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Research Expertise Creative Works Showcase

March 2, 2023

12:00 - 2:00 p.m.





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Exercise Motivation Among Special Populations

Gust, A. Math, Science, and Technology Department, University of Minnesota Crookston

Exercise is associated with improved quality of life and physical function, particularly in older adults and persons with chronic health conditions. Physical activity declines with age, with chronic health conditions potentially adding to the decline.

PURPOSE: To investigate physical activity and exercise motivation among persons with various chronic health conditions, apparently healthy older adults, and among persons participating in community exercise programs associated with older adults and those with chronic disease.

METHODS: Surveys comprising of demographics, physical activity (PA) (Physical Activity Scale for the Elderly (PASE)), and exercise motivation (Behavioral Regulation in Exercise Questionnaire (BREQ2)), were distributed to participants across a five state Midwestern region and local community exercise programs targeting special populations (N=222).

RESULTS: A significant main effect for health condition was found for identified regulation $F(1,220) = 2.37, p = .03$ and intrinsic regulation $F(1,220) = 2.41, p = .03$, and for obesity on amotivation $F(1,220) = 3.03, p = .05$, identified regulation $F(1,220) = 10.46, p < .001$, and intrinsic regulation $F(1,220) = 6.91, p = .001$. Post hoc analyses revealed significant differences for amotivation between those with pulmonary disease ($M = 0.84 \pm 0.74$) and those with Parkinson's disease ($M = 0.32 \pm 0.46, p = .04$) and heart disease ($M = 0.31 \pm 0.52, p = .02$); identified regulation between those with pulmonary ($M = 2.06 \pm 1.41$) and those with no health condition ($M = 2.26 \pm 1.09, p = .04$), Parkinson's disease ($M = 3.82 \pm 0.75, p = .00$), heart disease ($M = 2.98 \pm 0.85, p = .01$), and cancer ($M = 3.00 \pm 0.83, p = .02$); and intrinsic regulation between those with pulmonary disease ($M = 1.49 \pm 0.75$) and those with no health condition ($M = 2.12 \pm 1.83, p = .04$), Parkinson's disease ($M = 2.80 \pm 2.47, p = .05$), and heart disease ($M = 2.49 \pm 2.12, p = .01$) and between those with orthopedic conditions ($M = 1.91 \pm 1.63$) and those with Parkinson's disease ($M = 2.80 \pm 2.47, p = .01$), and heart disease ($M = 2.49 \pm 2.12, p = .01$). Significant difference were found between non-obese persons and obese and morbidly obese for identified regulation ($M = 2.87 \pm 1.02$ vs. $2.27 \pm 1.12, p = .001$) and ($M = 2.87 \pm 1.02$ vs. $2.00 \pm 1.3, p = .002$) respectively and for intrinsic regulation ($M = 2.29 \pm 1.19$ vs. $1.82 \pm 1.25, p = .04$) and morbidly obese ($M = 2.29 \pm 1.02$ vs. $2.00 \pm 1.3, p = .002$). Significant differences were found between those who participate in a community exercise program (N=77) and those who do not (N=145) for amotivation ($M = .32 \pm .50$ vs. $.64 \pm .84, p < .001$), identified regulation ($M = 3.14 \pm .81$ vs. $2.35 \pm 1.17, p < .001$), and intrinsic regulation ($M = 2.61 \pm .95$ vs. $1.80 \pm 1.29, p < .001$).

CONCLUSION: Overall, health conditions did not appear to have an impact on physical activity or exercise motivation. However, those with pulmonary disease had lower physical activity and exercise motivation compared to participants with other health conditions. Obese and morbidly obese participants had less exercise motivation compared to their non-obese counterparts. Participation in community programs appeared to have a positive impact on exercise motivation. Further analysis is expected comparing community programs type.



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Analysis of Crocin and Safranal Content in *Crocus Sativus* L. Samples from Iran, Spain and Morocco

Tsebaot, G¹., Turman, E., Lancaster, D., Mukku, V¹., and Mouhanni, H^{1,2}.

1. Math, Science, and Technology Department, University of Minnesota Crookston
2. University Ibn Zohr, Morocco

Crocus sativus L., commonly known as saffron, has a geographically wide habitat, ranging from the Mediterranean to south Asia. Saffron is used in foods and in perfumes as well as dye and medicine and as such is of commercial importance. Although more than 150 compounds were characterized from saffron, crocin, picrocrocin, and safranal are the most abundant compounds. The quality of saffron samples is determined by the ratio of these three components.

Saffron has been grown in eight contiguous regions of Morocco, including Taliouine, since the 10th Century. High Performance Liquid Chromatography with Diode-Array Detection (HPLC-DAD) was used to determine the relative content of crocin, picrocrocin, and safranal from 9 Moroccan samples, and a sample each from Spain, and Iran. Three samples had relatively minor amounts of these compounds. Details of the HPLC-DAD analysis will be presented.

This project contributes to Internationalization of Undergraduate Research at Crookston wherein University of Minnesota Crookston students work on collaborative projects with visiting scientists. Such exchanges lead not only to intellectual development but also afford opportunities for cultural exchanges.



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Sterol Composition of Freshwater Sponges from Minnesota

Mukku, V., Schroder, A., Andersen, K., and Dudley, T. Math, Science, and Technology Department, University of Minnesota Crookston

Freshwater sponges (Phylum: Porifera, Class: Demospongiae) made the evolutionary leap from marine to freshwater habitats during the Jurassic period. The diversity of freshwater sponges is limited to about 250 species of which 31-33 species were described from the Nearctic region which includes the United States. The described species fall into three families, and 17 genera.

We surmised that the likelihood of discovering new sponge species in Minnesota is high and embarked on determining the diversity, distribution, and the chemical composition of freshwater sponges in Minnesota lakes and rivers. Phase 1 of the project is complete. Our research group collected over 100 samples of sponges from various rivers and lakes primarily in Northern Minnesota.

Each sponge sample was extracted with two organic solvents (dichloromethane and methanol). The organic extracts ranged in weight from 0.0001 grams to 0.1 grams. All extracts were analyzed by Gas Chromatography coupled to a Mass Spectrometer (GC-MS). Analysis of the GC-MS data showed the presence of a series of 3-hydroxy sterols and corresponding enones. Sterol identification was made based on comparing with a spectral database. Some sponges contain other compounds such as long chain carboxylic acids, alcohols, and aldehydes as well. In this poster, we will report the relative composition of sterols in various sponges.



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Use of pSCRIPT for Better Customer Experience in Online Business

Hossain, M. Math, Science, and Technology Department, University of Minnesota Crookston

The popularity of online businesses is increasing every day. People are using online businesses more than ever due to the current COVID-19 pandemic. Extensive use of social media is also contributing to the spread of such online businesses where customers share their experiences with others through online reviews. Furthermore, technological advancement such as Cloud computing has made online business opportunities more accessible than ever before. As a result, the size of business-related data has taken a different form. Businesses are generating audio, video, or text data for advertisement, product review, and other purposes. Therefore, we see a considerable volume of data being produced with a significant variety. Also, the business data is changing rapidly over a short period, making the data volatile and having high velocity, making online businesses a great source of “Big Data” where we find the 4 V’s of big data. Analyzing big data requires fast and accurate tools and techniques. This research aims to use pTree technology to analyze big data. One method to achieve our goal is to use pTree based SeCuRed Interesting Pattern and Text miner – pSCRIPT. First, it uses pHIDES to secure the data in the cloud. Then it applies pTree-based text mining algorithms to analyze the data to find any interesting pattern in the text corpus. Text mining is a branch of data mining where textual information is analyzed in order to discover patterns and gain perceptions within the corpus of text documents. In e-Commerce, text mining can be used in many areas, such as recommending complementary products to the targeted customer, combating cyber fraud, offering customers personalized discounts, etc. In this research, we are particularly interested in applying text mining to improve these experiences of online business customers. We use pSCRIPT, pTree based text miner, to provide fast and accurate results for a large dataset. This research also uses the pTree based data encryption system known as pHIDES that we proposed in our previous research proposal.



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Emerging Financial Technology (Fintech) in Nepal

Gurung, T., and Hossain, M. Math, Science, and Technology Department, University of Minnesota Crookston

The term fintech describes innovative startup companies operating in the financial sector that apply modern technology solutions in the financial services industry to offer digitally enhanced products and allow widespread access to financial products at a lower cost than traditional players (Statista, 2022). It is a growing industry. One of many good examples of fintech is Venmo. It is changing the way we pay, borrow, and exchange money. As we know, technology is growing and thriving more than ever, similarly in the financial industry as well. Global investment in the fintech sector has added up to nearly \$100 billion since 2010.

According to a 2010 study, SMEs (excluding microenterprises) give employment to a huge percentage of the population in Nepal. 83 percent of the industrial employment generation comes from SMEs only. BO2 aims to solve the problem of access to finance for a lot of SMEs. The important sectors in which BO2 wants to provide funding are renewable energy, health, agriculture, and information technology (Kong, 2017).

In Nepal, at present, there are 28 commercial banks, 67 development banks, 41 finance companies, and 42 microfinance development banks. There are a total of 4,274 branches of all these financial institutions. Many banks have come forward to offer technology-based services such as branchless banking, which fulfills people's payment and credit needs. These people do not have access to a formal financial system. More than 213,000 people are currently availing services through 812 branchless banking centers in Nepal. Financial inclusion is one of the biggest challenges in Nepal. Financial institutions' quick response to the latest technologies raises people's access to finance (Kong, 2017).

According to a recent report by NRB, the United Nations Capital Development Fund (UNCDF), and the United Nations Development Program, only 61 percent of adults have access to formal financial services in Nepal. Of these 61 percent, only seven percent use all four financial products. Savings, payment, credit, or insurance. Out of the remaining 39 percent population, 21 percent use informal channels, and 18 percent do not have any access to the financial system.

In the article, fintech has the potential to transform lives in Nepal and shows some of the great possibilities and opportunities that the use of fintech can create. As it has done in many parts of Sub-Saharan Africa, Fintech provides an opportunity to increase access to financial services in Nepal to those who live in areas where Banks cannot profitably operate brick-and-mortar businesses. If fintech were to increase access to financial services for all Nepalis, they would have a better chance to lift themselves out of poverty, investing in their children's education and saving for emergencies, to name a few examples. Fintech in Nepal is at a nascent stage and needs financial and regulatory support. Many Nepalis also prefer to use cash, especially in rural areas where illiteracy rates among some groups, such as adult women, remain high. In 2016, while most women and men-owned mobile phones in Nepal, less than 10 percent of those men and women used mobile phones for financial transactions. Banks have consistently found it hard to operate in rural areas because of the lack of proper infrastructure.



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The Effects of Fertilizer Sources and Site Location on the Mitigation of Greenhouse Gas Emissions from Creeping Bentgrass Putting Greens and Kentucky Bluegrass Roughs

Chapman, K. E., ^{1*} and Walker, K. S.²

¹Department of Math, Science, and Technology, University of Minnesota Crookston

² Department of Agriculture and Natural Resources, University of Minnesota Crookston

Understanding greenhouse gas (GHG) emissions from turfgrass, the largest managed agronomic crop in the United States, allows managers to make cultural management decisions that reduce GHG emissions. The objective of this project was to conduct a two-year field study evaluating fertilizer source [Urea (URE), Polymer Encapsulated Urea (POL), and Milorganite (MIL)] and site location (varying soil moisture) on GHG [carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O)] emissions. GHG data, soil temperature, soil moisture, canopy greenness, and turfgrass quality were collected. High soil temperature and moisture were correlated with soil CO₂ and N₂O flux ($p < 0.0001$). The wet rough fluxed significantly more CH₄ across the 2-year study ($p < 0.05$). The POL fluxed the highest amount of soil CO₂; while POL and MIL fluxed the largest amount of soil N₂O on the wet rough ($p < 0.05$). MIL and POL increased canopy greenness in both roughs during the spring ($p < 0.05$). On the green, URE produced greater canopy greenness in the spring and fall. MIL, POL, and URE improved canopy greenness during the summer. Our results indicate when soil moisture and temperature are high, turfgrass managers should employ methods of reducing soil temperatures that do not increase soil moisture to reduce GHG emissions. Under warm and wet conditions, gaseous losses of GHGs are accelerated with slow-release fertilizers. Residual nitrogen from slow-release fertilizers can also result in greater GHG losses, especially in areas that experience low soil moisture levels in the previous season.



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A Hybrid Deep Neural Network Model to Forecast Day-Ahead Electricity Prices in the USA Energy Market

Md. Saifur Rahman¹, Hassan Reza²

¹Department of Math, Science, and Technology, University of Minnesota Crookston

²School of Electrical Engineering and Computer Science, University of North Dakota

A day-ahead electricity price forecasting is a very crucial area of research that focuses on predicting prices in wholesale electricity markets. Although many contributions have been made to the subject of energy price forecasting in the last few years, it is debatable if there is a state-of-the-art method for assessing prediction in the USA energy market. The USA wholesale and retail markets highly appreciate any improvements in accurate forecasts with electricity prices. At the moment, it is clearly noticeable how much more effective renewable energy sources are having at the US power market. In addition, the reproducibility of research, clear view of input features, and inclusion of renewable resources in electricity price forecasting are missing or loosely attempted. In this paper, we tackle these issues by providing a concrete view of input features, data preparation, data normalization, and also high performing VMD-LSTM hybrid deep learning model for forecasting day-ahead prices. The inclusion of renewable input features like temperature data to catch solar energy effects, and wind speed data to capture wind energy effects in electricity prices in the USA market make our model unique. The proposed VMD-LSTM hybrid model with 24 input features shows only 0.2935 mean absolute error with the MISO market data to forecast prices. Unquestionably, in the subject of forecasting electricity prices, the proposed VMD-LSTM model with the given input features setup is a respectable example of a state-of-the-art deep learning model.



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New Environmental Science Book Published

Shostell, J. | Math, Science, and Technology Department, University of Minnesota Crookston

Environmental Science: A Need for Living Sustainably offers an appealing and contemporary approach to understanding environmental science in today's rapidly evolving global context. Captivating narrative stories, plentiful critical thinking and experiential activities, and compelling examples pulled from around the world complement solid coverage of key foundational concepts. Early chapters are structured around core environmental themes, ethics, matter, and energy to set the stage for the remainder of the book. Subsequent chapters efficiently address complex topics that are often covered over two or more chapters in the leading competitors. This fresh and up-to-date approach encourages students to focus on the main issues, enabling faculty to cover more content in less time while improving student learning retention.



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Utilizing Tiny Earth in the Undergraduate Microbiology Classroom

¹Dingman, B., ¹Anderson, K., and ³Hillary Barron

¹University of Minnesota Crookston; ²White Earth Tribal and Community College

Recent decades have experienced an increase in demonstrated antibiotic resistance. Antibiotic resistance is one of the top health concerns of the 21st century, so it is important that researchers seek to better understand microbial community structure and identify potential sources for new antibiotics. We used the Tiny Earth model to identify, isolate, and identify potentially new sources of antibiotics in rural areas. The Tiny Earth project is a student-sourcing antibiotic discovery community dedicated to the discovery of potential new antimicrobials. Using this model of inquiry-based learning in a general microbiology laboratory has shown greater interest in the subject and deeper learning through an engaged learner. Through a collaboration between the University of Minnesota Crookston campus and the White Earth Tribal Community College, instructors sought to engage general microbiology students through the Tiny Earth model of inquiry-based learning.

In this project, students chose several rural soil samples, including agricultural samples near a commercial cattle operation. These samples were explored for new sources of antibiotics as well as variations in overall community structure. The students worked to develop isolation protocols utilizing different growth media and culturing methods. The student researchers calculated dry weights, isolated, and sub-cultured to pure isolates using standard techniques. Various standard biochemical assays were used in the characterization schemes along with subsequent PCR identification by sequencing of isolated strains. Students hypothesized differences between sample collection sites. As required, the students were exposed to the standard techniques required of a general microbiology laboratory. However, the Tiny Earth model also allowed the students to test their pure isolates against ESKAPE safe relatives. The chemical extracts from the initial positive isolates were then tested again against the same safe relative(s). This application of the Tiny Earth model allowed students to contribute to the ongoing search for potential new antibiotics. Furthermore, students were exposed to various advancements in microbiological laboratory instrumentation, as well as ongoing federal and international collaborative research projects.



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Morphological Identification of Freshwater Sponges in Minnesota

Bergerson, J., Mukku, V., Andersen, K., Dudley, T., and Schroeder, A.
Math, Science, and Technology Department, University of Minnesota Crookston

Sponges (phylum: Porifera) are among the most ancient and primitive living animals, lacking true tissue organization. Sponges are sessile animals that survive as filter feeders in both marine and freshwater environments. There have been over 200 freshwater sponge species described worldwide and only 32 have been described in North America. In Minnesota, only five species have ever been described and this was over 30 years ago. There is no current data about the diversity of freshwater sponges in Minnesota. Therefore, we have collected freshwater sponges in lakes and rivers throughout Minnesota to determine what species are present.

Freshwater sponges are composed of a hard skeleton made of silica called spicules. There are three broad categories of spicules: megascleres, microscleres and gemmuscleres. The morphology of each of these spicules varies by species and are useful for species identification. Collected sponges were digested using boiling nitric acid to leave only the spicules behind. The spicules were washed and mounted on microscope slides. The spicules were imaged using differential interference contrast imaging and measured for size. The images and size of spicules were compared to freshwater sponge taxonomical keys for species identification. In this poster, will present the overall findings of the morphological characteristics and species of freshwater sponges collected in Minnesota.



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Engaging Citizen Scientists to Support Freshwater Sponge Research

Lacoursiere, J., Mukku, V., Andersen, K., and Dudley, T., Schroeder, A.
Math, Science, and Technology Department, University of Minnesota Crookston

Freshwater sponges are the simplest of animals and play a vital role in the aquatic ecosystem by providing food and habitat for other aquatic invertebrates and vertebrates. Freshwater sponges are filter feeders, meaning they pass water through pores and filter out food particles from the water. Sponges have the potential to filter more than 50,000x their own volume in a day. They have also been shown to be capable of removing nitrates, phosphates, and other inorganic chemicals from the water. Because of their importance to the freshwater ecosystem, we are interested in determining the distribution and diversity of species throughout Minnesota. We have currently sampled 80 different lakes and rivers in Minnesota. However, in the "Land of 10,000 Lakes" there are still many places for which we have been unable to sample for sponges.

One potential solution to the problem of not being able to collect all over the state, is to recruit citizens who may be interested in helping collect sponges throughout Minnesota. To start recruiting citizens to help, we attended five regional county fairs. We developed sponge collection kits to hand out to citizens that would allow them to obtain environmental data and a small sample of the sponge to send to us for morphological and molecular analyses. In this poster, we will present the development of the freshwater sponge collection kit and the initial findings of citizen recruitment in freshwater sponge collections.



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Identification of Antibiotic Resistance Genes in Bacteria Associated with Freshwater Sponges

Fox, B., Mukku, V., Andersen, K., and Dudley, T., Schroeder, A.
Math, Science, and Technology Department, University of Minnesota Crookston

Sponges (phylum: Porifera) are among the most ancient and primitive living animals, lacking true tissue organization. Sponges are sessile animals that survive as filter feeders in both marine and freshwater environments. Sponges have been reported to have highly specific, but diverse microbial communities. The microbial symbionts perform a wide range of functions, including vitamin synthesis, biochemical transformations of waste products, and production of bioactive compounds. Furthermore, because antibiotics are known to readily enter our freshwater environments, there is a potential that the bacteria present in freshwater sponges also harbor antibiotic resistance genes that could have implications for human health.

Freshwater sponges were collected from different locations throughout Minnesota. DNA was extracted from bacteria associated with the freshwater sponges. Polymerase chain reaction with gel electrophoresis was used to screen bacteria for antibiotic resistance genes that have often been reported from freshwater habitats. In this poster, we present the initial findings of screening the bacteria of freshwater sponges for common antibiotic resistance genes.



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Utilization of Local Agricultural Waste Products for Production of Viable Biopesticides in Mosquito Infested Regions via Rudimentary Fermentation

Ghislain Ntignonawoe¹, Victorien Dougnon², Evangeline Fox¹, Charlotte Brew¹, Karl Anderson³

¹University of Newcastle, Callaghan, ²Polytechnic School of Abomey-Calavi, University of Abomey-Calavi, Cotonou, Benin; ³University of Minnesota Crookston, Crookston, MN, USA

Background:

Mosquito-borne illnesses have plagued humanity for centuries. Outbreaks of malaria, yellow-fever, dengue, chikungunya, and Zika continue to rise around the world, resulting in the annual deaths of an estimated 1 million people. Recent studies have demonstrated how climate change and increased human travel/migration have exacerbated the occurrences of these mosquito-borne illnesses.

Current methods of mosquito control can be costly, potentially dangerous, and inaccessible to regions most in need. Biopesticides, such as *Bacillus thuringiensis* subsp. *israelensis* (Bt/Bti), have been used to effectively control mosquito populations. However, commercial Bt/Bti production is considered expensive. Overall, cost-effective use of biopesticides would lessen the nuisance factor imposed by mosquito populations.

Objectives:

The primary goals of this study were to examine cassava, yam, sweet potato waste as potential culture media bases for Bt/Bti, develop rudimentary fermentation devices and parameters for use in field applications, and examine both functional and economic feasibility of using local agricultural waste products to produce viable Bt/Bti biopesticide.

Methods:

Locally sourced (Beninese) Bt/Bti was cultured in varying mixtures of cassava, yam, and sweet potatoes in both liquid and agar media. Growth efficacy and efficiency was measured utilizing standard plate counts and UV/Vis Spectrophotometry. Successful medias were scaled up and applied to 208-liter drums and Bt/Bti was added. These rudimentary fermentation vessels were monitored for biopesticide production under ambient conditions. pH, temperature, and Bt/Bti growth were recorded. Additional microscopy analyses and PCR confirmation were performed.

Results:

Preliminary results indicate that varied concentrations of cassava, yam, and sweet potato as growth media are utilized by Bt/Bti. All experimental medias yielded Bt/Bti growth similar to, or surpassing, that of standard nutrient controls. Large scale field experiments demonstrated Bt/Bti growth efficacy, with the expressed need to maintain consistent temperatures during the growth phase in order to achieve more efficient concentration of Bt/Bti.

Conclusions:

Agricultural waste products originating from cassava, yam, or sweet potato function sufficiently to culture Bt/Bti biopesticides at both laboratory- and field-scale. Additional work should be performed to further demonstrate the feasibility of such biopesticide production in the rural regions most in need of mosquito control.



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Stimulating STEM Opportunities in West Africa: International Collaborations Spurred by ASM Membership

Ghislain Ntignonawoe^{1,2}, Louis Komlan², Karl Anderson³

¹University of Newcastle, Callaghan, Australia ²University of Lomé, Lomé, Togo; ³University of Minnesota Crookston, Crookston, MN, USA

Background

Social and environmental factors have prompted educational systems to develop science, technology, engineering, and math (STEM) programs in recent decades. Globally, such programs have surged, and there is a need to establish frameworks which succeed in STEM integration. Membership to professional, education, and business societies/organizations are useful in achieving cohesive standards needed in STEM education. One such society, the American Society for Microbiology (ASM), is among the largest life science societies in the world, whose members include researchers, educators, and a variety of health/business professionals. Currently, ASM has over 200 Ambassadors, 35 Branches, over 130 Student Chapters, ASM's vast network promotes an overall understanding of microbiology. As a result, membership and active participation often result in new contacts and collaborative opportunities for its members and students.

Objectives

Recently, ASM members in Lomé, Togo have worked with other international ASM members to establish RAB-Togo, a network of biology enthusiasts in Togo. Members of this network work to establish protocols and laboratory experiences which promote creativity, teaching, and entrepreneurial STEM opportunities. RAB-Togo is also tackling STEM gender equality in West Africa and seeks to encourage women in Togo to pursue education and careers in STEM. ASM Members and Ambassadors have worked to develop microbiology protocols which can be implemented by RAB-Togo officials in Lomé. Members have also worked to secure much needed microscopes to be used by RAB-Togo's Bio'phile Project. The goal of this presentation is to explore and demonstrate recent impact that ASM Member/Ambassador contributions have had on RAB-Togo's STEM framework.

Methods

RAB-Togo works with K-12 students, undergraduate science students, and a variety of community members throughout Togo. In order to gauge the overall success of RAB-Togo's efforts, surveys which evaluate participant goals, interest, and skills were provided at each of RAB-Togo's site visits. Participants were given opportunities to become involved in collaborative research activities conducted by ASM Members and Ambassadors. Survey results, as well as participant comments related to collaborative research projects, were recorded and evaluated for perceived success.

Results

This study has collected more than three years of data. Results of RAB-Togo's efforts have demonstrated improved participant interest and competency in areas of STEM. Participants have developed new skills in areas of microbiology. Additional surveys to evaluate community economic impact are currently underway.



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Creating Meaningful Learning Experiences: Course Design Approaches in Accounting and Finance Classes.

Johnson, R. C., Saeedi, A., and Wieland, O. Business Department, University of Minnesota Crookston
Location:

This report demonstrates the integration of various curriculum design instruments and procedures to achieve the stated global learning outcomes. It illustrates how different course design approaches align with appropriate learning outcomes, learning activities, assessments, and integrated technology. Following the Significant Learning course design template, we developed a collaborative assignment that addresses at least one global learning outcome.



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An Exploratory Study of Perceived Expectations to be Granted Tenure

Myers, K¹, and Thompson, K².

1. Business Department, University of Minnesota Crookston 2. Advancement and Alumni Relations, University of Minnesota Crookston

Through a combination of quantitative and qualitative research methods, we investigated the perceived expectations related to granting tenure at UMN Crookston. The goal was to (1) understand perceptual similarities and differences related to the tenure process and (2) share the findings with faculty as an opportunity to deepen their understanding of these perceptions and potentially use the information in future discussions on the application of department and campus requirements. We surveyed and interviewed twenty tenured UMC faculty from the four academic departments to understand the perceived value they placed upon various forms of teaching, research, and service in the tenure decision process.

Some of the survey questions included ranking evidence of effectiveness of teaching, the use of mentoring, if expectations have changed, the idea of publishing in top tier journals, the number of peer-reviewed journal publications expected, if tenure can be achieved without publishing in a peer-reviewed journal, community engaged scholarship, and the importance of writing grants.

During this poster session we'll highlight some of the research results that were found to be the most interesting.



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Using a Gamification Model to Enhance Student's Learning Experience

Miller, A. C. Business Department, University of Minnesota Crookston

Whatever Gamification in education is, it is all over the interweb. A recent search yielded 39,600,000 results. I am aware of multiple UMC faculty members practicing Gamification whether they know it or not.

Topics:

- What is gamification?
- My presentation will present an early published Gamification Model that supports seven key benefits of Gamification.
- Development and deployment of simulation as a prime Gamification tool used in business schools and corporate training.
- A sample of student feedback.
- Evidence of success and an alternative to institutional “assessment” derived from analysis of a learning curve.

<https://absel-ojs-ttu.tdl.org/absel/index.php/absel/article/view/40>



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Trust in Cryptocurrency Investment

Saeedi, A. and Al-Fattal, A. Business Department, University of Minnesota Crookston

The purpose of this study is to investigate investors' trust in cryptocurrency investment. The study employs a survey through a Qualtrics panel of 458 participants from the US. Every participant in the survey either invests or has invested in cryptocurrency. The data was collected between May and June 2022. We used structural equation modeling in order to construct the five-aspect model of trust in cryptocurrency investment and test our research hypotheses. This research investigates technological, societal, regulatory, developer, and specifications aspects. The findings show significant relationships between trust and all five aspects of trust (i.e., technology, social, regulations, developers, and specifications). In addition, the multigroup analyses indicated differences between groups of education, age, gender, and amount of investment in terms of various aspects of trust. The significant differences are more evident in the aspects of regulations, social, and development between two groups of females and males.



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Prediction of Corporate Bankruptcy: A Multi-class Approach

Saeedi, A. Business Department, University of Minnesota Crookston

The purpose of this study is to predict corporate bankruptcy and to determine the attributes affecting bankruptcy prediction in the U.S. publicly listed companies using gradient boosting (GBoosting) machine learning technique. The research data consists of 118,514 firm-year observations for U.S. public companies from 1992 to 2019. The dataset comprised various financial ratios, ownership concentration, executive compensation, market price variables, macroeconomic variables, and audit-related variables. The results of this study show that a multi-class and high dimensional setting using GBoosting provides a more accurate prediction of bankruptcy in terms of accuracy and Type I & Type II error rates compared to previous research. An analysis of relative variable importance indicates that industry variable, ownership concentration/structure, financial ratios, market price variables, and macroeconomic variables (Moody's seasoned AAA bond yield and real GDP growth) have the highest rank among the predictors.



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A High-Dimensional Approach to Predicting Audit Opinions

Saeedi, A. Business Department, University of Minnesota Crookston

This study develops a model for the prediction of audit reports. The research data comprises 57,881 firm-year observations for public companies listed on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the NASDAQ from 2000 to 2019. The dataset consists of a high dimension of predictor variables (105 variables), including accounting-based, ownership concentration, executive compensation, market price, analysts rating, macroeconomic, and audit-related variables. A commercial version of Gradient Boosting, called TreeNet®, is used to build the prediction model. The results indicate that the developed model demonstrates high performance in predicting going-concern reports with an accuracy rate of 97.5%.



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Business Administration Students' Perceptions, Intentions and Perceived Challenges of Entrepreneurship in the United States

Al-Fattal, A. Business Department, University of Minnesota Crookston

This chapter investigates business students' understanding of main concepts related to entrepreneurship in the United States (US). Concepts investigated are perceptions, intentions, and challenges. The theoretical section of the chapter discusses aspects of perceptions, intentions, and challenges in relation to existing literature. This chapter presents an empirical study which employs qualitative in-depth interviews with 23 undergraduate business students from one public university in the Midwest of the US. The findings reveal that students' perceptions about entrepreneurship are focused on pursuing and owning a business venture. The results also show that students have a high level of intention to pursue entrepreneurial prospects. The desire for fulfilling ambition and achieving success is the most important motivator. On the other hand, the present study found that financing entrepreneurial projects is the major challenge for business students. Further research is recommended to investigate the topic in a wider population through a quantitative survey including a larger sample of business higher educational institutions in the US.



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Undergraduate Business Students' Perceptions about Virtual and Remote-work Leadership Skills

Al Fattal, A., Walker, E. and Lundbohm, R. Business Department, University of Minnesota Crookston

With changes introduced to the work environment since the COVID-19 pandemic, an ever-increasing amount of interest has been focused on remote work and virtual leadership. This chapter researches the topic of virtual and remote-work leadership and focuses on investigating business students' perceptions of skills relevant to virtual leadership positions. The chapter presents an empirical exploratory research study conducted through four focus groups with 20 undergraduate business students. The findings reveal business students have a relevant understanding of the differences between traditional and virtual work environments. Socialization and isolation are among the most dominant themes regarding the differences in work modes. The findings also show that business students understand the challenges associated with leading in virtual and remote work settings and they prefer traditional future leadership positions to avoid such challenges. The study highlights several relevant leadership skills needed according to business students such as communication, the ability to engage, and technological competencies. The study has practical implications for business program development and their relevance and sensitivity to the changing work landscape. Further research could build on the findings of this study and survey a wider population of students.



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Using Agronomic Data to Minimize the Impact of Field Conditions on Player Injuries and Enhance the Development of a Risk Management Plan

Walker, E.,¹ and Walker, K. S.²

¹ Business Department, University of Minnesota Crookston

² Department of Agriculture and Natural Resources, University of Minnesota Crookston

An important aspect of facility management is the development of a comprehensive risk management plan. Player safety has only recently been a consideration when developing a risk management plan. Field conditions have not received much attention as it relates to player safety. Several injuries at Optus Stadium in Perth Australia raised questions about the playing surface being the cause. The purpose of this study was to determine the ability of established athletic field agronomic measures to predict injuries from football fields and soccer pitches. Logistic regression was used to predict injury based upon soil compaction, soil moisture, surface firmness, and turfgrass quality. Results indicate that athletic fields that met good standards had the lowest probability of injury and injury probability is the highest when field conditions are considered poor. These results provide parameters facility and athletic field managers can use to determine whether an athletic field demonstrates a low risk of injury, needs to be improved, or a game should be canceled.



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Gary Pines Master Plan Update

Castle, E. E., and Stelljes, J. Agricultural and Natural Resources Department, University of Minnesota Crookston

The city of Gary, Minnesota, has invested continual effort in implementing the 2018 Gary Pines Master Plan, which guides the management of 160 acres of naturalized forest and grassland prioritized for public recreation. This design project focused on creating a Master Plan Update for five components of stakeholder interest: trail accessibility and maintenance, invasive plant species, edible plant species, observation area seating, and site parking.



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Changes in Mare Milk Composition in Response to Concentrate Feeding

Pyles, M., and Gerbracht, I. Agricultural and Natural Resources Department, University of Minnesota Crookston

Milk is a complex and adaptive substance that sustains neonatal foals. Mare milk is highly variable and influenced by factors such as diet and stage of lactation. Understanding the influence of maternal diet on mare milk composition is important in the management of broodmares for the optimization of foal developmental outcomes. This study aims to evaluate the short-term effects of a concentrate meal high in nonstructural carbohydrates on the macronutrient composition of mare milk.

Six Thoroughbred mares (5 to 7 days postpartum) will be used for this study. The mares will be fed two concentrate meals per day with ad libitum forage. A pre-feeding milk sample will be collected from each mare then milk will be collected hourly for 12 hours after concentrate feeding. Milk samples will be analyzed using Fourier Transform Infrared Spectroscopy to measure the macronutrient composition (protein, fat, total carbohydrates, and total solids). Blood samples will be collected from the mares via jugular venipuncture and analyzed for glucose using a glucometer. The data will be analyzed using an ANOVA with repeated measures to evaluate the changes in nutrient concentration over time.

The results of this study will be presented at a scientific conference and a manuscript will be prepared for publication in a peer-reviewed journal.



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Teacher Candidates Epistemic Reflexivity in the Elementary Classroom

Foss, J. A. Humanities, Social Sciences, and Education Department, University of Minnesota Crookston

Explicit focus on the nature of science (NOS) is useful for planning and designing science instruction (Lederman, Schwartz and Abd-El- Khalick, 2001). Content knowledge and knowledge about NOS support instruction through process focused inquiry. Opportunities to focus on process-oriented inquiry can support science outcomes such as scientific literacy, increased capacity for critical thinking, and understanding that there are trusted processes to obtain knowledge for “personal decision making” (National Research Council, 1996).

Teacher candidates learning elementary science methods as part of a baccalaureate teacher induction program engaged in **reflexivity** (Brownlee, Feucht, & Schraw, 2017), or a process of critical thinking about the nature of knowledge development in science to self-determine aims and processes that are useful to teach. This occurred through personal deliberations about pedagogy that aligns with a tenet of NOS as tentative but reliable.

Data was collected in Spring of 2022 to document the ways 4 candidates responded to a pre and post course engagement based on key concepts of epistemic reflexivity articulated by Brownlee, Ferguson, and Ryan (2017) and refined by Brownlee, Rowan, Ryan, et. al., (2019). This case study included candidates’ discernment about epistemic aims and reliable processes, deliberations about instructional decisions and the criteria candidates determined for evaluating these actions. The analysis (in development) allows for considering the extent reflexivity is useful for teacher candidates to align aims with a process-oriented inquiry.



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The Scholarship of Clues: The Professor in the Library with her Laptop

Johnsen, R. E. Business Department, University of Minnesota Crookston

The subject matter of academic literary studies is the treasure trove of texts from the ancient to the contemporary, from anywhere in the world. The popular literary genre of crime fiction encompasses many time periods, regional/national origins, and ethical philosophies, and research addressing crime fiction has grown exponentially over the past several decades. Research on crime fiction overlaps with traditional conventional literary and cultural subjects, and it offers significant opportunities for public scholarship. What constitutes research in crime fiction, and what kinds of publications and presentations does it support? This poster presentation will showcase examples of Professor Johnsen's research dissemination in Nordic, regional American, historical, and feminist crime fiction, including examples from academic, pedagogical, and general-audience venues.