**Spring 2020 Master’s Theses**

The Effects of GIS on Students’ Attitudes, Engagement, and Achievement in a Middle School Earth Science Classroom

William Bell – MA Science Education/Biology

**Abstract**

Geospatial Information Systems (GIS) has the potential to increase spatial thinking skills and engagement by improving critical thinking skills through problem solving and visualizations. GIS can be used by students to interact and manipulate real-world data and integrates technology in the classroom to capture the attention of our students. In this research study Geographic Information Systems (GIS) using ArcGIS by ESRI was used to help increase student engagement and students’ ability to think geospatially through problem-based learning projects on plate tectonics. The 40 participants in the study were enrolled in an eighth-grade earth science course and were divided into an intervention group and a control group. Data were gathered through pre and post-tests that measured spatial ability and a student attitude survey. A post-test on content was given and researcher observations using a journal were recorded throughout the study. Findings from the research study found that there was a significant increase in the spatial ability of the intervention group, while still achieving similar plate tectonic test scores between the intervention and the control group. Students’ attitudes were slightly higher for the intervention group and the researcher noted that the students enjoyed the GIS computer visualizations. Based on the results of the study, GIS is an addition that should be used in the science classroom to teach spatial skills in order to increase students’ spatial abilities, to improve students’ interest through using technology while at the same time teaching the students the content.

The Influences of an Argumentative Discourse on Learning About Climate Change on High School Students’ Scientific Argumentation Ability

Timothy Jacobs – Advanced MA Science Education/ High School

**Abstract**

The Next Generation Science Standards (NGSS) has developed student outcomes and practices that serve as a guideline for science to compliment Common Core Standards (CC) and one of the eight practices essential to K-12 Science and Engineering is engaging in argument from evidence. Scientific argumentation is the process by which science as a discipline develops and refines knowledge. Scientific argumentation should play a prominent role in science education and in science classrooms. The purpose of this research study was to determine if scientific argumentation in high school to investigate climate change could affect students’ discourse as well as interest in science. In this study, 23 high school earth science students were involved in discourse around the socioscientific issue of climate change. Data was collected on level of interest in career in science by completion of a survey, a survey on students’ climate change attitudes, a claim, evidence, reasoning questionnaire, and a score on their scientific argument using a CER rubric. Due to school closures a limited amount of post-responses was available. The career in science survey showed a slight increase in total mean score by 0.69 while the climate change attitudes survey data showed a slight increase of 0.375 in total mean score. The CER questionnaire showed increases in all students’ responses with a total mean increase of 45% suggesting students successfully learned about the scientific argumentation process. It was more difficult for them to apply it however as the CER rubric revealed students struggled with reasoning as the mean score was a 2.2 out of 4. Therefore, due to the findings of the study, scientific argumentation should be implemented in earth/environmental science classrooms when learning about socio-scientific issues such as climate change because of the potential of an increase in student interest in science careers, an increase in understanding and creating scientific arguments and an increase in student engagement through discourse in the science classroom.

Model-Based Teaching in High School Physical Science to Increase Motivation, Participation and Desire to Attend School

Neomi Carter – Advanced MA Science Education/ High School

**Abstract**

Model-based Science teacher and learning (MBST/MbL) is a framework for building science literacy. Science teachers have the responsibility to teach science to students who struggle with the ability to learn core concepts such as math, reading, writing and science, students named exceptional students (EC students) for example. However, research has shown that science teachers feel unprepared to teach EC students in their regular science class and believe that the special education teacher should have the responsibility to teach them. In turn the special education teacher feels unprepared to teach science. However, EC students are continually being enrolled in a general education science class. Many EC students shy away from participating or engaging in classroom activities and may even refuse to attend school to avoid the awkwardness of having to interact with the teacher and their classmates. The purpose of this study was to determine if the MbL framework to teach science would motivate and engage EC students who were enrolled in general education science class using a two-week MbL physical science unit. Students were given a pre/post Science Motivation Questionnaire II. Students’ participation was monitored throughout the study using a Weekly Participation Tracker in which they were able to score up to 15 points every 5 days. Students’ attendance was monitored throughout the study to determine if attendance improved during the study. Lastly, 4 EC students who volunteered participated in a brief open-ended interview with the researcher in which the responses were recorded. It was found that using MbL increased self-determination in all of the students in the class. Participation increased throughout the unit with all students increasing by mean of two points overall and the EC students increasing by a mean of 3 points overall. Participation scores ranged from 92% to 21% and were affected by attendance. Attendance was found to be influenced by a variety of outside factors such as suspensions and illness, which were beyond the science classroom. Overall, the EC students reported that the MbL unit supported them in being motivated to participate and thereby developed a belief in belonging which encouraged them to learn science with the general education students in the class. They believed that they could contribute to the learning in the class. All students in the class were more engaged and motivated to learn science using MbL. It is recommended that the MbL framework be used to teach science to involve all students in the science endeavor.