to determine the relationship between soil health and regenerative farming practices over time. Overall, our goal is to determine how rotational grazing affects soil quality. We hope to share our findings with farmers considering implementing rotational grazing.

Healthcare Accessibility in Regards to Race and Income

Ally Welty Peachey

Faculty Mentor: Jim Yoder

This project examines how geographically, some communities are disproportionately impacted by healthcare access. Quantifying the inequalities in access to healthcare could help to bring changes and improve the overall health of various communities. Spatial analysis is used to compare how geographic accessibility to hospitals varies between socioeconomic and racial groups in the state of Virginia. Census tract data with median household income and minority groups are used to determine accessibility to the nearest hospitals. As a tract's median income increases the distance to hospitals and healthcare facilities decreases, and as the percentage of minority groups in a tract increases the distance to healthcare facilities increases.

Phytoremediation in *Typha latifolia* L. (Broadleaf Cattail)

Ally Welty Peachey with Doran Kennedy

Faculty Mentor: Matthew Siderhurst

Phytoremediation is when plants can be used to remove heavy metals from soil and water. Heavy metals can be harmful to aquatic plants and animals. The *Typha latifolia* L. (Cattail) is a perennial marsh plant that grows across the United States. We wanted to test the potential for cattail plants to be used to remove Cu^{2+} via Phytoremediation. We had three treatment groups that each received varying levels of Cu^{2+} . The concentration of Cu was measured after the cattails bloomed; the cattails' ability to remove Cu was determined.

Portrait of a Leader

Hunter West

Faculty Mentor: Alyse Lehrke

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Effects of nicotine on heart contractility and heart rate

Aden Weybright with Destiny Lyday

Faculty Mentor: Kristopher Schmidt

Previous studies have shown that vaping can adversely affect the circulatory system and lead to sudden death. Nicotine can cause an increase in heart rate, an increase in heart contractility, and an increase in the length of ventricular repolarization of the QRS complex. In this experiment, we will be studying the effects of nicotinic vapor on a frog's heart rate and ECG.

Our experiment will consist of three trials; for each frog we will measure the contractility of the heart, heart rate, and ECG when the frog is exposed to vape smoke without nicotine. These values will then be measured again after the frog has been exposed to vape smoke that contains nicotine. This procedure will be repeated three times.

Impact of Food Access and Purchasing to the Harrisonburg City Nitrogen Footprint

Lindsey White

Faculty Mentor: Jim Yoder

This project will analyze the impact purchasing power of food has on Nitrogen in Harrisonburg City. This project will also analyze the correlation between income level, race, household size, and age has on the amount of Nitrogen being used by residents in Harrisonburg City.

Influence of Agricultural Runoff on Tide Spring Water Quality

Lindsey White with Zach Bauman, Grace Harder, Anika Hurst

Faculty Mentor: Stephen Cessna

This project explores the potential presence of nitrates and phosphates as well as other factors that influence the health of the stream. This study will take place at the headwaters of Tide Spring Branch in Linville, Virginia and continue until it reaches the conjunction of Linville Creek. We will be using these measurements to explore the effects of agricultural runoff in the waterways.

Effect of EDTA on the Phytoremediation of Copper Using Ivy

Aidan Yoder with Marciella Shallomita

Faculty Mentor: Matthew Siderhurst

The technique of phytoremediation is an important and sustainable way to to remove toxic chemicals from water in order to improve water quality in ecosystems. In this experiment, Copper is used as the the toxic chemical to be tested with ivy. The purpose of our experiment is

to test the effects of EDTA on the take up of copper in ivy growth. We hypothesize that EDTA aids in the take up of copper and allows the ivy to remove the copper from the water.

Portrait of a Leader

Hannah York

Faculty Mentor: Alyse Lehrke

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A Spatial Analysis of the Impact of Exit Proximity on Interstate 81 Vehicle Accidents

Felicity Zimmerman

Faculty Mentor: Jim Yoder

A 2001 study conducted by the U.S. Fatality Analysis Reporting System (FARS) and General Estimates System (GES) showed that out of all interstate crashes, 18% occurred at interstate exchanges. Additionally, interstate exchanges were responsible for 17% of crashes involving an injury and 11% if fatal crashes. The study also calculated that interstate interchanges accounted for only 5% of the total interstate area. Utilizing Arc GIS and crash data from 2015-2019, this project analyzes the percentage of crashes which occur in and around exits on Interstate 81 in Virginia.

Portrait of a Leader

Andrew Zook

Faculty Mentor: Alyse Lehrke

A research project on the life and leadership of a model leader in a relevant field. The leader's story, experiences, and values may serve as a type of mentor for others who are developing their own ideas and identities as leaders in the same field.

Could Video Games Improve Our Chances of Survival?: A Physiological Perspective

Katelyn Zuercher

Faculty Mentor: Susannah Moore

Researchers have begun investigating the survival processing theory (SPP) – a memory paradigm that finds that humans remember survival-relevant words better than non-survival words. To test this theory, thirty participants were given memory recall tasks with either a reading task or a popular entertainment source: first-person shooter (FPS) video games. Additionally, their heart rate and blood pressure were monitored throughout the study to have a physiological perspective on the potential combination of emotional arousal and the survival processing paradigm. There is limited information on the combination of FPS video games, SPP, and emotional arousal, so results pulled from this study will shed some light on the question: have video games improved our chances of survival?

Could Video Games Improve Our Chances of Survival? Exploring the Survival Processing Paradigm and First-Person Video Games

Katelyn Zuercher

Faculty Mentor: Susannah Moore

Researchers have begun investigating the survival processing theory (SPP) – a memory paradigm that finds that humans remember survival-relevant words better than non-survival words. To test this theory, thirty participants were given a memory recall task with either a reading task or a task with a popular entertainment source: first-person shooter (FPS) video games. There is limited information on the combination of FPS video games and SPP, so results pulled from this study will shed some light on the question: have video games improved our chances of survival?

The Effect of Chronic Illness on Quality of Life, Life Satisfaction, and Health Behaviors

Kierra Zuercher

Faculty Mentor: Susannah Moore

Chronic illness is one of the medical community's most discussed topics, affecting over 50% of the adult population (Riegel, 2012). Due to the longevity and general incurability of chronic illnesses, many patients find themselves with a reduced quality of life as a result of their diagnosis. If a patient has a reduced quality of life due to their illness, it is likely that they will possess a reduced life satisfaction as well (Strine, 2007). This could take a significant mental toll on individuals experiencing even mild symptoms and inconveniences, let alone those with moderate to severe conditions. The constant discouragement of seeing little to no improvement may result in infrequent or lack of positive health behaviors such as exercising, taking medications, reaching out to family and friends for support or seeking help from medical care providers. Current research has explored each area separately in relation to chronic illness, but little research has been done to find the correlations between chronic illness, life satisfaction, quality of life and health behaviors: how do they impact each other? There is great value in analyzing life satisfaction, quality of life, and health behaviors together: it could potentially show how each one affects the others. The current study seeks to examine the correlations between chronic illness, life satisfaction, quality of life, and health behaviors with an adult population of those diagnosed with one or more chronic illnesses. A survey was given to two different populations to evaluate the connections. Data collection is currently ongoing.