

Twelfth Annual

# Summer Student Research Symposium



**August 01, 2014  
St. Thomas Campus  
College of Science & Mathematics  
University of the Virgin Islands**

# 12th Annual Summer Student Research Symposium

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Friday, August 01, 2014  
University of the Virgin Islands  
St. Thomas Campus, U.S. Virgin Islands  
Administration and Conference Center

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**Event Organized by:**

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The Emerging Caribbean Scientists (ECS) Programs increase research training and promote excellence for STEM (science, technology, engineering, and mathematics), psychology, and nursing students at the University of the Virgin Islands.



## 2014 Participants

Mathematics Behind the Science	Summer Sophomore Research Institute	Summer Undergraduate Research Experience
Alexander Fortenberry Ashley Thomas Ayayi Anthony Briana Rhymers Candance Petersen Carlos Ramos Christina Show Duryan Cozier Dyami Isles EvVeta Charles Jakobi Peets Kalina Webster Kamira Webster Kedisha Charles Keryl Liburd Khala Vanterpool Khana Smith Kwame Forbes Nirisha Commodore Shanee Richards Stephon Smith	Bretton Alwood Eliakin delRosario Jonique George Kaleb Liburd Krislen Tison Ruel Mitchel Shakim Cooper Sharone Richards Sheresia Gumbs Sherika Alexis Stephen Santana Vivani Pickering Zandria Acosta	Allena Clifford Amelle Williams Ayanna Fredericks Elangeni Yabba Khalin Nisbett Lesa Royer Meritzer Lawrence Omani Tuitt Richard LaPlace Serena Joseph Tonya Bartlette Yentyl Levet Ykeshia Zamore

### **Summer Program Descriptions:**

- Math Behind the Science (MBS) Program – This residential, summer bridge program is designed to enhance the mathematics readiness of college-bound STEM students by preparing them to enter the introductory calculus course and provide a foundation for success.
- Summer Sophomore Research Institute (SSRI) – This summer research program allows current UVI students to work with faculty on a research project and participate in workshops to learn basic research methods and techniques.
- Summer Undergraduate Research Experience (SURE) – By participating in this program, students that are selected as SURE Fellows work closely with UVI faculty on challenging scientific research projects across a variety of STEM disciplines.

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## **Partner Abuse of Women in the Virgin Islands**

**Allena Clifford**

Dr. Gloria Callwood (mentor)

Caribbean Exploratory NIMHD Research Center

St. Thomas, University of the Virgin Islands

Based on a previous study that found high prevalence of Intimate Partner Violence (IPV) among women in the Virgin Islands, an intervention clinical trial is being initiated. This intervention adapts a nationally recognized program, Sister to Sister, to be used with women who report being in an abusive relationship. This project will examine the process of adapting the Sister to Sister program to assure that it is culturally appropriate for use among women in the Virgin Islands.

Based on focus groups there are different perspectives on IPV by island districts. Therefore we hypothesize based on focus groups that there are no differences in perspectives on IPV by island districts. Separate focus groups of abused women, men, Health Care and Service Providers, US VI law enforcement, judicial professionals, and domestic violence advocates and Community leaders (faith, social groups, educators, women's groups, advocates) were held on each island district. Participants were provided with key findings from the initial study and content of the Sister to Sister Program and ask to provide feedback on the content. The focus groups were recorded. Transcripts of the focus groups are being analyzed using qualitative analysis software, Atlas-ti. It is expected that there will be substantive differences in responses by island districts, particularly with the group of abused women.

This research is funded by the UVI NIH-RISE Program Grant #GM061325 and the Caribbean Exploratory NIMHD Research Center.

## Threats to Our Reefs: Changes in Lionfish Prey Consumption and Biometrics

**Amelle Williams, Elangeni Yabba and Omani Tuitt**

Dr. Bernard Castillo II (mentor)

Kynoch Reale-Munroe (mentor)

University of the Virgin Islands

The red lionfish (*Pterois volitans*) is an invasive species that is originally from the Pacific Ocean. Lionfish have no known natural predators in the Atlantic and Caribbean. They are excellent predators and feed on herbivorous fish that live on coral reefs. The two primary objectives for this project were to collect lionfish biometrics and to conduct gut analyses. Specifically, we were interested in returning to the same location in the west end of St. Croix, US Virgin Islands where a study in 2011 was conducted to assess potential changes in prey consumption. We were also interested in detecting potential changes in the length and weight of lionfish found at the same site over time. Our first hypothesis was that a significant difference in gut contents would be observed between 2011 and 2014, due to overconsumption of preferred prey. The second hypothesis was that lionfish lengths and weights would have increased significantly from 2011 to 2014. In 2011, the top three identifiable lionfish prey were juvenile wrasse (47%), damselfish (33%) and crustaceans (20%). Our data this year showed the top three identifiable prey species to be crustaceans (77%), damselfish (13%) and juvenile wrasse (7%). The data suggests that between 2011 and 2014, there has been a drop in the number of damselfish and wrasse as well as a substantial increase in the number of crustaceans. It is postulated that the observed change in diet is a reflection of available prey on the reef. The potential ecological implications of a shift in reef fish needs further study. Our biometric data showed that lionfish were becoming heavier per millimeter of body length. Because lionfish are getting heavier, they will need to eat more to sustain themselves at their current bodyweight.

This research was funded by NSF HBCU-UP Grant #HRD – 1137472.

## **Perceived and Projected Alcohol and Drug Use Among College Students**

**Ayanna Fredericks**

Dr. Kimarie Engerman (mentor)

University of the Virgin Islands, St. Croix, USVI

In the United States, alcohol and drug use by college students have led to an increase in violence, illegal activities, risky behaviors, and death. The purpose of this research is to examine the relationship between the frequency of perceived and projected alcohol and drug use by students at the University of the Virgin Islands. The CORE Alcohol and Drug Survey was administered to 53 students between the ages of 18 to 24 who were enrolled in lower-level courses. Results from Spearman's rho Correlation revealed a statistically significant moderate direct relationship between the frequency of perceived alcohol use and projected alcohol use, ( $r=.49$ ,  $p<.05$ ). However, there was no statistically significant relationship between the frequency of perceived marijuana use and projected marijuana use. The findings from this study can help create programs that aid in reducing the use of alcohol and drugs among college students.

This research was supported by MBRS-RISE Grant #5R25GM061325 and SPO20211.

## **Feeding History in Relation to Foraging Preference of Solar Powered Sea Slugs**

**Bretton S. Alwood and Kaleb Liburd**

Dr. Teresa Turner (mentor)

University of the Virgin Islands, St. Thomas USVI

The sea lettuce slug (*Elysia crispata*), sometimes called the solar powered sea slug due to their ability to store chloroplast from their food in their parapodia (frills) and to capture energy from the sun using photosynthesis. Because previous studies have been inconclusive, we observed two groups of *Elysia crispata*, collected in St. Thomas, in order to understand what factors affect their feeding/foraging preferences. We collected the first group of slugs at the beginning of the six weeks and conducted tests on them. We hypothesized that *E. crispata* would forage mostly for the green alga *Caulerpa sertularioides*, because other researchers suggested it to be a primary food source. An alternative hypothesis would be that they foraged for a variety of algae, which would bring up the question of how they handle the various forms of chloroplasts. While our methods changed over time, we stuck to the basic method of placing a slug in a container with two or three species of algae, then recording the slug's activity for 5 – 10 min. We initially were starving the slugs in between experiments, but then began to feed them. Over the course of a few weeks and multiple experiments, we noticed that the slugs were now mainly/only eating the green alga *Bryopsis* during the experiments. We hypothesized that the slugs became ingestively conditioned to the *Bryopsis* because that's all we fed them between trials. For example, data from trial 1 showed no significant preference (chi-squared test, Trial 1 p-value>0.05) whereas trial 6, which compared the exact same algae after feeding, was highly significant (Trial 6 p-value<0.001). To further test for conditioning, we collected a second batch of slugs and fed them, *Caulerpa sertularioides*, to see whether they too will become ingestively conditioned to the *Caulerpa sertularioides*.

This research was funded by NSF HBCU-UP Grant #1137472.

## **Malware Signature Detection: A Comparison between Brute Force And Boyer-Moore Algorithms**

**Eliakin del Rosario**, Zandria Acosta,  
Troi Williams, Miguel Mark and Marc Boumedine (mentors)  
University of the Virgin Islands, St. Thomas U.S. Virgin Islands

The internet allows millions of users to communicate, share media, download applications, purchase online services, and store personal data. Unfortunately, nefarious individuals use malware (computer programs that have malicious intent) to take advantage of people who rely on internet services. Malware creators have the ability to remotely monitor other individuals, steal their personal information, and exploit their computers sometimes without a target's knowledge. As a result, malware detection has become a serious security concern. Signature detection is one method used in combating malware. A signature is a sequence of bytes that can be used to identify known malware within a file. This project uses signatures to automate malware detection within files. Signatures of varying length have been inserted into files of various sizes. Our Java program uses a brute force algorithm and a collection of signatures to detect malware within files quickly. We compare our approach against the Boyer-Moore algorithm in order to determine the limitations and benefits of our approach. We anticipate that the Boyer Moore algorithm is more efficient in term of time; however, for specific scenarios our program is just as efficient.

This research was funded by NSF HBCU-UP Grant #1137472.

## The Investigation of Lemongrass in the US Virgin Islands

**Lesa Royer and Khalin Nisbett**

Dr. Brandy, Yakini (mentor)

University of the Virgin Islands

Cymbopogon citratus, Lemongrass, is abundant in the US Virgin Islands. Ancient remedies use this tea bush for its medicinal benefits. Citral, the most prominent ingredient, is a mixture of two isomers, Geranial and Neral, which are believed to contribute to the medicinal capabilities. Fifty gram aliquots of diced lemongrass leaves and stems were steam distilled resulting in the extraction of 5 grams and 11 grams of lemongrass oil, respectively. Geranial ((E)3,7-dimethylocta-2,6-dienal) was synthesized in 61.4 % yield by the oxidation of Geraniol using sodium dichromate dihydrate under acidic conditions. Structural elucidation using Infrared (IR) Spectroscopy and Proton Nuclear Magnetic Resonance (1H NMR) proved that the Geranial was successfully synthesized. This is a preliminary study to determine the anti-prostate and anti-breast cancer activities of synthesized Geranial and Neral and natural lemongrass oil.

### **Acknowledgements**

Lemongrass was provided by the University of the Virgin Islands Co-operative Extension Service on the St. Thomas Campus. The Infrared spectrum of Geranial was provided by the University of the Virgin Islands Department of Chemical and Physical Sciences on the St. Croix Campus. This research was conducted with the financial assistance from the SSRI/SURE summer research program.

This research was funded by NSF HBCU-UP Grant #1137472.

## **Seagrass Cultivation for Conservation**

**Meritzer Lawrence and Viviani Pickering**

Lorraine Buckley, Ph.D. (mentor)

University of the Virgin Islands

The purpose of this research is to assist Coral World Ocean Park with the development of a seagrass exhibit. We tested whether or not the sunny or shaded tanks would make a better habitat for sea grass. *Thalassia testudinum* (native) and *Halophila stipulacea* (invasive) in Brewers Bay and UVI tanks were sampled and measured for shoot density, leaf height, fluorescence, light intensity and temperature in the summer of 2014. Our results show that the height of both seagrasses decreased over. However, the shoot density for both sunny and shaded *T. testudinum* increased whereas the *H. stipulacea* decreased over the four week period of our experiment. Furthermore, results displayed that fluorescence for *T. testudinum* shoots in the sunny tanks was higher than that compared to *H. stipulacea*. Fluorescence is much lower in the sunny tanks than in the field and shady tanks. This indicates that the stress levels are highest in the sunny tanks. We concluded that the better habitat to grow the seagrasses may be in shaded tanks because the temperature is not as high as the sunny tanks.

This research was funded by NSF HBCU-UP Grant #1137472.

## Antioxidant Activity in Commercial Spices

**Omani Tuitt, Elangeni Yabba and Amelle Williams**

Mentors: Bernard Castillo II, Ph.D.,<sup>1</sup>

Kynoch Reale-Munroe and Michael Renfroe, Ph.D.<sup>2</sup>

<sup>1</sup>University of the Virgin Islands, <sup>2</sup>James Madison University

Recent research indicates that antioxidants can be used as a prevention method of harmful degenerative diseases, such as cancer, cardiovascular and neurological diseases. The purpose of this research was to quantify antioxidant activity in commercial spices and to determine which spices had the highest total antioxidant activity. Based on previous published work, our hypothesis was that the hydrophilic antioxidant activity would be greater than the lipophilic antioxidant activity for all spices. Five different spices, namely basil, oregano, thyme, parsley and cilantro were purchased in St. Croix, USVI. Antioxidants from these spices were extracted in both aqueous and organic solvents, separately. The antioxidant activity was determined using an ABTS/H<sub>2</sub>O<sub>2</sub>/HRP decoloration method and monitored at 730 nm using a UV-VIS spectrophotometer. The antioxidant activity was reported as Trolox equivalent per grams of fresh weight. Our results showed that the anti-oxidant activity for all hydrophilic extracts were significantly greater than the lipophilic extracts. Our results also showed that oregano had the highest total antioxidant activity ( $529.15 \pm 9.87 \mu\text{mol TE}$  per gram of fresh weight) and parsley had the lowest ( $52.66 \pm 12.52 \mu\text{mol TE}$  per gram fresh weight).

This research was funded by NSF HBCU-UP (Grant Number HRD – 1137472).

## **Distribution and Movement of Two Conch Species, *Strombus Costatus* and *Strombus Pugilis*, in Brewer's Bay**

**Richard Laplace**

Dr. Stephen Ratchford (mentor)

University of the Virgin Islands, St. Thomas, US Virgin Islands

Conch are large sea snails that are harvested for food and shells. Over the past few months we have noticed a large population of both milk conch (*Strombus costatus*) and West Indian fighting conch (*Strombus pugilis*) in Brewer's Bay. It is possible these two smaller, lesser studied species are replacing the overfished queen conch (*Strombus gigas*) thus prompting our initial research: to determine their distribution and movement. In order to determine their distribution we snorkeled northeastern Brewer's Bay using 240m<sup>2</sup> transects and 480m<sup>2</sup> point counts and we found that the fighting conch were densely packed (0.73/m<sup>2</sup>) in a small area (~2400m<sup>2</sup>) of silt like sand while the milk conch were more widely distributed (0.073/m<sup>2</sup> over 10500/m<sup>2</sup>) either in the Syringodium sea grass or in the sand flats. While in the lab we used time lapse video recordings to observe these slow-moving snails. We found that fighting conch buried themselves more than milk conch did. Also the conch moved less during the morning than in the afternoon and night. To confirm this diel change in behavior in the field, we tagged and flagged conch and recorded their displacement over a short period of time (35-72 minutes) in the morning and afternoon and then calculated and compared their speed. Our first observation revealed that the conch tend to move faster in the afternoon than in the morning which agrees with our observations in the lab. A week later we found no difference in displacement, possibly due to the exclusion of mating pairs, egg laying, and buried conch during this second set of observations. We repeated the flag and tag techniques to determine if milk conch speed may be correlated with their habitat. We placed milk conch in a lugworm patch and in a Halophila patch, (where we do not find them) and on the sandy plain (where we do). We found that the conch moved more on the sandy plain and move very little in the lugworm and Halophila patches. Future studies may include: changes in their distribution by season, movement and behaviors at night, causes of low movement in Halophila and lugworm mounds, mating behaviors, as well as factors affecting burial.

This student completed this work in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by UVI NSF HBCU-UP Award Number: 1137472

## Neutron Stars

**Ruel Mitchel**

Dr. David Morris (mentor)

Etelman Observatory

University of the Virgin Islands, St. Thomas, US Virgin Islands

We present preliminary work on identifying the nature of X-ray sources in the globular cluster NGC6717. Previous work has suggested that one or more of the detected X-ray sources may be quiescent low-mass X-ray binaries, a binary star system comprised by a main-sequence star in orbit with a neutron star. Studying neutron stars gives us access to exotic jurisdictions that we can't explore here on Earth. A neutron star is a compact object that has roughly the mass of our Sun crammed in a ball approximately 10 kilometers in radius. A teaspoon of neutron star matter would weigh a billion tons on Earth, and they have magnetic fields trillions of times as strong as Earth's. Since we cannot sustain such conditions in laboratories, we observe neutron stars with telescopes to determine their properties and better understand these exotic forms of matter. Using NASA's Chandra X-Ray Observatory, SWIFT, and Hubble Space Telescope, we determine the flux of all X-ray binary sources in the NGC6717 globular cluster. We also analyze the X-ray variability of each source and search for any significant outbursts. I will display my results in examining this globular cluster using the data I analyzed from these telescopes. These data, together with previous studies of qLMXBs in other globular clusters (e.g. Guillot et. al. 2009), will help to constrain the dense matter equation of state.

This research was funded by NSF HBCU-UP Grant #1137472.

## **Limiting magnitude of the Virgin Island Robotic Telescope (VIRT)**

**Shakim Cooper**

Dr. David Morris (mentor)

Etelman Observatory

University of the Virgin Islands, St. Thomas, U.S. Virgin Islands

We present a limiting magnitude of the Virgin Island Robotic Telescope (VIRT) located at the Etelman Observatory. The goal of the limiting magnitude study is to determine the required exposure time to detect a source of a given brightness. Due to the brightness of the night sky, the relationship between exposure time and brightness sensitivity is not linear. This study will also identify the point of "diminishing returns" for the telescope, the point at which an increase in exposure time no longer produces a significant increase in brightness sensitivity. A graph of brightness versus exposure time with an asymptote to the limiting magnitude will be the main method of determining this value. Data reduction and analysis was accomplished primarily through the use of NOAO's IRAF utilities and the Smithsonian Astrophysical Observatory's DS9 image viewer.

This research was funded by NSF HBCU-UP Grant #1137472.

## Exploring Microclimates on St.Thomas

**Sharone Richards**

Avram Primack, Ph.D

Institute for Geocomputational Analysis and Statistics (GeoCAS)  
University of the Virgin Islands

Microclimates are local zones where the climate is different from the surrounding area. Climate is the yearly pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods of time. St. Thomas has wet and dry microclimates on the west and east ends of the island. This research assessed the available climate information to search for microclimates on St. Thomas. We collected data from the seven Davis Vantage weather stations located at Botany Bay, Antilles School, Coral World, Cowpet Bay, Pinkwhale Road, Chez Jobsis, and Njelteberg. The data were downloaded and converted into Excel format and corrected for missing information. Using the corrected data, we examined correlation plots and created regression models to see if temperature at the stations could be predicted by geography (latitude, longitude, and elevation) and other climate variables (precipitation, humidity, and barometric pressure). The results that were found were of the correlation analysis that showed most stations were positively correlated with each other, negatively correlated, and some was not correlated. Correlation analysis shows that Botany Bay is not well correlated with the other stations, suggesting it has its own microclimate. Coral Bay also seems to have its own microclimate having no correlation to some other stations. Regression analysis showed that geographic factors explained 27 percent of the variability in temperature. When other climate variables were added the model explained 67 percent of the variability. Regressions analysis shows that more than geography is necessary to fully explain the differences in the temperature with the stations. In the future, work should include adding more stations to collect data from more locations, checking stations to make sure they are operating properly, constructing regression models with better geographic and climate factors, and using of the regression modeling to create climate maps that can be coupled with land use to assess the potential for erosion.

This research was funded by NSF HBCU-UP Grant #1137472.

## No Chytrid Fungus Found on the Island of St. Thomas

**Sherika Alexis, Krislen Tison and Sheresia Gumbs**

Dr. Alice Stanford (mentor)

University of the Virgin Islands, St. Thomas, US Virgin Islands

Major insect predators such as frogs, function in maintaining a balance in the insect food chain. Populations of these amphibians are declining worldwide. A contagious fungus known as *Batrachochytrium dendrobatidis* (Bd) has been affecting frogs by disrupting their respiration and/ or osmosis regulation. When the frog loses its ability to breathe, heart failure occurs and this contributes to the drop in amphibian populations. The decline has already been noted in the Caribbean, primarily in Puerto Rico. Recent studies were done on the island of St. Thomas in 2011 where three out of one hundred amphibian samples tested positive for the fungus. Therefore, the aim of this study is to learn whether the Chytrid fungus is still active, and how it may negatively affecting the amphibian population on St.Thomas. We predict the 2014 study to yield similar, if not heightened results. To test this, frogs of the *Eleutherodactylus coqui* (E.coqui) and *Eleutherodactylus antillensis* species were captured from various sites and swabbed to collect any possible fungus present on the skin. After acquiring the possible Bd DNA, the frogs were released. Any DNA present on the swabs or on the frog collection bags were extracted. Lastly, PCR was done to amplify any possible Bd DNA. No samples tested positive, disproving the hypothesis and showing that the frogs here are not infected like the E. coquis in Puerto Rico. The seasonal time of testing may have possibly affected the results so further testing will be done in seasons other than summer.

This research was funded by NSF HBCU-UP Grant #1137472.

## Assessing Land Cover Change on Saint Thomas

**Stephen Santana**

Avram Primack, Ph.D. (mentor)

Institute for Geocomputational Analysis and Statistics (GeoCAS)  
University of the Virgin Islands

The RUSLE (Revised Universal Soil Loss Equation) describe the important factors in the soil erosion process. Land cover is one of these factors. Development changes natural areas to impervious surfaces that have different resistance to erosion natural. Land cover can be mapped using current available aerial photography and then comparing it to older photographs to quantify the direction of changes caused by human activity. We used ARC Desktop to map land cover changes for two watersheds on ST. Thomas.

We obtained aerial photography for Saint Thomas for the years 2010 and 1994 and the USGS watershed map for the territories. The two watersheds used were the location including the airport and UVI and to the immediate west. The land was classified as water, forest, open canopy, Rooftop, Runway, and Lawn using the 2010 photographs and compared with the 1994 photographs.

Some areas changed from forest to roads and buildings.

We have aerial photography dating back to the 1940's that could be included in this analysis to further our research and possibly allow us to gain a better understanding on some changes that occur from events such as hurricanes. Once completed an analysis of the entire territory could be done.

This research was funded by NSF HBCU-UP Grant #1137472.

## **Complexometric Titrations using a Platinum Indicating Electrode**

**Tonya Bartlette and Jonique George**

Dr. Stanley Latesky (mentor)

University of the Virgin Islands, St. Thomas Campus

In a complexometric titration, the end point of the titration is marked with an indicator. EDTA is a strong metal binding agent, which makes it ideal for the titration of metallic ions. Based on the fact that the reduction potential for a metal ion can change upon complexation of a ligand such as EDTA, we propose that this can be used to detect the endpoint of the titration of a metal ion using EDTA and a platinum-sensing electrode. Our experiment was broken into two methods. For the indicator method, we weighed out the solution in a flask, added water, buffer, and some indicator and then added EDTA from a burette. For the electrode method, we followed the same steps but instead of indicator, we used a small platinum-sensing electrode to monitor the changes and added the EDTA in increments, using a pipette. There was a color change with the indicator method and there was a sharp change in the graph of the electrode method. The experiment was successful. The sharp rise in the graphs meant that the platinum sensing electrode successfully monitored the titration and spotted the endpoint.

This research was funded by NSF HBCU-UP Grant #1137472.

## Motivation in Digital Game-Based Learning

Yentyl Levet

Dr. Marc Boumedine and Dr. Kimarie Engerman (mentors)  
University of the Virgin Islands, St. Thomas, US Virgin Islands

Typical classrooms are usually comprised of students with various learning styles; therefore, it is reasonable to have multiple teaching strategies that ensure maximized accommodation of each student. The school systems, for a long time, have often neglected logical-quantitative modes of instruction among others and have been bias toward linguistic modes. Howard Gardners Multiple Intelligence theory suggests that each student has a different mind and consequently remembers, performs, understands and learns in dissimilar ways (Gyan-Mante, 2013). If students' needs are appropriately met, then learning is better facilitated—leading to higher occurrence of positive reinforcement—and motivation eventually increases. Digital games provide means of incorporating the main intelligence learning styles such as visual/spatial, bodily/kinesthetic, musical/rhythmic, interpersonal, intrapersonal, linguistic and logical/mathematical into everyday teaching. Therefore, Ha: Effective use of educational digital games as instructional tools positively increases students' motivation and engagement during learning and performing educational tasks. To test this hypothesis, a 14-item questionnaire adapted from the Motivated Strategies in Learning Questionnaire (MSLQ) (Pintrich & DeGroot, 1990) was administered to 12 students, generally between 6-9 years old, as a pre-test and then as a post-test after having them play an educational digital game based around the concept of friction in relation to speed, "Bugs on a Plate." The adapted version of the MSLQ measured intrinsic motivation, extrinsic motivation and task value. The pre-test vs. post-test T-TEST showed statistically significant values at the  $p \leq 0.05$  confidence interval for task value, but not intrinsic and extrinsic motivation, therefore, the null hypothesis was rejected. For further investigation, future studies of a larger sample size and more longitudinal in nature are anticipated.

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This research was funded by NSF HBCU-UP Grant #1137472.

## **Intrusion Detection System: Effectiveness of Regular Expressions for Detecting Malware Signatures**

**Zandria Acosta** and Eliakin delRosario

Dr. Marc Boumedine and Troi Williams (mentors)

University of the Virgin Islands and the National Science Foundation

Cyber Security is a growing field within the computer science community. One important research area is malware detection and prevention. Malware steals and disrupts data, causes computer systems to crash and can create catastrophic events, if not monitored for daily. Because malware programs have malicious intentions, it is often possible to characterize harmful behavior using patterns or signatures within the executable files. One way to detect the presence of these signatures is through regular expressions. Regular expressions are patterns that are used to match character amalgamation in strings. By using regular expressions searching, text processing and data validations are easier to manage saving time and effort when it comes to automating pattern-matching processes. This work evaluates the application of regular expressions for the detection of malicious codes. The Java programming language is used to express the signatures and find malicious patterns. In order to test the effectiveness of my approach, I experimented with five different sized files ranging from ten kilobytes to thirty-five megabytes. I calculated the execution time for the detection program to find the signature. The signatures to be discovered inside has five characters that will be used to find within the five files provided within the experiment. As a result it gives the matching text, the starting and ending indexes, as well as the total time it took for the program to run through. The execution time is recorded and compared to the results of my research partner who is using another set of algorithms. Four different files were used during a one-week span. As a result the program was successfully completed and is now under further development to be able express more sophisticated patterns.

This research was funded by NSF HBCU-UP Grant #1137472.

## **Notes**

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- ◊ Title III - Environmental and Health Sciences Fund

### Event Organization Team

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