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UNIVERSITY RESEARCH AND
CREATIVE ACHIEVEMENT DAY

Graduate Poster Presentations

Location: Alumni Hall – Student Center

Time: 2:00 PM – 4:00 PM

Discourse Encoding in Subordinate Clauses: Insights from corpus analysis

Mike Aune

Applied Linguistics master's program

Advisor: Dr. Helen Koulidobrova

This project focuses on an understudied linguistic construction with theoretical significance for the encoding of discourse-level functions in syntax. The construction in question, dubbed 'quasi-subordination' in Dayal (2025), is one where properties of question-asking typically considered the domain of main clauses are instead found in embedded clauses. Such a construction provides a unique avenue for research into where and how pragmatic information — such as the act of requesting information — is encoded in sentence structure. The novel contribution of this thesis is bringing spoken language corpus data to bear on this relatively rare construction, examining natural attestations in search of insights that may confirm, complicate, or extend what the theoretical literature predicts.

Fraud Detection using Graph Neural Networks

Mark Rodriguez

Artificial Intelligence

Advisor: Dr. Md Rafiul Hassan

Fraud is an increasingly prevalent issue in society. As we begin relying on more systems for financial services, information on locations and events, and even just general opinions, we need to minimize fraud in these systems in order to keep them functioning as best they can. In the domain of fraud detection, many detection system applications tend to focus on financial fraud and the detection of fraudulent reviews on online platforms. Detecting fraudsters for both of these applications was very similar with many of the same ideas and architectures being used for both. By detecting fraudsters in systems like these, we can minimize the damage done to these systems and make them more effective. To create a system that can detect fraud in a robust way, many have turned to deep learning systems. Deep learning is a sub-field of machine learning which utilizes a multilayered neural network for learning tasks. There are various neural network structures that can be used for deep learning tasks, but certain structures have been proven more effective for specific tasks. The most common Neural Network structure seen in fraud detection is the graph neural network (GNN). To convey the ability of graph relationships in identifying fraud, I will use a Graph Convolutional Neural Network (GCN) to identify fraudsters on a credit card dataset. This approach will be compared to other classification methods to show the effectiveness of graph neural networks for identifying fraud.



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ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION OF A DIVISION I COLLEGIATE FEMALE BASKETBALL ATHLETE

Avery Gabrenas
Athletic Training
Advisor: Dr. Kathy Pirog

During a competitive basketball game, a 19-year-old female basketball player sustained a non-contact injury to her right knee while landing from a layup. Immediate complaints included pain, instability, and loss in range of motion. Lachman's test for anterior cruciate ligament (ACL) laxity produced an abnormal end-feel, though the assessment was difficult to interpret due to acute pain and muscle guarding. Varus and valgus stress testing both elicited pain. The athlete was provided with crutches due to the inability to ambulate independently. Joint effusion occurred approximately 30 minutes post-injury. Differential Diagnosis: Anterior cruciate ligament rupture, posterior cruciate ligament (PCL) rupture, medial and lateral meniscus tear, medial collateral ligament (MCL) sprain, lateral collateral ligament (LCL) sprain. Treatment: Diagnostic test results included negative x-rays and an MRI reading that indicated an ACL rupture and a torn lateral meniscus. Intraoperative findings confirmed a grade 3 ACL tear and a tear to the lateral meniscus. A bone-tendon-bone reconstruction of the ACL and a partial lateral meniscectomy was performed. Post-operatively the knee was immobilized at zero degrees of flexion and weight bearing as tolerated on crutches was permitted. Uniqueness: The uniqueness surrounding this case comes from the associated lateral meniscal injury. Conclusion: An anterior cruciate ligament injury can be a season or potentially career altering event for an athlete.

Function of natural wax coating on predation of Spotted Lanternfly (*Lycorma delicatula*) egg masses by native arthropod predators

Oliver Kelsey
Biology (Wildlife and Conservation Biology)
Advisor: Dr. Alicia Bray

The spotted lanternfly (SLF), *Lycorma delicatula*, is an invasive pest native to China, India, and Vietnam. They are a generalist, phloem feeding pest that can feed from over 100 different species of plants. By January 2023, SLF had been found in 14 Northeastern states following their 2014 introduction and detection in Pennsylvania. Spotted lanternfly lay a waxy coating on top of their egg masses; it is hypothesized that the fluff protects against weather. However, there is limited literature that discusses the possibility of the wax protecting eggs from predators. Eighty-four SLF egg traps were set in three towns across Connecticut. Once the eggs were laid, they were assigned to one of four treatment groups, net + wax, net + no wax, no net + wax, and no net + no wax. The goals of this study are to 1) test the hypotheses of the function of wax on winter survival vs. predator protection, and 2) determine whether native arthropod predators, including other insects and spiders, are regularly feeding on SLF eggs and if egg predation is a reliable form of biological control for SLF. Traps will be collected over the summer, SLF survivorship and the severity of predation will be quantified.



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Anterior Ankle Dislocation in a NCAA Division I Female Diver

Jillian Plieth

Athletic Training

Advisor: Dr. Thomas McCarthy

Anterior Ankle Dislocation in a NCAA Division I Female Diver Plieth, JN BS, McCarthy, T MS, ATC, DRomano, AM DAT, ATC, Pirog, K EdD, ATC, Central Connecticut State University, New Britain, Connecticut Background: A 19-year-old female collegiate diver sustained a traumatic ankle dislocation during competition in late October 2025. While performing a hurdle take off (what height board), the athlete landed on to side of the board, resulting in a forceful eversion and an anterior dislocation. Athlete was transported to the emergency department where a dislocation was confirmed by x-rays. A closed reduction was performed; the athlete was placed in a posterior splint, given crutches and discharged with referral to orthopedics. The athlete underwent ankle reconstruction seven days post injury. Key words: anterior dislocation, eversion, deltoid ligament. Differential Diagnosis: Tibia-fibular fracture. Diagnosis: X-Ray confirmed an anterior dislocation. Rehabilitation and Management: Early rehabilitation focused on restoring range of motion, with emphasis on dorsiflexion. Five months post-operatively athlete reports intermittent and irregular bruising, and consistent pain to the medial malleolus. Follow-up MRI revealed inflammation to the soft tissue surrounding the implanted hardware. The surgeon provided two management plans that consisted of two options: conservative rehabilitation; surgical removal of hardware. The athlete elected to follow a conservative

Does Sourcing Strategy Matter for Hospital Performance

C. Christopher Lee

MBA

Advisor: Dr. C. Christopher Lee

This paper examined the impacts of sourcing strategy on hospital performance. Sourcing strategy includes four options: (1) group purchasing organization (GPO) only, (2) direct distributor (DD) only, (3) hybrid (GPO and DD), (4) Independent. Hospital performance was measured by supply chain performance, hospital operating efficiency, hospital profitability, and hospital quality of patient care. The sample data were collected from the 2020 American Hospital Association (AHA) U.S. Hospital Survey datasets and the Centers for Medicare and Medicaid Services (CMS) website. This study also tested the moderating effect of hospital size measured by the number of beds. The regression analysis conducted hypothesis testing. This research included four studies. Study 1 focused on hospital efficiency (N = 3051). Study 2 focused on hospital profitability (N = 5991). Study 3 focused on supply chain performance (N = 2997). Study 4 focused on hospital quality (N = 752). Preliminary results showed that the sourcing strategy was significantly related to hospital efficiency and profitability, while there was no statistical significance for supply chain performance and hospital quality. Both theoretical and practical implications were discussed.



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ANTERIOR CRUCIATE LIGAMENT REPAIR WITH AUTOLOGOUS QUADRICEP TENDON, LATERAL EXTRA-ARTICULAR TENODESIS, AND ARTHROSCOPIC REVISION IN A DIVISION I FOOTBALL PLAYER

Anthony Cusimano
Athletic Training
Advisor: Dr. Kathy Pirog

Background: 18-year-old male defensive lineman sustained a left knee injury during practice. Mechanism of injury noted foot fixation and hyperextension with contact from two players. Athlete reported a “pop,” followed by pain and instability. Physical examination revealed limited range of motion (ROM), joint effusion, and a positive Lachman test for ACL deficiency. Differential Diagnosis: anterior cruciate ligament sprain, posterior cruciate ligament sprain, meniscus tear, hamstring strain, collateral ligament sprain, osteochondral lesion. MRI confirmed an ACL rupture. Treatment: ACL reconstruction using an autologous quadriceps tendon and lateral extra-articular tenodesis with the iliotibial band was performed. Postoperative management included ROM limited to 0–30 degrees, weight bearing as tolerated, and progressive rehabilitation. Initial ROM was 26 degrees flexion and -8 degrees extension. Nine weeks post-operatively, flexion improved to ~99 degrees. With an extension loss of an additional ~2 degrees resulted in concern for a cyclops lesion. Follow-up MRI identified a cyclops lesion and arthroscopic debridement was performed sixteen weeks from the initial surgery. Uniqueness: This case highlights cyclops syndrome causing persistent loss of extension following ACL reconstruction, requiring surgical intervention. Conclusion: ACL injuries commonly occur with foot fixation, lower leg rotation, and traumatic force. Cyclops lesions, though less frequent, can impair extension.

Synaptic Localization of the D2-like Dopamine Receptor DOP-2 in ASH Sensory Neurons of *Caenorhabditis elegans*.

Jack Moquete
Biomolecular Science
Advisor: Dr. Chase

Dopaminergic signaling plays a central role in modulating sensory processing and behavior across species, yet the precise subcellular localization of dopamine receptors within defined sensory circuits remains incompletely understood. In *Caenorhabditis elegans*, the D2-like receptor DOP-2 has been implicated in locomotory and neuromodulatory processes; however, its spatial distribution within polymodal sensory neurons remains unresolved. Here, we investigate the expression and subcellular localization of DOP-2 in ASH sensory neurons—key mediators of aversive responses—using a targeted fluorescent fusion construct (sra-6p::DOP-2::GFP). High-resolution fluorescence imaging reveals a punctate distribution of DOP-2 along ASH axons, consistent with synaptic or perisynaptic localization. These findings suggest that dopaminergic signaling may directly modulate synaptic transmission within ASH circuits. To further validate the synaptic association of DOP-2, ongoing studies incorporate established presynaptic and active zone markers, including synaptobrevin (SNB-1) and Liprin- α (SYD-2), to assess colocalization and refine the spatial resolution of receptor localization within ASH circuitry.



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Identification and Validation of Novel Polymorphisms in the in *H. Vulgaris* as a Target of HyADAR Mediated RNA-Editing

Ethan Khentigan

Biomolecular Science

Advisor: Dr. Barry Hoopengardner

ADAR converts A-to-I in mRNA, recognized as G; Used for RNA editing in humans, a recent study found Hydra contain a specific hyADAR. There is a chance to establish novel RNA editing sites that could be used to better understand stem cell renewal, and neurotransmitter dysfunction. We are researching if Hydra have ADAR mutations in ion-gated channels & senescence genes; Using BLASTn on NCBI to compare mRNA variants for A-G & C-T polymorphisms. IGF2, HTK7, and FOXO were chosen for being conserved across many species' growth pathways. IGF2 and HTK7 are 76% and 70% homologous to Human Chrm 5, involved in nerve development, and to INSR, important for nerve migration and differentiation. They are linked to mitochondrial protection against Parkinson's disease in mice, and activated by insulin-like molecules to regulate growth based on temperature changes. FOXO is implicated in mediating responses to oxidative stress and dietary restriction, promoting pathways that minimize cumulative cell damage. A 73% human homolog, FoxO3, is linked to longevity by managing metabolism and apoptosis. CHRNA7, the cys-loop ligand gated ion channel, was identified as a homolog in Hydra. A link has been made between schizophrenia and dysfunction of the human ortholog of the cys-loop ligand gated ion channel. The determination of an editing site in the cys-loop ligand gated ion channel presents a novel approach to treat dysfunction of the cys-loop ligand gated ion channel, and the human ortholog CHRNA7.

Subacute Polystyrene Particle Exposure Impairs Regeneration in Planaria

Lin Vitarbo

Biomolecular science

Advisor: Dr. Betsy Dobbs-McAuliffe

Micro- and nano-plastic pollution is a growing concern in aquatic ecosystems, but many toxic effects on aquatic organisms remain unclear. Planaria are useful models because they contain abundant stem cells, called neoblasts, that regenerate missing tissues after injury. These cells migrate to wound sites and differentiate into specialized tissues, allowing planaria to regrow complex structures such as the head, eyes, and pharynx. Because regeneration is rapid, visible, and linked to stem cell activity, planaria provide an effective system for studying environmental contaminants and tissue repair. In this study, we examined whether subacute exposure to fluorescent polystyrene microspheres affects regeneration and survivability in planaria. Worms were exposed for eight days to 0.044 μm Dragon Green polystyrene microspheres at 3, 4, or 6 g/L and compared with an unexposed control group. After exposure, worms were amputated along the transverse plane and monitored during recovery to assess regeneration relative to controls. Fluorescence was tracked to evaluate retained particles after amputation. Survivability was recorded for both cut and uncut worms. We predict that prolonged exposure to polystyrene particles disrupts regeneration and reduces survival in a concentration dependent manner. This study will clarify how plastic pollution affects stem regeneration and health in planaria.



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LLM Forensic Benchmarking: Logit Gaps and Floating-Point Instability

Sadie Simek

Cybersecurity and MSc Ai

Advisor: Dr. Ramyapandian Vijayakanthan

As Large Language Models (LLMs) become embedded in sensitive domains such as healthcare and finance, the security implications of their deployment warrant closer scrutiny. This paper investigates a critical and underexplored vulnerability: the tendency of LLMs to memorize training data, and the persistence of that memorized content even after models undergo quantization, the process of compressing model weights for efficient offline and edge deployment. We examine whether the transition from full precision to compressed formats, including the widely adopted GGUF format, produces predictable patterns of data exposure and inference instability that could be exploited to manipulate model behavior. To evaluate this risk, we developed a fully reproducible benchmarking pipeline that generated and analyzed approximately 30,000 data points over five months, drawing on models sourced from Hugging Face. Central to our methodology is the introduction of Floating-Point Instability (FPI) analysis, a novel technique for determining whether hardware-level differences between CPU and GPU processing mask or amplify the exposure of memorized content. We evaluated model behavior across a deliberately varied hardware spectrum: a consumer-grade Windows 11 laptop (Intel Core i7), GPU-accelerated Azure virtual machines, and a high-end NVIDIA Grace Blackwell (GB10) workstation.

Exploring Health and Well-Being of International Faculty at Central

Yein Cho

Health Psychology, Psychological Science

Advisor: Dr. Holly Brott

International faculty in U.S. higher education face compounding stressors beyond those experienced by their domestic counterparts, yet their health experiences remain largely undocumented. This qualitative study explored how international faculty at Central Connecticut State University (CCSU) navigate health-related challenges within the context of cultural adaptation and institutional demands. Semi-structured interviews were conducted with four international faculty members during Fall 2025, and data were analyzed thematically. Five candidate themes emerged: Cultural Confusion and Response Uncertainty, Overwhelmed by Responsibilities, International Status and Vulnerability, Health-Related Challenges, and Supportive Resources and Coping. Findings revealed that participants experienced acculturative stress, burnout tied to non-replaceable academic roles, and immigration-related anxiety that compounded general workplace pressures. Physical and mental health concerns were common, yet participants also identified collegial networks, institutional resources, and preventive health practices as meaningful supports. These findings suggest that institutions may better support international faculty through culturally informed mentoring, expanded family resources, and dedicated immigration guidance.



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Operational and Clinical Predictors of Psychiatric Readmissions: Insights from National CMS Data

C. Christopher Lee

MBA

Advisor: Dr. C. Christopher Lee

This study investigated the relationship between four operational and clinical variables—transition-of-care documentation, post-discharge medication continuation, follow-up care within 30 days, and use of seclusion—and 30-day psychiatric readmission rates at U.S. inpatient psychiatric facilities. Data from the 2020 CMS IPFQR and American Hospital Association U.S. Hospital Survey were combined to supplement facility characteristics. Ordinary least squares multivariate regression analysis was conducted ($N = 1224$). Follow-up care within 30 days was significantly associated with lower 30-day readmission rates ($\beta = -0.275$, $p = 0.002$), strongly supporting Hypothesis 3. Medication continuation showed a marginally significant negative relationship ($\beta = -0.158$, $p = 0.069$), partially supporting Hypothesis 2. Transition record completeness was not significant ($p = 0.303$), and seclusion use was significant but contrary to expectations ($\beta = -0.162$, $p = 0.038$), offering no support for Hypotheses 1 and 4. Benchmarking facility performance supports hospital administrators in reducing readmissions and costs and improving care quality. These findings can inform hospital quality improvement, cost-management strategies, and operational decisions to reduce avoidable psychiatric readmissions, potentially improving bed utilization and overall hospital performance.

When Do ESG Initiatives Influence Hospital Performance? The Moderating Role of Ownership Type

C. Christopher Lee

MBA

Advisor: Dr. C. Christopher Lee

Previous studies examined Environment, Society, and Governance (ESG) initiatives and hospital performance, but few have explored the specific conditions affecting this relationship. This study analyzed how ESG initiatives relate to hospital efficiency, profitability, and quality, and whether ownership type moderates these effects. Using 2020 American Hospital Association (AHA) data from 3,051 U.S. hospitals, efficiency was measured by the Data Envelopment Analysis (DEA) score, profitability by Return on Assets (ROA), with ESG initiatives based on 34 survey items. Quality was measured using the Hospital Overall Rating (HOR), obtained from the Centers for Medicare & Medicaid Services (CMS). Ownership types included government, NFP, and for-profit. Results showed that ESG initiatives were positively correlated with efficiency (H1a) and quality (H3a), but not with profitability (H2a). No significant moderating effects for efficiency or profitability were found, though NFP ownership significantly moderated the relationship between ESG and quality (H3b).



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Physical and Digital Gamification of Mathematics Review and its Effect on Test Results

Frank Bua

MS STEM Education

Advisor: Dr. Patrick Foster

Over the last 20 years, there has been an interest in gamified uses of technology to assist learning across various subjects. The most popular form is digital gamification, with the majority of current studies being aimed towards popular review tools and games such as Kahoot or Blooket. Gamified math review tends to increase engagement and student interest in various topics across mathematics. Research regarding gamified math instruction review typically yields results that show moderate or no significant improvement over a control group. We wanted to see how a mix of physical and digital gamification would serve as a mathematics review tool if used the day before an assessment. IXL was used as the primary instrument for data collection. Students were grouped into two groups based on their diagnostic scores in mathematics and then randomly assigned to either participate in a standard practice problem-driven review or a Dungeons & Dragons review game, making use of both physical gameplay and digital practice. Following the review, students were given an identical quiz. Overall, results indicate that the gamified review tested was not as effective as the standard review.

Examining the mediating role of attention span between TikTok Use and Impulsivity

Destiny Hurst

Psychology

Advisor: Dr. James Conway

The present study examines attention span as a mediating factor in the relationship between TikTok use and impulsivity. Prior research has demonstrated that increased social media use, particularly short-form video platforms such as TikTok, is associated with reduced attention span, while diminished attention span has been linked to higher levels of impulsivity. However, limited research has explored these relationships within a mediation framework. The current study aims to address this gap by testing whether attention span mediates the relationship between TikTok use and impulsivity in young adults. It is hypothesized that reduced attention span will partially mediate the relationship between heavier TikTok use and greater impulsivity.



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The Moderating effect of Subjective Socioeconomic Status on the Relationship between Agreeableness and Volunteerism

Emily Boucher

Psychology

Advisor: Dr. James Conway

Abstract: The purpose of this study is to examine the relationship between agreeableness and volunteering and how subjective socioeconomic status moderates the relationship. Many previous studies have found a positive relationship between agreeableness and volunteering, but none have examined this relationship with subjective socioeconomic status as a moderator. Our goal is to have the survey distributed to approximately 120 participants within Central Connecticut State University's Department of Psychological Science's participant pool and through social media. The surveys consist of questions pertaining to volunteer work hours, agreeableness, and subjective socioeconomic status. Trait Theory will be used to drive the primary hypothesis that agreeableness will be positively associated with volunteering, reflecting prior research. Trait theory along with an Integrated Theory of Volunteer Work will be used to support the secondary hypothesis that lower subjective socioeconomic status as a moderator will weaken the relationship between agreeableness and volunteering. Results will be used to support prosocial organizations in recruiting and supporting volunteer workers. **Keywords:** agreeableness. subjective socioeconomic status, volunteerism, moderator

Don't Drop Noncompliers When You Can Keep Them and Use an IV

Samantha James-Brown

Psychology

Advisor: Dr. John Protzko

What do you do with participants who don't cooperate with instructions in a given condition? We examined an intention-to-treat (ITT) approach alongside what happens when noncomplying participants are dropped from the analysis to demonstrate how results change under these circumstances; specifically, how findings are pushed into statistical significance where there otherwise would not be any. But the problem with using an ITT approach is that it can weaken statistical power and make effect sizes appear smaller. As an alternate approach, we describe a way of keeping everyone in the analysis while maintaining the ability to claim causality using a method borrowed from econometrics, an instrumental variable (IV). Using examples from previously published research, we explain this concept in nontechnical language, so that researchers in the psychological sciences can adapt and implement IV analyses in their own experiments, avoiding altogether the error of breaking randomization as a result of dropping participants.



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A Software-Defined Supervisory Architecture for PLC-Free Robotic 3D Scanning in Precision Metrology of Mechanical Components

Rumman Shahzad
Software Engineering
Advisor: Dr. Haoyu Wang

Industrial robotic inspection systems are widely used for high-precision measurement of complex components in high-value manufacturing environments. Such systems are typically coordinated using programmable logic controllers (PLCs), which can complicate integration of inspection-specific software functionality and operator interaction. This paper presents a laboratory-validated supervisory architecture for robotic three-dimensional scanning and data acquisition within a manufacturing inspection workflow, in which a C#-based application coordinates an ABB IRB 1200 industrial robot and a FocalSpec LCI 1620 confocal line sensor without a PLC. Pre-programmed motion routines are executed entirely on the robot controller, while the supervisory application manages staged procedure sequencing, scan triggering, parameter configuration, and operator interaction. Experimental evaluation demonstrated reliable execution of a scanning sequence for a NIMS block, synchronized scan acquisition aligned with responsive supervisory control, and configurable scan parameters balancing data resolution and responsiveness. This work demonstrates that software-centric coordination can support flexible, operator-oriented data acquisition for industrial inspection while preserving robot-resident motion control.

PhishWise - Phishing Detection Training Web Application

Gerti Gjini
Software Engineering
Advisor: Dr. Yusuf Albayram

Phishing remains a persistent and evolving cybersecurity threat. However, the effectiveness of existing training solutions may be limited as they rely on static, “one-size-fits-all” approaches. This project introduces PhishWise, a personalized phishing detection training web application that integrates adaptive learning with artificial intelligence to improve user awareness and behavior. PhishWise is developed using the Django framework and follows modular architecture consisting of assessment, personalization, training, and analytics components. After creating an account on PhishWise, users first asked to complete a background survey and a pre-training assessment that includes both theoretical questions and realistic phishing email classification tasks. These assessments are used to generate category-specific performance scores. Based on these results, an AI model generates tailored training content, including annotated phishing examples and targeted explanations that address user weaknesses. The application provides real-time feedback and tracks user progress over time. Users retake the assessment to measure improvements in phishing detection accuracy, while a dashboard visualizes performance metrics. An administrative interface enables monitoring of trends and updating of training content. PhishWise provides a scalable, data-driven approach to enhancing phishing awareness.



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The Impact of Gamification on 7th Grade Science Students

Michaela Savinelli

STEM Education

Advisor: Dr. Patrick Foster

The primary research question for this study is: To what extent does the implementation of gamified study tools impact content retention, student engagement, and assessment performance among 7th-grade students? It is hypothesized that students utilizing gamified platforms (such as Quizizz or Gimkit) will demonstrate significantly higher levels of behavioral engagement and superior long-term information retention compared to students using traditional, non-digital study methods.

The Effects of Trauma on Learning

Marlon Blackwood

Stem Education

Advisor: Dr. Patrick Foster

My topic will be on the effects of trauma on learning that impacts children. Children will experience emotional harm through others, known as vicarious trauma, even though they are not always directly exposed. Research on trauma affected classrooms shows that children often internalize the stress and fear around them through media exposure, parents, siblings, and peers. Understanding how vicarious trauma affects children's ability to learn is essential as schools are becoming safe havens for students coping with trauma (Creating Healing School Communities, n.d.). By witnessing others' distress, trauma can be experienced by children indirectly rather than firsthand, which aligns with research on psychosocial and cultural learning showing that children absorb emotional cues from their environment. Stress transmitted through media exposure, parents, siblings, and peers can eventually lead to internalized fear for children, affecting their emotional regulation and sense of safety.



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Curriculum Shifts and Student Outcomes: A Study of Fourth Grade Mathematics Achievement, Anxiety and Attitudes

Kaitlyn Kelemen
STEM in Education
Advisor: Dr. Patrick Foster

This action research study examines the impact of a curriculum shift on fourth-grade students' mathematical experiences, with a focus on achievement, attitudes, and anxiety. Conducted in a public elementary classroom, the study explores the implementation of a newly adopted mathematics curriculum, Think! Mathematics, and how it influences students' understanding and perceptions of mathematics. The study took place over one instructional unit (approximately four weeks) in a fourth-grade classroom of 19 students, with 17 participating. A qualitative research design was used to examine patterns in student performance and perceptions within the classroom context. Data collection included pre- and post-unit assessments, the Abbreviated Math Anxiety Scale (AMAS), and the Attitudes Toward Mathematics Inventory (ATMI). These tools were used to gather information about students' mathematical understanding as well as their emotional and attitudinal responses during the curriculum implementation. Analysis focuses on identifying patterns and shifts in achievement, attitudes, and anxiety over the course of the unit. This study aims to contribute to understanding how curriculum changes impact both academic and affective aspects of student learning, informing more effective mathematics instruction and implementation practices.

Teaching Mathematics Through a Technology Education Approach: Effects on Student Engagement and Performance

Luke Vermilyea
STEM Education
Advisor: Dr. Patrick Foster

The purpose of this study is to explore whether teaching math through a technology education approach improves student engagement and understanding. This project compares two instructional methods for teaching fractions to students in Technology and Engineering Education classes. One group first learns through a traditional lesson presented from the board, while another learns through a hands on measuring activity commonly used in technology education. The groups then switch so all students experience both methods. The goal is to determine whether applied, hands on learning improves engagement and performance. Student disengagement and difficulty connecting math to real world applications are common challenges. Research shows that students who experience abstract instruction without practical context often struggle to maintain attention and understanding (George et al., 2025; Wang et al., 2025). In contrast, technology education relies on applied problem solving and measurement based learning, which may help students make sense of mathematical ideas (Milara & Cortés Orduña, 2024). Studies also suggest that hands on learning can improve motivation and understanding (Yakin, 2022; Miller, 2018). This study examines whether a measuring based approach supports fraction understanding when compared to a traditional lesson using the same content and assessment.



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Teacher Perspectives on AI and Student Engagement in Middle School Education

Gabriella Garcia

STEM Education

Advisor: Dr. Patrick Foster

This study will explore how middle school teachers view artificial intelligence (AI) and how they believe it could eventually support creativity, engagement, and project performance in STEM classrooms. Because of age restrictions and school policies, my students cannot directly use AI tools in class. For that reason, this project focuses on teacher experiences and opinions rather than student use. My research question is: How do middle school teachers view the potential use of AI tools to enhance creativity, engagement, and performance in future STEM project-based learning? I chose this topic because AI is beginning to influence education in many ways, even if middle school students cannot use it in school yet. Teachers are already hearing conversations about AI, seeing it used in higher grades, and beginning to think about how it might affect their curriculum planning and classroom practice. Research I reviewed shows that AI may help with brainstorming ideas, problem-solving, and encouraging students to think more creatively on STEM projects. Other studies point out that teachers will play a major role in guiding AI use and helping students use tools responsibly. There is not much research yet on how middle school teachers feel about AI, especially teachers who work hands-on with engineering and project-based STEM lessons. Their voices matter because they understand student needs, classroom realities, and the challenges younger learners face.