

STEM EDUCATION PAPER ABSTRACTS

COMBINING AN AUTHENTIC RESEARCH EXPERIENCE WITH DISCUSSION OF THE PRIMARY LITERATURE IN AN UNDERGRADUATE MICROBIOLOGY COURSE. *SINEAD NI CHADHAIN*, UNIVERSITY OF SOUTH ALABAMA.

At many institutions, biology majors' only exposure to the field of microbiology occurs in a single elective course. At University of South Alabama this course fulfills many roles, serving as an introduction to the field, preparation for advanced coursework, and a prerequisite for many graduate or professional programs. In addition, the course is designated a writing intensive course where students are supposed to develop competency in scientific communication. Historically the writing component was addressed by assigning a research paper. However, many students lacked the skills necessary to understand the sources they cited in their papers. The laboratory curriculum was also fairly standard with exercises where students learned aseptic technique, bacterial identification, etc. while working with known cultures provided by the instructor. I wanted to incorporate an inquiry-based research project into our course that would address both the writing component of the course and incorporate authentic research into the curriculum. I combined blog based discussions of research papers describing the isolation and characterization of naphthalene degrading bacteria with student research in the laboratory component of the course. Research papers were posted in sections on a class blog and students were required to post a minimum of two comments on each section and write a paper summary once the discussion closed. At the same time each student isolated their own naphthalene degrading bacterium from a soil or water sample through serial dilution and plating on minimal medium with naphthalene as sole carbon and energy source. The presence of an aromatic dioxygenase was confirmed by incubation with indole and production of indigo. Standard staining techniques were performed to confirm that pure cultures were obtained before biochemical testing and amplification and sequencing of the 16S rRNA gene, construction of phylogenetic trees, and screening of the cultures by PCR for aromatic dioxygenase genes. The semester concluded with a poster session where students presented their research projects to the biology department community. Overall, students isolated 30 naphthalene degrading bacteria with 28 students successfully maintaining their isolates in pure culture until the end of the semester. DNA sequence analysis revealed that the isolates belonging primarily to the *Acinetobacter* and *Bacillus* genera. The genomes of two selected isolates will be sequenced and studied in a follow up research intensive course in Experimental Bacterial Genomics.

STEM OUTREACH OPPORTUNITIES FOR THE AUGUST 2017 TOTAL SOLAR ECLIPSE. *MEL BLAKE*, UNIVERSITY OF NORTH ALABAMA.

Few events are as impressive as a total solar eclipse. From any given location it can be several decades between such events, and they offer a unique opportunity for teaching about the sun, moon earth system and astronomy in general. On August 21st, 2017 a total solar eclipse will take place that will be visible from much of the continental United States, from Seattle to South Carolina. From Alabama it will be a partial solar eclipse, but it will still be an impressive celestial event. I will share ideas about possible STEM outreach activities that can be done to encourage people to view the eclipse and teach about the importance of such events in history.

A RELATIONSHIP BETWEEN HAMMING DISTANCE AND 8-QUEENS PROBLEM: A STEM EXERCISE. *SERKAN GULDAL*, *ZEKAI DEMIREZEN*, *MICHAEL LIMPSOMB* AND *MURAT TANIK*, UNIVERSITY OF ALABAMA AT BIRMINGHAM.

This paper we introduce an activity designed for STEM students. We have a program at UAB Electrical and Computer Engineering department to reach out local high schools for engineering training. As such we design and develop various activities for our STEM classes. In this activity we cover Hamming Distance and its use in information theory and we cover N-Queens problem and its use in computer science. To make the activity interesting we connect these two problems. In our inquiry, we displayed all 92 8-queen solutions on a cube and calculated hamming distances between solutions. We observed that there are 33 distinct Hamming distance.

STEM EDUCATION POSTER ABSTRACTS

TRAINING THE NEXT GENERATION: AN ANALYSIS AND COMPARISON OF CURRICULA IN INSTRUMENTAL MUSIC EDUCATION. *DESTIN HINKEL*, UNIVERSITY OF SOUTH ALABAMA.

Overview

Music education curricula usually have a common division of ensemble types in the fall and spring of the academic year. In instrumental music, this division occurs with primarily marching band in the fall and indoor ensembles in the spring. Unfortunately, marching band puts more of an emphasis on repetition and automatization than genuine musical development, and music students are generally not introduced to a comprehensive music education until midway through the year. This study sought to identify exactly the strengths and weaknesses of a curriculum that is structured in this manner.

Methods

A survey was sent to 484 band directors in the state of Alabama with quantitative questions regarding the focus of their curricula, as well as other questions meant to acquire a general idea of their teaching techniques and how they differed between different types of ensembles. The band directors were also given an open ended option to each question so that they could justify or further explain their answers. Primary sources on music education were also consulted to evaluate the psychology of those learning music along with the philosophies and methodologies of those who teach music. Interestingly, the qualitative and quantitative data was not consistent across the board. For example, band directors who indicated on the chart that they focused their entire programs towards concert band wrote paragraphs about how marching band took up far too much of their time.

Results

Concluded from the study was this idea that students in many musical programs across Alabama and other parts of the United States are not receiving a comprehensive music education. Instead, they are taught music through repetition and autonomy encourage primarily from the marching band. Although the current curriculum focuses much more on marching band, there is no evidence that says educational moments are not present for all types of ensembles, the methodologies used will have to change drastically so that educators are able to both educate students musically in the fall and put on a quality marching band performance. Although much planning goes into the selection of repertoire for the concert band in the spring, the planning of the competitive marching band begins almost immediately after the previous season has ended with the selection of show music and a drill designer. The idea that so much thought is spent on an ensemble that teaches music through repetition gives the impression that a musically stimulating concert band is not the center of all ensembles in the instrumental music program.

INTEGRATING RESEARCH-BASED TEACHING IN SECONDARY AND UNDERGRADUATE SCIENCE COURSES. *NIKKI PATEL* AND *UDUAK AFANGIDEH*, FAULKNER UNIVERSITY.

Integrating Research-Based Teaching in Secondary and Undergraduate Science Courses

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Science teachers across Alabama hope to inspire students to pursue future education and career opportunities in the science, technology, engineering, and mathematics (STEM) fields. Current research studies suggest that students are losing interest in science as they progress from middle school through undergraduate levels of education. In a global society, students in the U.S. are falling behind in math and science. As educators, it is important to first identify and confirm the source of the decline and make effective changes to our pedagogy to prepare our students to be competitive candidates for future opportunities in the STEM fields. This research study surveyed a group of 10th-12th grade students at a rural, low-income school in Alabama. and found that over 80% of students reported having a notion of self-confidence in their ability to do well in science, but less than 30% of students believed they would be able to use and apply their knowledge outside of school. Survey questions included the instructional activities primarily used throughout the course, and how often those activities were used to facilitate learning and understanding of science concepts. Results indicated the interest of students in science was adversely affected by mode of instruction and inadequate laboratory instructional periods. It appears that in order to immediately address the academic concerns leading to the decline of student interest in science, as well as other STEM subjects, educators must find innovative ways of capturing their students' interest, relate content in a meaningful way and encourage students to confidently make their own connections and discoveries through inquiry. It is proposed that the preliminary data collected in this study be used as a model for future research to enable identification of the reasons for the decline of student interest in science, as well as other STEM subjects so that appropriate steps could be taken to address those issues.

KEYWORDS: STEM, research integration, secondary, undergraduate, inquiry-based learning

EFFECTIVENESS OF STUDY HABITS IN UNDERGRADUATE INTRODUCTORY BIOLOGY. *HEATHER SPROWL* AND *HEATHER TINSLEY*, UNIVERSITY OF MONTEVALLO.

Study habits are variable, and their success often depends on a particular student's learning style as well as the type of course for which the student is studying. Understanding which study habits are most effective for improving student performance is important to help students succeed in college. This is particularly true in gateway courses, courses that are foundational for a major, high enrollment, and high risk in terms of student performance. Our study wishes to determine which study habits are most effective for student performance in BIO 105 Introductory Biology I, a gateway course at University of Montevallo. Over the span of two semesters, we administered a survey of study habits and test taking strategies after each semester exam to students enrolled in BIO 105. Analysis of these surveys revealed that, while a

few study habits and test taking strategies differed between A/B students and D/F students, the combination of strategies used may be a better determinant of student success.

COURSEWARE ENGAGEMENT IN STEM AND NON-STEM DISCIPLINES. ROBERT FAULK, LAURA POWELL AND CHARLES BROWN, UNIVERSITY OF SOUTH ALABAMA.

General Psychology (PSY 120) receives high enrollment by students majoring in virtually all disciplines. Few studies have compared the academic effort and study strategies invested in general education distribution requirements exhibited by students majoring in STEM and non-STEM disciplines. In General Psychology, students are assigned to read an e-book that has been designed to track the number of hours students spend reading and engaging the courseware material over the course of the semester. Not surprisingly, our preliminary research has shown that learning outcomes (final grades) are associated with courseware engagement. In general, the more time students spend utilizing the courseware materials, the higher their grade. However, variation in engagement efforts across disciplines has not been examined. According to Chen (2013), while attrition rates in STEM majors are high, non-STEM attrition rates are even higher in some areas. It is possible that those students populating STEM disciplines are able to assimilate the content of the general education curriculum with less effort than their non-STEM peers. Academically, they may simply be more efficient and gifted students. Alternatively, it is possible that STEM disciplines are populated by students who are obsessed with the quest for perfection and exhibit elevated investment in all of their courses. To address these questions, we collected institutional demographic data from 1,936 students enrolled in General Psychology and linked declared major with courseware engagement time and course grade. Results showed no significant difference in engagement between STEM and non-STEM students; however, results did show a significant difference in grade between STEM and non-STEM students, with STEM students receiving higher grades in General Psychology on average.