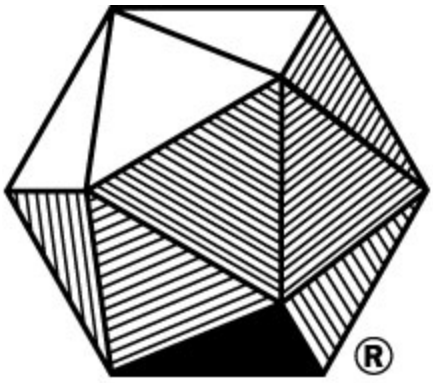

MAA

MATHEMATICAL ASSOCIATION OF AMERICA

82nd Annual Meeting
of the
Oklahoma – Arkansas Section

Virtual Meeting
Hosted by
Cameron University
8-10 April 2021

MAA Core Interests:
Education
Research
Professional Development
Public Policy
Public Appreciation

OK-AR Section Website
http://sections.maa.org/okar

Executive Committee
2020 – 2021

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Kristi Karber, Treasurer
Michael Lloyd, Communications Director
Britney Hopkins, Section Representative

Abbreviations for Institutions Represented in this Program Book

ASU	Arkansas State University – Jonesboro
BSU	Ball State University
BYU	Brigham Young University
CSU	California State University – Bakersfield
CU	Cameron University
CUM	Concordia University, Montréal
CWU	Central Washington University
ECU	East Central University
HSU	Henderson State University
LU	Langston University
NSU	Northeastern State University
OBU	Oklahoma Baptist University
OSU	Oklahoma State University
OU	University of Oklahoma
OWU	Oklahoma Wesleyan University
UAF	University of Arkansas
UAFS	University of Arkansas – Fort Smith
UAPB	University of Arkansas at Pine Bluff
UCO	University of Central Oklahoma
UP	University of Paris Diderot

Meeting Overview

All times Central Daylight Time

Thursday, April 8

4:30 pm	Section NExT
6:00 – 8:30 pm	Team Jeopardy Competition, Science Building 260, 160, and LL60
8:30 pm	Integration Bee, Science Building LL60

Friday, April 9

10:00 – 11:00 am	Faculty Sponsors Meeting Department Chairs Meeting
1:00 – 2:35 pm	Presented Papers, Undergraduate Students, Sessions 1 through 4, Breakout Rooms 1 through 4
1:00 – 3:15 pm	Presented Papers, Sessions 5 through 10, Breakout Rooms 1 through 5
3:30 – 4:30 pm	Editor Lecture *Mathematical Fights! The Seedy Underbelly of Mathematical History*. Dominic Klyve, Central Washington University Editor, *The College Mathematics Journal*
6:00 – 7:30 pm	Awards Ceremony
7:45 – 8:45 pm	Section Visitor Lecture *How Mathematics is Making Hollywood Movies Better.* Michael Dorff, Brigham Young University Past President of the MAA

Saturday, April 10

8:00 – 8:55 am	Presented Papers, Sessions 11 through 15, Breakout Rooms 1 through 5.
9:10 – 10:25 am	Section Business Meeting
10:30 am – noon	Student Workshop, Breakout Room 1, *Games and Puzzles with a Mathematical Bent*. Michael Dorff, Brigham Young University Faculty Workshop, Breakout Room 2, *Teaching Mathematics via Primary Historical Source Projects*. Dominic Klyve, Central Washington University

Thursday Evening, April 8, 2021

4:30 – 6:30 pm	**Section NExT**, Coordinator: Kristi Karber
6:00 pm	**Competitions for Undergraduates** Presiding: Scott McClendon
6:00 – 8:30 pm	**Team Jeopardy Competition**
8:30 – 12:00 pm	**Integration Bee**

Friday Morning, April 9, 2021

10:00 – 11:00 am	**Department Chairs Meeting** Presiding: Carolyn Eoff

Meeting of Faculty Sponsors of MAA Student Chapters Lunch

Friday Afternoon, April 9, 2021

Undergraduate Session 1: Applied Mathematics and Modeling, 1:00 – 2:15 pm, Breakout Room 1

1:00 - 1:15 pm **Control Function Identification for a Parabolic PDE with Mixed Boundary Conditions**
Luke McLennan (CU)
Mentors: Gregory Herring, Narayan Thapa
Abstract: Control function identification is a type of inverse problem where a control function parameter in a differential equation is unknown. In this presentation we will investigate a control function identification problem for a parabolic PDE of the form $u_t = u_{xx} + p(t)u + f$. We will consider a mixture of Dirichlet and Neumann boundary conditions. We will develop numerical schemes for solving the problem and analyze their effectiveness.

1:20 - 1:35 pm **Autoencoder-Based ECG Anomaly Detection**
Thomas Dunn (UCO)
Mentors: Emily Hendryx, Tyler Cook
Abstract: Electrocardiogram (ECG) data can provide a wealth of information about the health of a patient which a physician can use to develop a treatment. However, for the diagnosis to be correct the ECG must be read and interpreted accurately in real time. This presents a problem as even experienced clinicians struggle to distinguish normal from anomalous EGCs in cases when the differences are subtle or distributed over long periods of time. We explore the use of an autoencoder model for an initial screening tool for ECG beats.

1:40 - 1:55 pm **Duffing Equation with Contact Conditions**
Nick Tate (ASU)
Mentor: Dr. Jeongho Ahn
Abstract: We consider a differential equation system that describes the motion of Seesaws. The seesaws are assumed to linear viscoelastic (Kelvin Voigt type) Timoshenko beams. For mathematical reasons, the half of a board is considered to formulate a couple of partial differential equations, where one end of the board on a support is clamped and another end touches a spring (coil) attached to land. The motion of the spring is formulated by the second order nonlinear differential equation called the Duffing equation. There are two contact conditions for the mathematical model: one is normal compliance that applies the contact between one end of the beam and the spring and another is complimentary conditions, when the spring touches the land. In this talk, we propose numerical schemes for the Duffing equation, using the implicit Euler method, where we employ the Newton-Raphson method to compute each time step numerical approximation. In the future work, time discretizations and finite element methods will be combined to show the simulations of seesaws.

2:00 - 2:15 pm **Numerical Solutions to Navier-Stokes IBVP with External Force**
Luke McLennan (CU)
Mentor: Narayan Thapa
Abstract: The Navier-Stokes equations are important partial differential equations which govern fluid dynamics. This project concerns a method for numerically solving the 2D Navier-Stokes equations with an external force term. We use the vorticity-stream formulation of the NSE. The Finite Difference Method will be employed in order to solve the equations. We use our computational algorithm coded in MATLAB to solve the equations considering different initial, boundary, and force conditions.

Undergraduate Session 2: Mathematics Education, 1:00 – 2:35 pm, Breakout Room 2

1:00 - 1:15 pm **Evidence-Based Calculus Instructions: My Student Participant Experience**
De'Avyon Griham (UAPB)
Mentor: Anna Harris
Abstract: COVID-19 brought a lot of unexpected problems, especially in learning mathematics. My Calculus class adopted evidence-based instructions (EBI), WebAssign, Julia Computing, Peer-Led-Team-Learning (PLTL) study sessions, and iPad notebook. Despite COVID-19, I have been learning mathematics well. In this presentation I will share how these EBI helped me to learn mathematics better.

1:20 - 1:35 pm **Peer Led Team Learning (PLTL) Leader Experience**
Ma'Kyah Goodlow (UAPB)
Mentor: Anna Harris
Abstract: PLTL is a small group of peers helping each other to get a better grasp of the lesson. Sometimes you get a better understanding from hearing a peer say something than your teacher. Overall the experience has helped me tremendously. We have incorporated WebAssign and graphing websites into our daily activities in order to become calculus wizards. WebAssign has helped a lot. If you do not understand a problem, there is always a video or a practice another version to help you understand the concept that needs to be applied. Also, when we go over a lesson in class the practice another version gives you a chance to try the technique on your own to make sure you truly understand. Online graphing calculators make it easy to see the graph or equation and understand what is going on. The graphs help to understand what I am truly looking for. I enjoy my group because we all try to help one another. It is not just me. I used a group message to help my group know when to meet and talk in if we ever needed help. I also set up a whole class Group Me so that everyone in class could collaborate. These are a few of the things I would like to mention in my PLTL presentation.

Undergraduate Session 3: Mathematics Education, 1:00 – 2:35 pm, Breakout Room 3

1:00 - 1:15 pm **Peer Led Team Learning (PLTL) Leader Experience**
James Robinson (UAPB)
Mentor: Anna Harris
Abstract: The purpose of this presentation is to share my experience as a peer-led-team-learning(PLTL) leader. My group tends to meet in the library around 3 every Mon-Thurs. While together we work on our own individual problems. They tend to ask me questions regarding Algebra and Precalculus since it has been a few years since they've taken math; luckily, they are simple questions and my otters just need a refresher. Occasionally we will come across a problem that we don't fully know how to do. When possible, we look at another practice problem and see if said problem shows the solution. We then look for the patterns in our original problems and solve them from there. If there is no pattern, then we look through the notes of the day and see what we can do. The days leading up to a test, we tend to go over all the problems (using the practice problems) and hand-write everything. If everyone understands then we just wish each other luck on the rest.

1:20 - 1:35 pm **Evidence-Based Instructions: Student Participant Experience**
India Hudson (UAPB)
Mentor: Anna Harris
Abstract: I have been participating in Calculus class with evidence-based instructions (EBI) since August 2020. In this presentation I will share why I liked the evidence-based instructions and how EBI helped me to improve my mathematics skills and retain content knowledge better.

1:40 - 1:55 pm **Applications of Active Learning with Programming Approach to Elementary Mathematics**
Jaden Kindsvater (LU)
Mentor: Andrew Bucki, AbebawTadesse
Abstract: A meta-analysis study made by S. Freeman et al. PNAS, 2014, provided evidence that Active Learning (AL) made average examination scores improved by about 6% as compared to Traditional Learning (TL). A. Bucki IKNiBO, 2016, and A. Bucki, A. Tadesse JME, 2019, proposed a new educational program, the Active Learning with Programming Approach (ALPA). The preliminary data show significant improvement over AL. This presentation will provide some examples illustrating the basic ideas, including ALPA content and pedagogy.

2:00 - 2:15 pm **Student Participant Experience of Evidence-Based Calculus Instructions**
Shaliyah Nelson (UAPB)
Mentor: Anna Harris
Abstract: We used three evidence-based instructions, WebAssign, Julia Computing, and Peer-Led-Team-Learning (PLTL) study sessions. I found learning mathematics can be fun and different than what I traditionally thought. In this presentation, I will share why I liked WebAssign, PLTL study sessions, and Julia programming.

2:20 - 2:35 pm **Comprehensive Peer Led Team Learning (PLTL) Leader Experience**
Jose Chavarin (UAPB)
Mentor: Anna Harris
Abstract: Being a peer-lead-team-learning (PLTL) leader, I have had to acquire Julia programming and other positive skills. In this presentation, I will share my stories of being a PLTL leader and how PLTL study sessions helped students and myself.

Undergraduate Session 4: General Mathematics and Statistics, 1:00 – 2:35 pm, Breakout Room 4

1:00 - 1:15 pm **Constructing Norm Retrievable Frames with Dynamical Structure**
Karaline Petty (OU)
Mentor: Keri Kornelson
Abstract: We investigate conditions on the operator and initial vectors that create a norm-retrievable frame with a dynamical sampling structure, a set that can recover the norm of a vector from samples generated by the repeated application of the operator to the initial vectors. We are particularly interested in frames that cannot also recover the phase of a vector. We approach the problem by considering whether existing examples can be generalized to large classes of frames. Specifically we identify a class we call alpha-beta frames satisfying our conditions in real, finite vector spaces.

1:20 - 1:35 pm **Determining an Algorithm to Eliminate a Strand of Particular Braids**
Rebecca Mathews (OBU)
Mentor: Cherith Tucker

Abstract: A goal of braid theory is to identify braids and differentiate braids from one another. One way to identify a mathematical braid is by its index, or the minimal strands needed to represent a braid. In this thesis, we will explore one method of minimizing the number of strands needed to represent a braid, working towards finding the braid index of particular braids. Specifically, we propose an algorithm to eliminate a strand of a braid if it lies completely over or completely under all other strands.

1:40 - 1:55 pm **Rest for the Weary: A Statistical Analysis of the NFL Bye Week vs. Team Success**
Daniel Wilson (OWU)
Mentor: Brian Turner
Abstract: Since the inception of the NFL's "bye week", it has been pondered whether the placement of that week has any statistical impact on a team's success, either in the regular season or in the playoffs. This project analyzes NFL data back to 2003, exploring for any such correlations. We also compile data for how much a bye week improves success for the following game, and how much having home field gives an advantage.

2:00 - 2:15 pm **Outlier Detection in Electrocardiogram Data Using Robust Principal Component Analysis**

Krisha Keesling (UCO)

Mentor: Emily Hendryx

Abstract: The electrocardiogram (ECG) is an important tool that measures the heart's electrical activity and is used to identify underlying heart conditions. ECG data can include, in addition to normal beats, physiological arrhythmias and even non-physiological waveforms. To detect anomalous waveforms that occur in the ECG, we apply robust principal component analysis (RPCA) via outlier pursuit. Principal component analysis (PCA) is commonly used when trying to recover an optimal low-dimensional representation of a specific data matrix. PCA, however, is sensitive to noise, so RPCA methods have been developed to combat this very shortcoming. Specifically, the use of RPCA via outlier pursuit offers an advantage in the ECG setting as it addresses the case when entire data points (beats) are corrupt rather than only a few samples distributed throughout the data matrix. In short, RPCA via outlier pursuit can be used to identify outliers in the data, and subsequent analyses can be performed using the space containing the "true" data (or typical beats, in this case). To evaluate the performance of RPCA with outlier pursuit in this context, we use the MIT-BIH Arrhythmia Database. This data set contains physician-defined beat labels that we use to tune parameters for the RPCA algorithm. Performing this parameter selection on a subset of the data to identify the expected fraction of noisy data points in the MIT-BIH data set, we designate "true" samples as the majority beat type displayed by the data. We then apply the algorithm to a separate test subset to measure outlier detection performance. Identifying and reducing outliers found in patient data is critical if the data is to be used in further analysis; the initial results presented here can serve to inform future work in the development of additional algorithms for clinical support.

2:20 - 2:35 pm **Developing an Original Theorem Regarding Various Voting Methods While Building Complementary Skill Sets, Inspiring Creativity and Encouraging Initiative in an Undergraduate Research Project**

Elizabeth Wissler (UCO)

Mentor: Kristi Karber

Abstract: The process of developing an original theorem via programmatic testing and its proof will be presented. The theorem provides a method of determining initial conditions that lead to different winners when utilizing various voting methods. The demonstrative problem intends to encourage students to think critically about political fairness, while the overall research process used reinforces the complementary nature of mathematical proof-writing and computer programming.

Session 5: Applied Mathematics and Modeling, 1:00 – 2:15 pm, Breakout Room 5

1:00 - 1:15 pm **Data Subset Identification Using CUR Index Selection Schemes**
Emily Hendryx (UCO)
Abstract: The DEIM-CUR matrix factorization has been shown to be viable for subset selection. The CUR factorization, however, can be formed in a variety of ways. This talk presents a comparison of some CUR methods with commonly used clustering algorithms, evaluating method performances on different data types. In doing so, we demonstrate the utility of CUR index selection schemes in data subset identification.

1:20 - 1:35 pm **A Numerical Minimization Algorithm for Convex Unconstrained Problems**
Ivan Raykov (UAPB)
Abstract: We introduce a numerical algorithm for solving convex smooth minimization problems by reducing the number of independent variables. We present a comparative study with numerical examples.

1:40 - 1:55 pm **ChainSeek: An Open-source Tool for the Detection of Chromoplexy**
Laquita Noel (UAPB)
Mentors: Karl Walker, Anna Harris, Michael A Bauer, Cody Ashby
Abstract: Although chromoplexy was first discovered to be a progressive driver of prostate cancer and has been indicated in non-small cell lung cancers, head and neck cancers, and melanomas, it has not been as extensively studied in other types of cancer. ChainSeek aims to provide a much-needed, open-source, and well-documented tool that detects chromoplexy and evolves with the continued development of high-throughput sequencing.

2:00 - 2:15 pm **The Stabilizing Effect of the Temperature on Buoyancy-Driven Fluids**
Uddhaba Pandey (OSU)
Abstract: The Boussinesq system for buoyancy-driven fluids couples the momentum equation forced by the buoyancy with the convection-diffusion equation for the temperature. One fundamental issue on the Boussinesq system is the stability problem on perturbations near the hydrostatic balance. We solve the stability problem for a two-dimensional Boussinesq system with only vertical dissipation and horizontal thermal diffusion. The results we obtained reveal a remarkable phenomenon for buoyancy-driven fluids. That is, the temperature smooths and stabilizes the fluids. If the weather were not present, the liquid is governed by the 2D Navier-Stokes with only vertical dissipation, and its stability remains open. The coupling and interaction between the temperature and the velocity in the Boussinesq system make the stability problem possible.

Session 6: Mathematics Education, Technology and Assessment, 2:20 – 3:15 pm, Breakout Room 1

2:20 - 2:35 pm **Engaging Students in the Classroom**
Kayla Murray (UAFS)
Abstract: In this talk, we will be discussing the use of Plickers to engage students during class meetings. The name for Plickers comes from a combination of the words picture and clicker. Each student is given a Plicker card, which contains a unique QR code. The students use this card to vote on multiple choice questions during class. We will be discussing the variety of ways to use these in a classroom.

2:40 - 2:55 pm **Step-By-Step Software-Guided Calculus and Statistics Problem Solving**
Kathryn Schaefer (Hawkes Learning)
Abstract: Explore Hawkes' mastery-based homework & testing software, featuring over 43,000 unique algorithmically generated question iterations and the powerful LaTeX-based Question Builder tool, allowing instructors to create their own questions! Discover how software can provide pinpointing, error-specific feedback, recognize alternative equivalent answers, and teach students through interactive step-by-step problem-solving tutorials with detailed explanations of the solution process. Save time with automated grading and receive detailed analytics on question-based performance, time on task, and assignment completion to track student success and intervene at crucial learning points. Learn about other Calculus and Statistics resources, including short example videos, concept overview videos, and immersive and challenging chapter projects based on real-world applications of course material. All attendees will be entered to win one of three $25 Amazon gift cards!

3:00 - 3:15 pm **Evidence-Based Instructions: Teaching Mathematics with Julia Computing**
Anna Harris (UAPB)
Abstract: Lecture-based learning is the predominant mode of instruction at UAPB and at other HBCUs as well. Lecture-based learning is a one-way communication, which treats students as passive participants who are to take notes while sitting quietly and who may ask questions only if time permits. Research has shown that this rigid learning method is not helpful for most students in acquiring new knowledge. In addition, research has shown evidence-based learning methods in college mathematics may improve retention rates of STEM disciplines and also attract more students to be in STEM fields, including minority students. With the goals of increasing students' passing rates, retention rates, graduation rates, and their ability to enter the STEM workforce, we designed and implemented these activities to enhance minority STEM students' mathematics performance. This presentation is about one of our evidence-based instructions we developed using Julia REPL and/or Nteract. Despite COVID-19, we were able to increase students' engagement and their learning, understanding, and retaining of mathematics concepts. Examples of Julia REPL and/or Nteract class notes, and Julia projects are also shared in the presentation.

Session 7: Topology and Mathematics Education, Student Access and Engagement, 2:00 – 3:15 pm, Breakout Room 2

2:00 - 2:15 pm **Topological Groups on Manifolds**
Andrew Bucki (LU), Abebaw Tadesse (LU)
Abstract: In this presentation, we study special topological groups, para-f-Lie groups, on manifolds utilizing purely algebraic methods. We introduce the notion of a para-f-Lie algebra. We use it to show that a Lie group G is the quotient of the product of an almost product Lie group and a Lie group with trivial para-f-structure by a discrete subgroup if and only if its Lie algebra g is a para-f-Lie algebra.

2:20 - 2:40 pm Active Learning with Programming Approach to Elementary Mathematics
Andrew Bucki (LU), Abebaw Tadesse (LU)
Abstract: This presentation introduces the new educational program Active Learning with Programming Approach (ALPA) in Mathematics, which extends the existing Active Learning (AL) program. Our preliminary study shows significant improvement in learning and course performance as compared to AL. We will provide some examples illustrating the basic ideas, including ALPA content and pedagogy.

2:40 - 2:55 pm **Creating Art with Mathematics**
Michelle Lastrina (ECU)
Abstract: In this talk, we discuss how an assignment from a Math and Art unit in a General Education mathematics course was used to develop a Math and Art preject curriculum box for use in K-12 classrooms. This project is based on creating artwork using the Fibonacci sequence in the style of Piet Mondrian. The talk will also look at other ways to incorporate mathematics into art lessons at various educational levels.

3:00 - 3:15 pm **An overview of corequisite instruction at Oklahoma State University**
Chris Francisco (OSU)
Abstract: We will give an overview of the structure of our corequisite math offerings at Oklahoma State University, some student success data from corequisite classes, and the challenges we continue to face.

Session 8: Mathematics Education, Calculus, 2:40 – 3:15 pm, Breakout Room 3

2:40 - 2:55 pm **Analyzing students' performances on implicit differentiation**
Sepideh Stewart (OU), Jonathan Troup (CSUB), Hannah Cary (OU), Luke Fronheiser (OU)
Abstract: Student difficulties in calculus are common and well-documented by mathematics education researchers. In this case study, the research team collected data from 84 Calculus I students by administering a test consisting of calculus and algebra questions at the end of the semester. Our preliminary results indicate that many students struggled with the implicit differentiation process. In this talk, we will analyze students' performances in detail. Among various reasons, we hypothesize the possibility that a shallow or inflexible understanding of school algebra can contribute to students' difficulties in solving calculus problems.

3:00 - 3:15 pm **Student Understanding of Domain and Range in Calculus I**
Cory Wilson (OU), Deborah Moore-Russo (OU)
Abstract: We will present differences in calculus students' early-class performance on tasks that: a) were expressed graphically vs. symbolically or b) involved specific types of functions. We will also report whether students' understanding of domain/range early in a Calculus I course correlated with their performance in the course.

Session 9: Mathematics Education, Upper Level, 2:40 – 3:15 pm, Breakout Room 4

2:40 - 2:55 pm **Tricky Trigonometry with lp-Norms**
David Stapleton (UCO)
Abstract: As an example of developing trigonometry in a Banach space, we consider defining trigonometry with various lp-norms through a unit circle derivation, and the geometrical consequences on the surface area and volume of the unit ball in higher dimensions. Hyperbolic functions are also mentioned. The results are mind-bending and provide a nice abstraction of Euclidean concepts for upper division students interested in projects that develop abstract geometry skills.

3:00 - 3:15 pm **Implementing a Peer-Review Process in an Elementary Number Theory Course**
Scott Williams (UCO)
Abstract: The lack of experience students have with reading and writing proofs presents a major hurdle in their first few proof-based courses. In an effort to remedy this, we have implemented a peer-review process where students proofread and submit anonymous comments on their fellow classmates' proofs. In this talk, we will describe our process and discuss its successes as well as some of its difficulties.

Session 10: Statistics and Programming, 2:20 – 3:15 pm, Breakout Room 5

2:20 - 2:35 pm **A Stratified Design for Sight-Resight Estimation of Cat Population**
Chizuko Iwaki (UAFS), Daiho Uhm (UAFS)
Abstract: Free-roaming cat populations are increasing in urban areas around the world. Trap-Neuter-Return (TNR) is a strategy which can theoretically lead to population decline with an ethical approach. To approximate the cost and time for TNR process, there must be a valid count of stray cats. This study aimed to estimate free-roaming cat populations using a sampling method called sight-resight. This work is being done in collaboration with Jen's Kitty Rehab, a local animal rescue organization, and Amy Skypala, University of Arkansas - Fort Smith.

2:40 - 2:55 pm **Revisiting the Problem of Points**
Andrew Wells (ECU)
Abstract: The problem of points considered by Pascal and Fermat in the early years of probability theory is echoed in questions about the impact of alternating advantage in two player games. Here we survey two different approaches from the 1970s by Kinston and Andersen and extend them slightly to a few more advantage alternating schemes.

3:00 - 3:15 pm **Using Web Tools for Programming**
Nicholas Jacob (ECU)
Abstract: Using online tools helps lower the bar for entry into open source programming languages. We examine several free, online programming hosting sites. Using the open source languages of R and python, both sites allow users to get started programming with minimal set up. Discussions include coding collaboration, github integration, and web publishing of documents.

3:30 – 4:30 pm **MAA Editor Lecture**

Presiding: John Diamantopoulos, Section Chair

Mathematical Fights! The Seedy Underbelly of Mathematical History

Dominic Klyve, Professor of Mathematics, Central Washington University
Editor, *The College Mathematics Journal*

Abstract: Although students are often led to believe that mathematics is a purely rational, unemotional, and orderly field of study, history shows that this is often not the case. This talk will discuss some of the greatest fights in the history of mathematics. We will hear stories of friendships destroyed and national rivalries heightened because of disagreements about underlying mathematics. We will consider what these fights teach us about the nature of mathematics, and we will learn some interesting math on the way.

About the Speaker: Dominic Klyve (KLEE-vee) is a Professor of Mathematics at Central Washington University. He is the author of more than 50 papers in number theory, the history of mathematics and science, and applied statistics. Klyve is a PI on $1.5 Million TRIUMPHS grant, which promotes the use of primary sources in the teaching of mathematics. He was a 2014 winner of the MAA's Alder Award, a national teaching award for young faculty who have a demonstrated impact within and beyond the classroom. He currently serves as editor of the *College Mathematics Journal*. During 2021 he is on leave from his university to work as "Lead Polymath" for Know Labs, a Seattle tech start-up.

Friday Evening, April 9, 2021

6:00 – 7:45 pm **Awards Ceremony**

Presiding: Narayan Thapa, Section 1st Vice Chair

Program will be included when finalized

7:45 – 8:45 pm **Section Visitor Lecture**

Presiding: John Diamantopoulos, Section Chair

How Mathematics is Making Hollywood Movies Better

Michael Dorff, Professor of Mathematics, Brigham Young University
Past President, Mathematical Association of America

Abstract: What's your favorite movie? Star Wars? Avatar? The Avengers? Frozen? What do these and all the highest-earning Hollywood movies since 2000 have in common? Mathematics! You probably didn't think about it while watching these movies, but math was used to help make them. In this presentation, we will discuss how math is being used to create better and more realistic movies. Along the way, we will discuss some specific movies and the mathematics behind them. We will include examples from Disney's 2013 movie *Frozen* (how to use math to create realistic-looking snow) to Pixar's 2004 movie *The Incredibles* (how to use math to make an animated character move faster). Come and join us and get a better appreciation of mathematics and movies.

About the Speaker: Michael Dorff is the past President of the Mathematical Association of America (MAA) and a professor of mathematics at Brigham Young University. He earned his Ph.D from the Univ. of Kentucky. He is interested in promoting mathematics to the general public, in non-academic careers in mathematics, and in undergraduate research. Also, he co-directs the MAA PIC Math program (Preparation for Industrial Careers in the Mathematical Sciences) and was the founder of CURM (Center for Undergraduate Research in Mathematics). He is a Fellow of the American Mathematical Society, a CUR (Council on Undergraduate Research) Fellow, and a Fulbright Scholar in Poland. He is married with 5 daughters. In any free time he has, he enjoys reading, running, and traveling (he has traveled to 49 U.S. states and 48 countries).

Saturday Morning, April 10, 2019

Session 11: Algebra and Discrete Mathematics, 8:00 – 8:55 am, Breakout Room 5

8:00 - 8:15 am **The Current Algebra of a Lie Algebra**
Kayla Murray (UAFS)
Abstract: Given a Lie algebra, we will define the current algebra associated to that Lie algebra. In particular, we will see that this is an infinite dimensional Lie algebra. Finally, we will discuss a particular family of modules for this Lie algebra, called Chari-Venkatesh modules. This talk will focus on the Lie algebra of 2X2 traceless matrices.

8:20 - 8:35 am **Covariant Affine Integral Quantization on a Coadjoint Orbit of the Poincaré Group in (1+1)-space-time Dimensions**
Haridas Kumar Das (OSU)
Mentors: Jean Pierre Gazeau (UP), S. Twareque Ali (late) (CUM)
Abstract: The content of the paper illustrates a general formalism, named covariant integral quantization, for giving a measure space paired with a separable Hilbert space a quantum version based on a normalized positive operator-valued measure. The example that we examine here concerns the Poincaré group in (1+1)-space-time dimensions, denoted $\mathcal{P}_+^{\uparrow}(1,1)$. The cotangent bundle of the quotient of $\mathcal{P}_+^{\uparrow}(1,1)$ by the affine group has the natural structure of a physical phase space. We do an integral quantization of functions on this phase space, using coherent states coming from a certain representation of $\mathcal{P}_+^{\uparrow}(1,1)$. The representation in question corresponds to the “zero-mass" or “light-cone" situation, which when restricted to the affine subgroup gives the unique unitary irreducible representation of that group. This representation is also the one naturally associated to the above mentioned coadjoint orbit. The coherent states are labelled by points of the affine group and are obtained using the action of that group on a specially chosen vector in the Hilbert space of the representation. They satisfy a resolution of the identity, which can be computed using either the left or the right Haar measure of the affine group. The covariant integral quantization is implemented using both choices and we obtain a relationship between the two quantized operators corresponding to the same phase space function.

8:40 - 8:55 am **P-shifted Matroids**
Nishad Mandlik (OSU)
Mentor: Jay Schweig
Abstract: We give a condition for a matroid to be transversal. This condition depends on P-shiftedness, which is a generalization of the classical notion of shiftedness. Our result both generalizes and recovers a result that characterizes all shifted matroids as transversal.

Session 12: Mathematics Education, Student Engagement and Assessment, 8:00 – 8:55 am, Breakout Room 2

8:00 - 8:15 am **Initial findings: Student learning from homework vs. lectures**
Allison Dorko (OSU), John Paul Cook (OSU)
Abstract: We observed students' work on exams including methods learned from the course online homework program that were different from the methods presented in class. We will report initial findings from a study investigating students' reasoning on exams as reflecting what they learned while doing homework, what they learned from lecture, and why one impacted their learning more than the other. The study includes data from both entry-level mathematics students and calculus III students.

8:20 - 8:35 am **Breaking Codes: An Online Math Club Activity**
Cherith Tucker (OBU)
Abstract: When we went fully online in the Spring 2020 semester, I wanted to continue to provide opportunities for the OBU Math Club to learn and connect. I created an online activity for our students that had them utilize various ciphers to break codes while also requiring them to interact with the math faculty members via email.

8:40 - 8:55 am **What Do We Know about Student Learning from Online Homework?**
Allison Dorko (OSU)
Abstract: Homework is one of students' opportunities to learn mathematics. However, we know little about what students learn from homework or the mechanisms by which they learn it. In this talk, I will review the research about student learning from online homework and briefly describe three of my projects aimed at filling this gap in the literature. I will also discuss the instructional implications for using online homework with your students.

Session 13: Mathematics Education, On-line and Hybrid Learning, 8:00 – 8:55 am, Breakout Room 3

8:00 - 8:15 am **Using Google Docs for Collaborative Learning**
Myron Rigsby (UAFS)
Abstract: *Google Docs* and *Google Sheets* allow multiple authors to simultaneously edit a single document. This provides a useful platform for student collaboration on a group activity, whether the class is conducted by videoconference or in person. I will share some examples of group activities that I have used and discuss some strengths and limitations of the format.

8:20 - 8:35 am **"It's a Keeper!" Practices to Preserve From "Hybrid" Teaching**
Sarah Marsh (OBU)
Abstract: All of us have confronted the challenges and opportunities presented by teaching in various formats during the COVID-19 pandemic. Higher education experts predict that teaching practices may never return to pre-pandemic "normal," but opinions vary as to exactly which changes will endure. In this talk, I'll share my reflections on the practical and conceptual changes I intend to retain in my teaching practice, based on a year of mostly "hybrid" (but some fully online or fully in-person) teaching.

8:40 - 8:55 am **Learning to Teach an Inquiry-Oriented Class Online**
Cynthia Francisco (OSU)
Abstract: Our math content courses for preservice elementary teachers at OSU are centered around active learning and inquiry. During the pandemic, we have faced the challenge of moving classes online that typically involve substantial hands-on group activities and minimal lecture. In this talk we will discuss strategies, challenges, and lessons learned in both asynchronous and synchronous courses, focusing especially on a synchronous geometry course.

Session 14: Mathematics Education Technology, Geogebra, 8:00 – 8:55 am, Breakout Room 4

8:00 - 8:15 am **Modeling and Solving Problems with GeoGebra**
Jose Contreras (BSU)
Abstract: In this presentation, I will illustrate how my students and I use GeoGebra as a strategic tool to gain insight into modeling and solving geometric problems. The problem to be investigated during this presentation is the classic buried treasure problem. Proofs will be discussed to support the conjecture suggested by GeoGebra.

8:20 - 8:35 am **Use of GeoGebra Activities in the Teaching of the Calculus Sequence**
Jack Jackson (UAFS)
Abstract: Over the last year Dr. Jackson has been creating applets using the free dynamic Geometry-Algebra software, GeoGebra. These activities provide dynamic visualizations of important Calculus topics. Dr. Jackson has collected these activities along with some of the best GeoGebra activities from other mathematics educators in a publicly available GeoGebra book. Some of these activities will be demonstrated.

8:40 - 8:55 am **The Joy of Posing and Solving Problems: The Varignon's Case**
Jose Contreras (BSU)
Abstract: In this presentation, I will illustrate how my students and I have used a problem-posing framework and GeoGebra to pose and solve Varignon problems using four main strategies: Specializing, generalizing, extending, and reversing. To enrich the students' experience, I start the investigation with the following version of the Varignon's problem: Let E, F, G, and H be the midpoints of the consecutive sides of a parallelogram ABCD. What type of quadrilateral is EFGH?

Session 15: Mathematics Education, Curriculum, 8:00 – 8:55 am, Breakout Room 5

8:00 - 8:15 am **Applied Algebra: An Alternative Approach to College Algebra**
Erin Williams (UCO), Britney Hopkins (UCO)
Abstract: In this talk we will discuss a new Applied Algebra course that serves as the Functions and Modeling Pathway at UCO. It provides a more applications based approach for students in majors that require some algebraic rigor, but do not eventually require engineering calculus. It both fulfills the university's core math requirements while serving as a prerequisite to courses like Bio-Calculus, Math Analysis for Business, Trigonometry, and General Chemistry. We use an open source text that we have modified in-house, paired with the homework platform, Edfinity.

8:20 - 8:35 am Faculty collaboration on entry-level college mathematics courses
Michael Oehrtman (OSU), William Jaco (OSU), Michael Tallman (OSU), Allison Dorko (OSU), John Paul Cook (OSU), Josiah Ireland (OSU)
Abstract: The Mathematical Inquiry Project supports opportunities for faculty to collaborate on entry level college math classes in Oklahoma. We will present outcomes of prior collaborations on active learning, meaningful applications, and academic success skills in College Algebra, Precalculus, and Functions and Modeling courses. We will then discuss upcoming opportunities to get involved in these areas or to be part of the ground-level organizing for collaboration on Quantitative Reasoning and Calculus I.

8:40 - 8:55 am **Preparing Students for Calculus**
Lee Ann Brown (OSU)
Abstract: Three years ago, OSU debuted a new course called Preparation for Calculus to replace our traditional Trigonometry and Precalculus courses. The new course has a greater emphasis on conceptual understanding and the ideas leading to calculus than its predecessors. In this talk, the course coordinator will discuss the reasons for the change, designing and implementing the new course, and student placement into the course. A sampling of homework and test questions will show some of the differences between the new course and more traditional courses.

9:10 – 10:25 am **Section Business Meeting**
Presiding: John Diamantopoulos, Section Chair

10:30 am-Noon **Student Workshop**
Games and Puzzles with a Mathematical Bent
Facilitator: Michael Dorff, Brigham Young University

Abstract: Come ready to play some games and solve some puzzles. Then we will talk about how math plays a role in them.

10:30 am-Noon **Faculty Workshop**
Teaching Mathematics via Primary Historical Source Documents
Facilitator: Dominic Klyve, Central Washington University

Abstract: In this hands-on minicourse, participants will be introduced to a classroom-tested approach for bringing history into the mathematics classroom via guided reading projects based on primary sources. The presenter has been engaged with this work during the last five years as a PI for TRIUMPHS (TRansforming Instruction in Undergraduate Mathematics via Primary Historical Sources), an NSF-funded seven-institution grant effort. Designed to actively engage students in doing mathematics as they read and work through the writing of mathematicians such as Euler, Cauchy, and Cantor, each "Primary Source Project" (PSP) focuses on a topic in the standard undergraduate mathematics curriculum, including mathematical context, primary source excerpts, tasks for students, and historical background.

Minicourse participants will explore this approach from both the student and instructor sides. First, in the role of students, they will work collaboratively through portions of specific PSPs. Following this opportunity to grapple with primary sources within a guided reading format, participants will discuss how to implement PSPs in the classroom. An overview of the pedagogical benefits of students learning from primary sources will be discussed, including student reactions.

Thank you for coming, and thank you to our hosts,
Cameron University

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