



National Science Foundation Louis Stokes Alliance for Minority Participation
Tampa Bay Bridge to Baccalaureate Alliance Undergraduate Research Experience
2018-2019 St. Petersburg College Student Research Projects



This material is based upon work supported by the National Science Foundation under Grant No. 1712738. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



Table of Contents

About the TB-B2B Undergraduate Research Experience Report	3
Microbiology Research Projects	5
<i>Antibiotic resistance of bacteria found on Tilapia fish</i>	6
<i>Bacteria found in running water from a water fountain</i>	9
<i>Types of bacteria found in homes where shoes are/aren't worn</i>	12
<i>Bacteria counts on door handles, toilet seats, and cell phones</i>	17
Mathematics and Statistics Research Project	22
<i>Number of college degrees in over saturated fields</i>	23
Environmental Science Research Project	39
<i>Colonization of native and invasive plant leaf litter by stream invertebrates</i>	40
Technology Research Projects	47
<i>Capability of Lego Pixycam camera to transmit images</i>	48
<i>Hosting a Cybersecurity capture the flag event (CTF) at SPC</i>	52
Contact Information	60
Appendix A	61



About the Tampa Bay Bridge to the Baccalaureate Undergraduate Research Experience Report

The Tampa Bay Bridge to the Baccalaureate (TB-B2B) Program provides resources and support to St. Petersburg College (SPC) Science, Technology, Engineering, and Mathematics (STEM) students as they work to achieve their 4-year STEM degree. The program is grant funded by the National Science Foundation (NSF) as part of the Louis Stokes Alliance for Minority Participation (LSAMP).

A goal of the NSF LSAMP TB-B2B grant, is for each College in the TB-B2B alliance to provide undergraduate research experiences (UREs) to students during their first and second years of undergraduate studies. Final reports of each URE conducted at SPC during 2018-19 are contained within this report.

Background

Prior to the start of each semester in 2018-19, TB-B2B enrolled students who had not yet completed a research project, were informed that 8-week research opportunities within their STEM major were available during the following semester, and included a paid stipend of \$250. Interested students were provided the name of a faculty in their field, and were directed to schedule a meeting with the faculty to discuss their research interests. SPC's URE Model is provided in Appendix A.

Eight St. Petersburg College TB-B2B students participated in 8-week UREs within their field of interest during 2018-19. Students received their stipend after all research project requirements were met at the conclusion of the eight weeks, including the completion of a final report. UREs included research projects in five categories, Microbiology, Mathematics/Statistics, Environmental Science, Robotics Technology, and Cybersecurity Technology.

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Listed below are the names of students who completed UREs with guidance from St. Petersburg College professors in five STEM disciplines, and submitted the final reports contained within this document.

Microbiology UREs conducted with Professor Shannon Ulrich, PhD

- Jonnetta Wilborn *Antibiotic resistance of bacteria found on Tilapia fish*
- Larissa Federmann *Bacteria found in running water from a water fountain*
- Dania Peralta *Types of bacteria found in homes where shoes are/aren't worn*
- Tara Wasson-Olden *Bacteria counts on door handles, toilet seats, and cell phones*

Mathematics and Statistics URE conducted with Professor Amy Kelley, MS

- Alexandria Johnson *Number of college degrees in over saturated fields*

Environmental Science URE conducted with Professor Erin Goergen, PhD

- Georgette Rutherford *Colonization of native and invasive plant leaf litter by stream invertebrates*

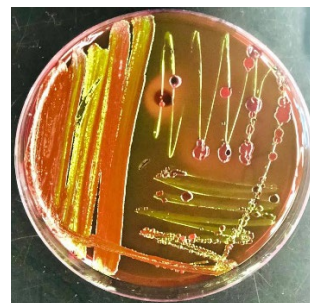
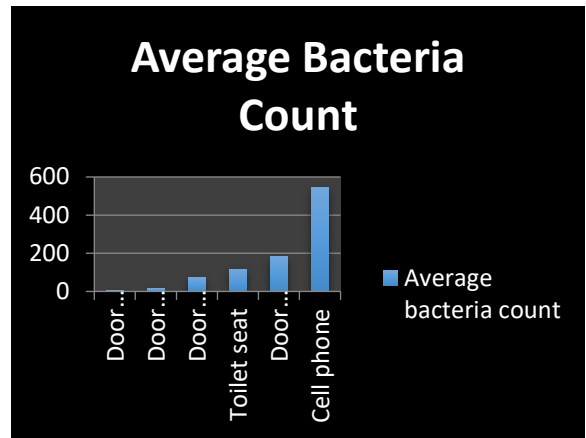
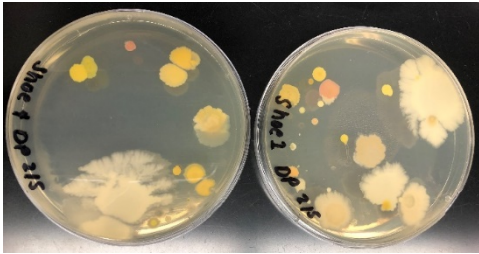
Robotics Technology URE conducted with Professor Dawn Ellis, MS

- James Fernandez *Capability of Lego Pixycam camera to transmit images*

Cybersecurity Technology URE conducted with Professor John Duff, PhD

- Lionel Plaisance IV *Hosting a Cybersecurity capture the flag event (CTF) at SPC*

Microbiology Research Projects



**Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program
Student Research Final Report**

Name: Jonnetta Wilborn

Professor: Shannon Ulrich, PhD

Date: 11/30/2018

Outline of Responsibilities

- Attending a weekly microbiology research meeting Tuesdays from 4:00-5:00PM
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor Ulrich either by phone or in person on a weekly basis for status updates and determination of the following week's goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Weekly Reports & Data

Week 1: Met with Dr. Ulrich to discuss possible research topics and toured the lab. Completed B2B associated forms. Learned about the equipment used in the lab.

Week 2: Read a chapter in a microbiology text book about bacteria. Discussed the research group's project on isolating bacteria from meat and determining antibiotic resistance profiles.

Week 3: Placed 50-g of tilapia into 100-ml of sterile 1X PBS (phosphate buffered saline). Mixed the sample for 1 min. Approximately, 20-ml of sample was then added to 2X TSB (tryptic soy broth) and incubated at 37°C for 48 hrs. Nutrient agar and EMB (eosin methylene blue) agar were prepared (Figure 1).



Figure 1. Preparation of Nutrient agar.

Week 4: Resulting enriched bacterial cultures were used as inoculum for a 4 quadrant streak method on EMB (eosin methylene blue) agar. Plates were incubated at 37°C for 24 hrs.

Week 5: Results of 4-quadrant streak plating were observed (Figure 2). Next, purity plated resulting colonies on Nutrient agar plates to ensure pure culture. Incubated plates at 37°C for 24 hrs.

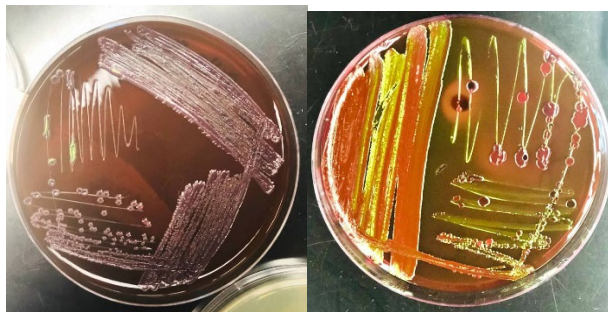


Figure 2. Four quadrant streak plate results.

Week 6: Kirby Bauer antibiotic resistance testing was completed.

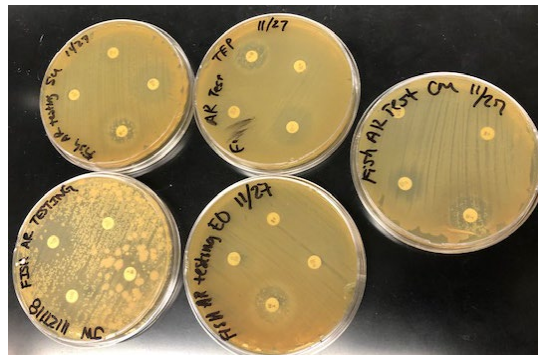


Figure 3. Antibiotic resistance results.



Conclusions

Tilapia is a farm raised fish. These fish are commonly exposed to various antibiotics during the farming process. It was suspected antibiotic resistance would be found in bacteria isolated from the tilapia meat. Results confirm isolates from tilapia did exhibit antibiotic resistance.

Techniques Utilized

Microbiological techniques learned:

- Media preparation
- 4 quadrant streak plating
- Purity plating
- Kirby Bauer Antibiotic Susceptibility Testing

Protocols Utilized

N/A



**Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program
Student Research Final Report**

Name: Larissa Federmann

Professor: Shannon Ulrich, PhD

Date: 11/30/2018

Outline of Responsibilities

- Attending a weekly microbiology research meeting Tuesdays from 4:00-5:00PM
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor Ulrich either by phone or in person on a weekly basis for status updates and determination of the following week’s goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Weekly Reports & Data

Week 1: Met with Dr. Ulrich to discuss possible research topics and toured the lab. Learned about the equipment used in the lab. Decided to test the number of microbes present in water from a drinking fountain when it is initially turned on and after 10-seconds. Received water sample collection kit.

Week 2: Read a chapter in Campbell’s Biology on the structure of eukaryotic and prokaryotic cell structure. Collected water samples from a fountain at a dog park. Nutrient agar was made.

Week 3: Filtered 40-ml of water on a 0.45um pore-sized filter to capture bacteria. The filter was placed on Nutrient agar and incubated at 25°C for 1 week.

Week 4: Counted plates. Isolated colonies from both sample plates using 4 quadrant streak method on Nutrient agar plates. Incubated at 37°C for 24 hrs.

Table 1. Results from bacterial enumeration from water samples collected from water fountains.

Sample	Results
Initial	38 CFU
Post-10 sec	5 CFU

Week 5: Purity plated resulting colonies on Nutrient agar plates to ensure pure culture. Incubated at 37°C for 24 hrs.



Figure 1. Bacterial cultures isolated using 4-quadrant streak plating.

Week 6: DNA extraction on 1 bacterial isolate from each sample using InstaGene Matrix (protocol below).

Conclusions

This research supports running water from a water fountain for approximately 10-seconds prior to drinking. This habit reduces bacterial loads in the water. More research should be completed to determine the significance of reduction.

Techniques Utilized

Microbiological techniques learned:

- Media preparation
- Water filtration
- 4 quadrant streak plating
- Purity plating
- DNA extraction



Protocols Utilized

PROTOCOL - DNA Preparation From Bacteria

BEFORE YOU START:

- Check incubator is set at 56°C
 - Set heat block to 100°C
-
1. Pick an isolated bacterial colony and resuspend it in 1 ml of autoclaved water in a microfuge tube.
 2. Centrifuge for 1 minute at 10,000–12,000 rpm. Remove the supernatant.
 3. Add 200 µl of InstaGene matrix to the pellet and incubate at 56°C for 15 minutes.
 4. Vortex at high speed for 10 seconds.
 5. Place the tube in a 100°C heat block or boiling waterbath for 8 minutes.
 6. Vortex at high speed for 10 seconds.
 7. Spin at 10,000–12,000 rpm for 2–3 minutes.
 8. Use 20 µl of the resulting supernatant per 50 µl PCR reaction.
 9. Store the remainder of the supernatant at -20°C.



Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program Student Research Final Report

Name: Dania Peralta

Professor: Shannon Ulrich, PhD

Date: 2/26/2019

Outline of Responsibilities

- Attending a weekly microbiology research meeting Tuesdays from 4:00-5:00PM
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor Ulrich either by phone or in person on a weekly basis for status updates and determination of the following week's goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Weekly Reports & Data

Week 1: Met with Dr. Ulrich to determine research project and toured the lab. Learned about the equipment used in the lab. Decided to examine number of bacteria on shoes and determine if removing shoes before entering the house leads to a decrease in bacteria on the floor.

Week 2: Nutrient agar was made. Learned aseptic techniques.

Week 3: Learned aseptic technique and applied it to culture *E. coli* and *S. aureus* on agar plates and broth. Swabbed 3 shoe samples.

Week 4: Observed *E. coli*, *S. aureus* (Figure 1) and shoe swab plates (Figure 2). Isolated colonies from both sample plates using 4 quadrant streak method on Nutrient agar plates. Incubated at 37°C for 24 hrs.

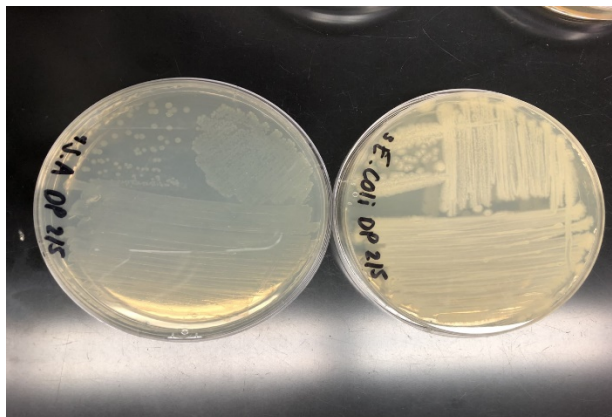


Figure 1. Cultured *S. aureus* and *E. coli* using aseptic techniques and 4-quadrant streak plating.

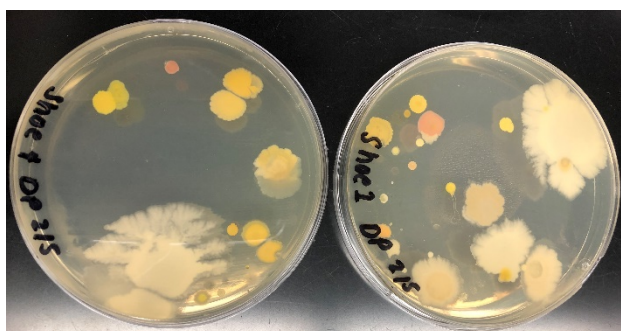


Figure 2. Shoe sample cultures.

Week 5: Two homes were sampled. The characteristics of the individual homes are outlined in Table 1. Samples were collected at 1', 5' and 10' intervals. Samples were collected using an eSwab Transport collection kit. A circular template measuring 60-mm in diameter was used to swab a consistent surface area totaling 2,826 mm². Samples were transported back to the lab and 0.1-ml of the eSwab transport media was spread plated on nutrient agar in duplicate as seen in figure 3A and 3B.

Table 1. Characteristics and occupant behavior associated with the two house samples.

Sample	Characteristics and Behavior of Occupants
House 1	Removed shoes prior to entering home; apartment building; no children under 14; no pets
House 2	Shoes are worn indoors; home with yard; children under 8; no pets

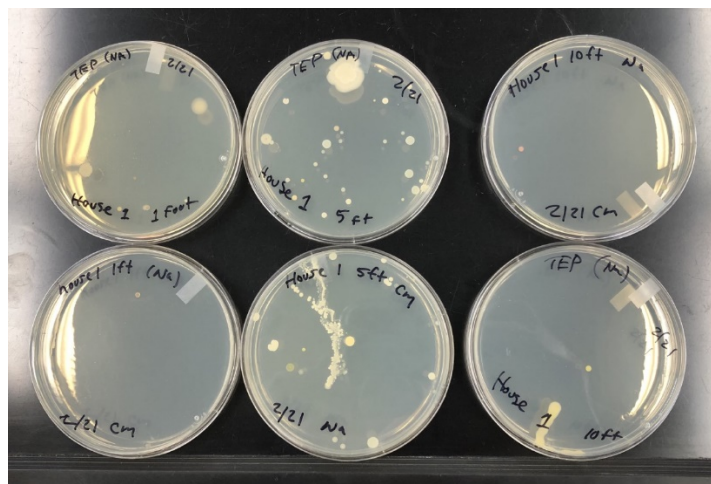


Figure 3A. House 1 bacterial cultures.

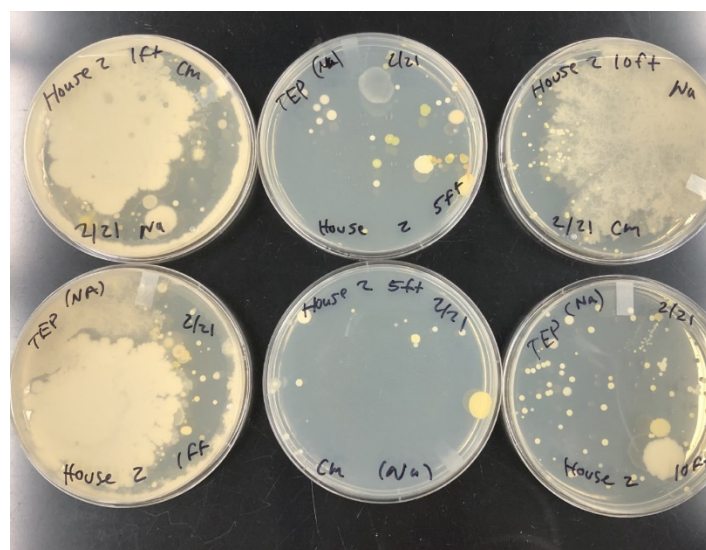


Figure 3B. House 2 bacterial cultures.

Week 6: Viewed Bacterial cultures from both house 1 and 2, counted colonies from each plate. Colonies counted for each plate were put into excel, and average were taken for each house at the 1',5' and 10' sampling (Figure 4A and 4B).

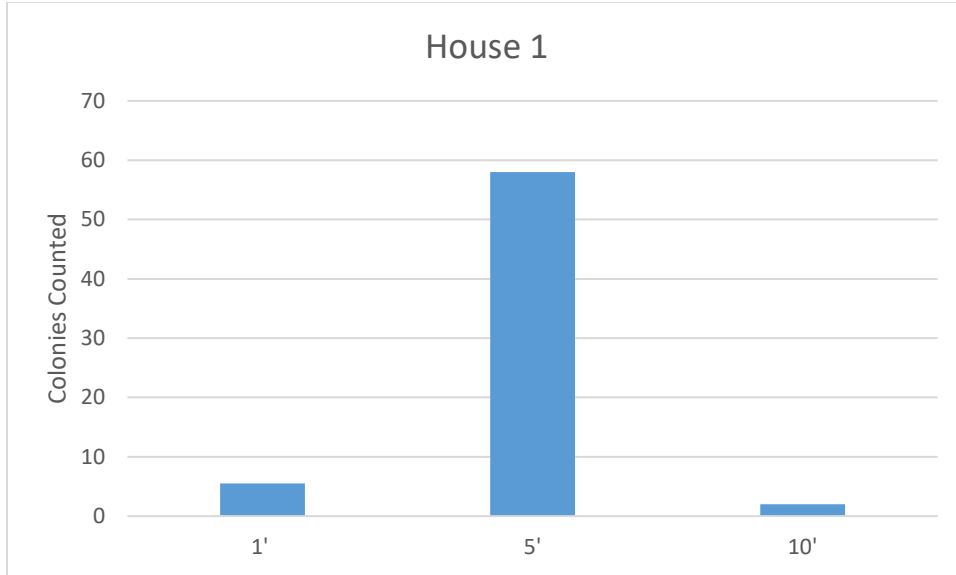


Figure 4A. Samples were collected from the floor in House 1, where shoes are not worn inside the house, at 1', 5' and 10' inside. Samples were plated in duplicate and average results are shown.

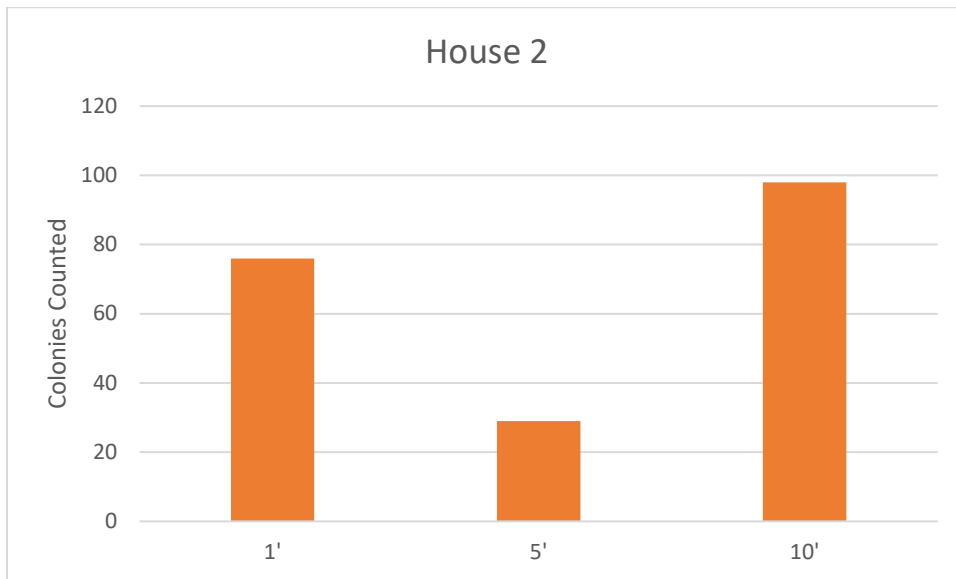


Figure 4B. Samples were collected from the floor in House 1, where shoes ARE worn inside the house, at 1', 5' and 10' inside. Samples were plated in duplicate and average results are shown.



Conclusions

Results after sampling both homes showed an inverse relationship with the most bacteria found 5' inside the home where shoes are not worn indoors whereas in the home with shoes worn indoors the most bacteria was found at 1' and 10' samplings. More research needs to be completed in order to determine if there are benefits to wearing shoes inside the house versus not.

Techniques Utilized

Microbiological techniques learned:

- Media preparation
- Aseptic techniques
- Aseptic sample collection
- 4 quadrant streak plating
- Purity plating
- Data analysis/excel use

Protocols Utilized

PROTOCOL – Nutrient Agar Preparation

1. Weighed 12 g of Tryptic Soy Agar and placed it into 300 ml of water.
2. Placed mixture on magnetic stirrer to mix.
3. Placed mixture in autoclave (121°C for 15 mins).



**Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program
Student Research Final Report**

Name: Tara Wasson-Olden

Professor: Shannon Ulrich, PhD

Date: 5/17/2019

Outline of Responsibilities

- Attending a weekly microbiology research meeting Tuesdays from 4:00-5:00PM
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor Ulrich either by phone or in person on a weekly basis for status updates and determination of the following week's goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Weekly Reports & Data

Week 1: Met with Dr. Ulrich to determine research project and toured the lab. Learned about the equipment used in the lab. Decided to examine number of bacteria on different surfaces.

Week 2: Made media for contact plates. Determined the testing sites of toilet seats, door handles, and cell phones.

Week 3: Poured plates for testing.

Week 4: Began sampling in different locations to observe the bacteria count on each surface and placed samples into the incubator.

Week 5: Removed samples from the incubator to count bacteria that was present on each surface. Took photos of the samples to include in the report as well as calculated the averages. Disposed of the samples.

Week 6: Placed the average of each sample and placed them into excel to create a chart for the results. Formed a conclusion based on the results gathered.

Sample	Average bacteria count
<i>Door handle outside building</i>	18
<i>Door handle inside building</i>	7
<i>Door handle inside restroom</i>	73
<i>Door handle outside restroom</i>	182
<i>Toilet seat</i>	116
<i>Cell phone</i>	544

Table 1. Average bacteria count on each surface tested.

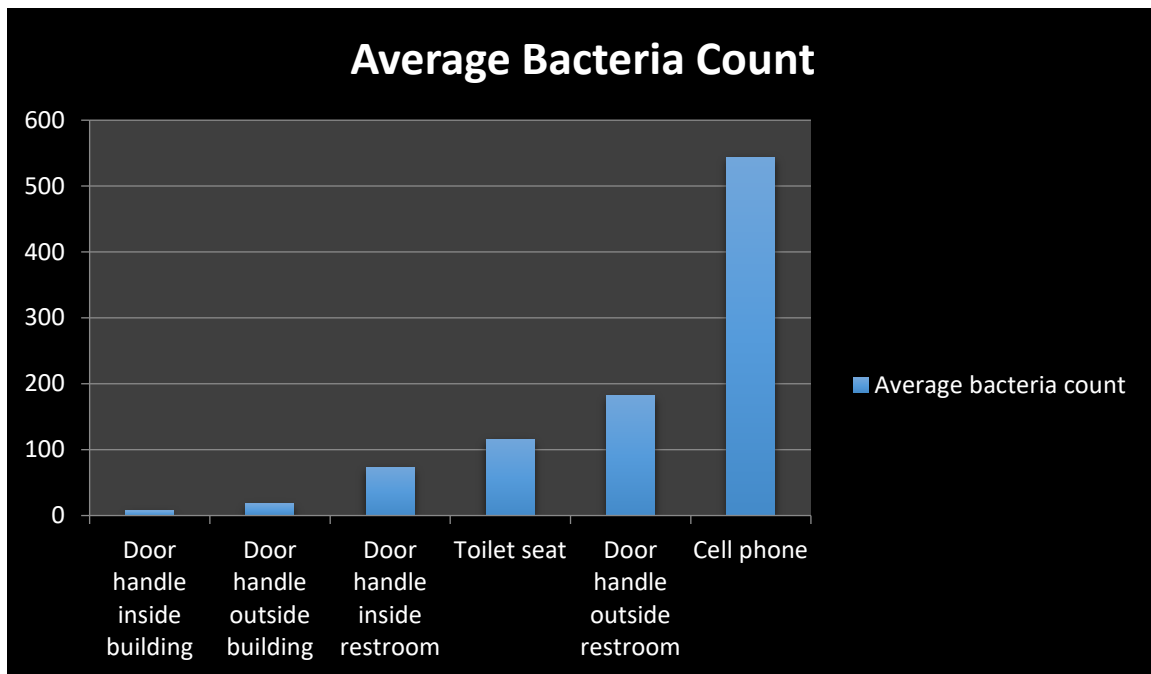


Chart 1A. The average bacteria count found on each surface placed in order of least to greatest.

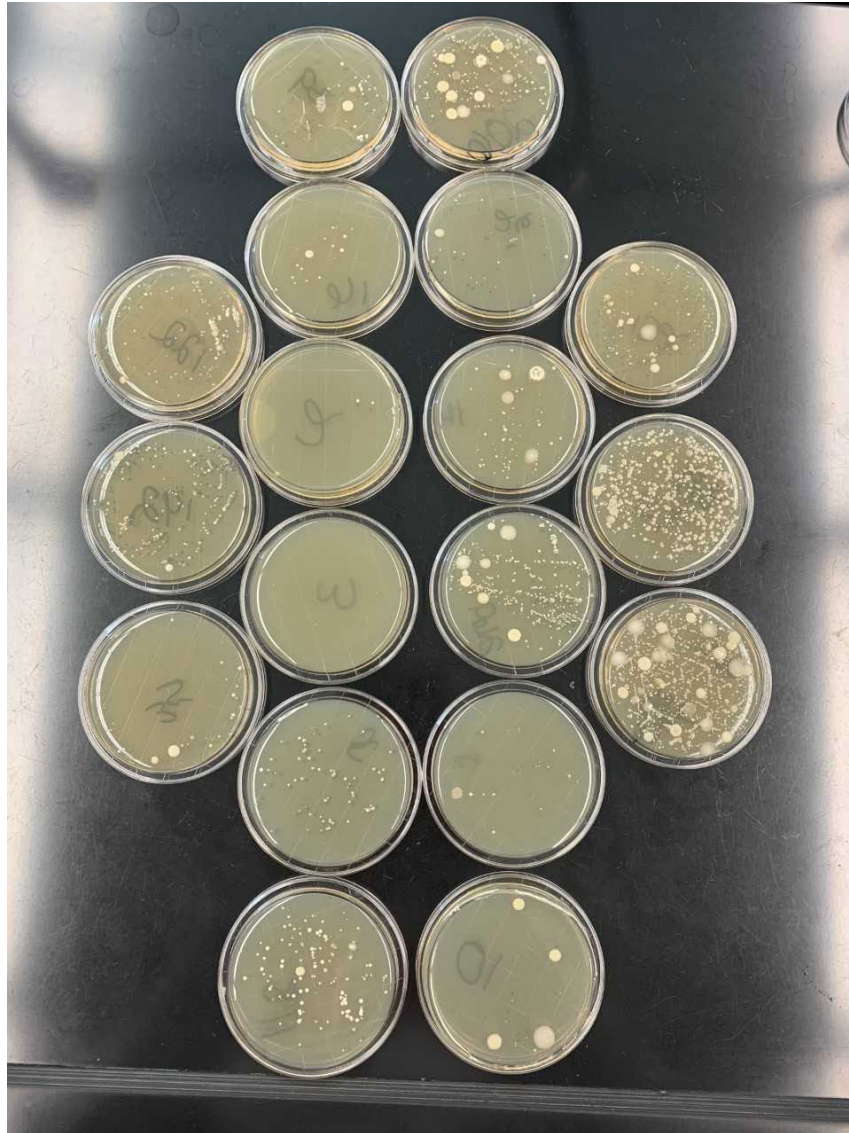


Figure 1A. Contact plate after one week of incubation. Sorted from the lowest to highest with cell phones being the furthest right.

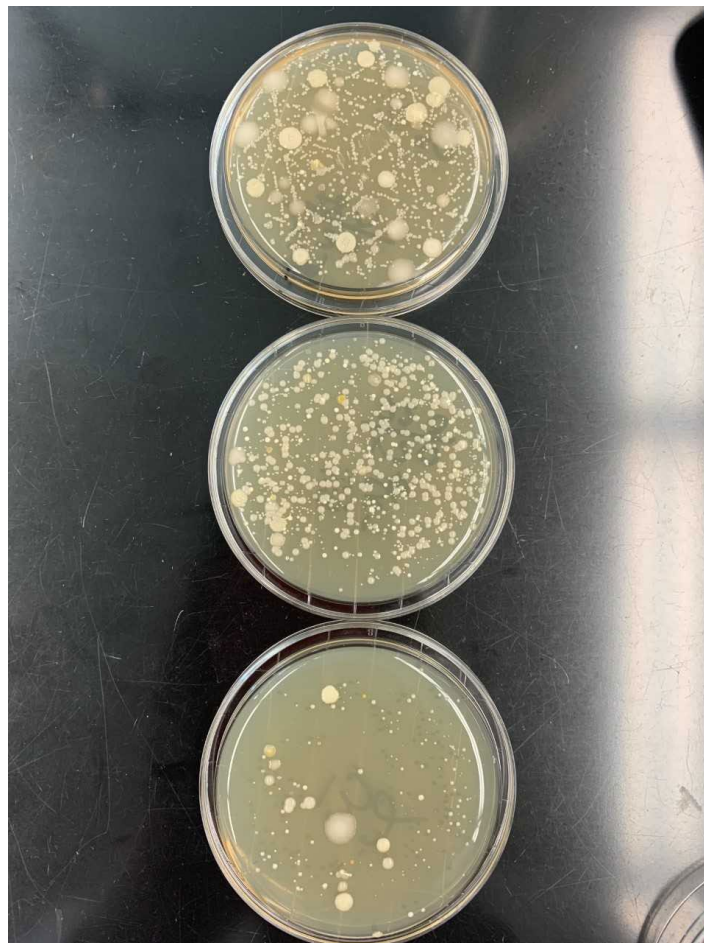


Figure 1B. Samples collected from cell phones. This image shows the large quantity of bacteria found on the surface of the average phone.

Conclusions

Results after sampling were surprising. Toilet seats are cleaner than most door handles. Cell phones have the largest bacteria count and are about four times higher than the other samples. The fact that door handles on the inside of restrooms are cleaner than the outside suggests that most people wash their hands after using the restroom. The door handle outside of the building has a lower bacteria count possibly due to the UV Rays and weather that is not ideal for bacteria growth.



Techniques Utilized

Microbiological techniques learned:

- Media preparation
- Sampling techniques
- Multiple samples collected at each site
- Creating contact plates
- Data analysis/excel use

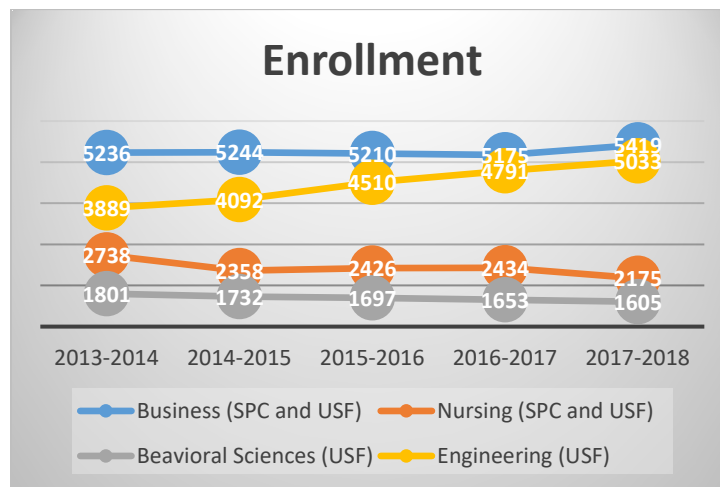
Protocols Utilized

PROTOCOL – Contact Plate Preparation

4. Weighed 12 g of Tryptic Soy Agar and placed it into 300 ml of water.
5. Placed mixture on magnetic stirrer to mix.
6. Placed mixture in autoclave (121°C for 15 mins).

Mathematics/Statistics Research Project

Occupation	Annual Mean Wage in Florida
Management Analyst	\$79,630
Registered Nurse	\$66,210
Marketing Analyst and Specialist	\$66,310
Mechanical Engineer	\$86,800



Q7: Do you feel like you are working within the field that you have your major in?	
ANSWER CHOICES	RESPONSES
Yes	50.00% 4
No	50.00% 4
TOTAL	8



Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program Student Research Final Report

Name: Alexandria Johnson

Professor: Amy Kelley, MS

Week 1: 3/25 – 3/31

After meeting with Professor Kelley on Friday, March 22nd we decided to do a project to see if there are too many people getting college degrees in oversaturated fields within the Tampa Bay area and try to come up with some solutions.

Background:

In the media I constantly see people share their thoughts on an issue that is concerning to me as a college student. A lot of people claim to not be working within the field that they majored in while in college and feel like college was a waste of time and money.

Goal:

To see if there is an issue with too many people majoring in oversaturated fields and find solutions to this issue.

Plan:

To create a survey that will essentially ask a person, who has obtained a bachelor's degree, what they're major was and if they feel as if they are working within the same field that they majored in. If not, I will ask further questions to get a deeper understanding of why they don't have a job in that field. To limit the sample, there will have parameters of only people who were born in between 1980 – 1995. Those people would all be around the same age and be old enough to have obtained a bachelor's degree. Another parameter will be to keep it at people who reside within the Tampa Bay area. To eliminate bias, I will make sure to include people of all races and ethnicities, and males and females.

Hypothesis:

I predict that I will find that careers you can achieve with a degree in Business or Psychology are oversaturated. As a result, that would mean that there are going to be a good amount of people who will likely not be able to get a job in a field within their major in the Tampa Bay Area.

Week 2: 4/1 -4/7

Drafting Survey:

This week I thought about how I could eliminate any bias and keep my population within the parameters I set up. After speaking with Professor Kelley, I learned that to eliminate bias I need to avoid cherry picking people to take my survey. She advised me to spread the word about my survey as much as possible to ensure that my results would be authentic.

Draft Survey Questions:

What year were you born?

What is your race/ethnicity?

What is your sex/gender?

What year did you graduate college with your bachelor’s degrees?

What college or university did you graduate from?

What was your major in college?

Do you feel like you are working within the field that you have your major in?

If not, why are you not working in the field that you majored in? (select all that apply)

Do you reside in the Tampa Bay Area?

Week 3: 4/8 – 4/14

Creating Survey:

After speaking with professor Kelley, I learned that there are many places you can go to online to create a survey. I went with Survey Monkey. I wanted to make sure that people who did not fall within my parameters had not taken my survey as well. To ensure this, when I asked what year they were born, I only gave them the option to pick in between the years of 1980 and 1985.

Link to Survey: <https://www.surveymonkey.com/r/96HC622>

Pictures of Survey:

<p>1. What year were you born?</p> <p><input type="radio"/> 1980 <input type="radio"/> 1988</p> <p><input type="radio"/> 1981 <input type="radio"/> 1989</p> <p><input type="radio"/> 1982 <input type="radio"/> 1990</p> <p><input type="radio"/> 1983 <input type="radio"/> 1991</p> <p><input type="radio"/> 1984 <input type="radio"/> 1992</p> <p><input type="radio"/> 1985 <input type="radio"/> 1993</p> <p><input type="radio"/> 1986 <input type="radio"/> 1994</p> <p><input type="radio"/> 1987 <input type="radio"/> 1995</p>	<p>2. What is your race/ethnicity?</p> <p><input type="radio"/> White or Caucasian <input type="radio"/> American Indian or Alaska Native</p> <p><input type="radio"/> Black or African American <input type="radio"/> Native Hawaiian or other Pacific Islander</p> <p><input type="radio"/> Hispanic or Latino <input type="radio"/> Another race</p> <p><input type="radio"/> Asian or Asian American</p> <p>3. What is your sex/gender?</p> <p><input type="radio"/> Male</p> <p><input type="radio"/> Female</p>
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4. What year did you graduate college with your Bachelor's degrees?

1998 2009
 1999 2010
 2000 2011
 2001 2012
 2002 2013
 2003 2014
 2004 2015
 2005 2016
 2006 2017
 2007 2018
 2008

5. What college or university did you graduate from?

6. What was your major in college?

7. Do you feel like you are working within the field that you have your major in?

Yes
 No

8. If not, why are you not working in the field that you majored in? (select all that apply)

There were not any available jobs.
 There were not any jobs available that met your financial needs.
 There were not any jobs available that met your personal needs.
 There were not any jobs that were close enough.
 Other
 You are working within the field you majored in.

9. Do you reside in the Tampa Bay Area?

Yes
 No

Distributing Survey:

To get the word out about the survey I emailed a link of it to Professor Kelley, so she could share it with more people. I also contacted Paula Knipp who is a part of the SPC Alumni Association. I tried contacting the USF alumni association but was unable to get a response back and I also posted it to my Facebook with an explanation of what my survey was about and encouraged everyone to spread the word.

Week 4: 4/15 – 4/21

Collecting results:

By the end of this week I had only received 8 responses, 2 of which I could not include in my data. One of those two did not reside within the Tampa Bay area and the other did not graduate college. I knew I needed to take my research in a new direction.

Link for results: <https://www.surveymonkey.com/results/SM-WVZJJZDBV/>

Results:

Q1

What year were you born?

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
1980	25.00% 2
1981	0.00% 0
1982	25.00% 2
1983	0.00% 0
1984	12.50% 1
1985	0.00% 0
1986	25.00% 2
1987	0.00% 0
1988	0.00% 0
1989	12.50% 1
1990	0.00% 0
1991	0.00% 0



ANSWER CHOICES	RESPONSES
1992	0.00% 0
1993	0.00% 0
1994	0.00% 0
1995	0.00% 0
TOTAL	8

Q2

What is your race/ethnicity?

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
White or Caucasian	87.50% 7
Black or African American	0.00% 0
Hispanic or Latino	12.50% 1
Asian or Asian American	0.00% 0
American Indian or Alaska Native	0.00% 0
Native Hawaiian or another Pacific Islander	0.00% 0



ANSWER CHOICES	RESPONSES
Another race	0.00% 0
TOTAL	8

Q3

What is your sex/gender?

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
Male	25.00% 2
Female	75.00% 6
TOTAL	8

Q4

What year did you graduate college with your bachelor's degrees?

- Answered: 7
- Skipped: 1

ANSWER CHOICES	RESPONSES
1998	0.00% 0
1999	0.00% 0
2000	0.00% 0
2001	14.29% 1
2002	0.00% 0



STEM TRANSFER
BRIDGE TO BACCALAUREATE



ANSWER CHOICES	RESPONSES
2003	0.00% 0
2004	14.29% 1
2005	14.29% 1
2006	0.00% 0
2007	14.29% 1
2008	0.00% 0
2009	14.29% 1
2010	0.00% 0
2011	14.29% 1
2012	0.00% 0
2013	0.00% 0
2014	0.00% 0
2015	14.29% 1
2016	0.00%



ANSWER CHOICES	RESPONSES
	0
2017	0.00% 0
2018	0.00% 0
TOTAL	7

Q5

What college or university did you graduate from?

- Answered: 8
- Skipped: 0

Did not graduate
4/17/2019 8:37 PM
Bryan College
4/17/2019 1:56 AM
St. Petersburg College
4/17/2019 12:35 AM
University of south Florida
4/17/2019 12:01 AM
University of South Florida
4/16/2019 11:15 PM
Florida state university
4/16/2019 11:10 PM
Florida State
4/16/2019 2:03 PM
St. Petersburg College
4/16/2019 1:47 PM

Q6

What was your major in college?

- Answered: 8
- Skipped: 0

N/A
4/17/2019 8:37 PM
Finance / Economics
4/17/2019 1:56 AM
Elementary Education
4/17/2019 12:35 AM
Statistics
4/17/2019 12:01 AM
Nursing
4/16/2019 11:15 PM
Criminology and Sociology
4/16/2019 11:10 PM
English Lit
4/16/2019 2:03 PM
Information Technology
4/16/2019 1:47 PM

Q7

Do you feel like you are working within the field that you have your major in?

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
Yes	50.00% 4
No	50.00% 4
TOTAL	8

Q8

If not, why are you not working in the field that you majored in? (select all that apply)

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
There were not any available jobs.	0.00% 0
There were not any jobs available that met your financial needs.	12.50% 1
There were not any jobs available that met your personal needs.	12.50% 1
There were not any jobs that were close enough.	12.50% 1
Other	50.00% 4
You are working within the field you majored in.	50.00% 4
Total Respondents: 8	

Q9

Do you reside in the Tampa Bay Area?

- Answered: 8
- Skipped: 0

ANSWER CHOICES	RESPONSES
Yes	75.00% 6
No	25.00% 2
TOTAL	8

Week 5: 4/22 – 4/28

New Plan:

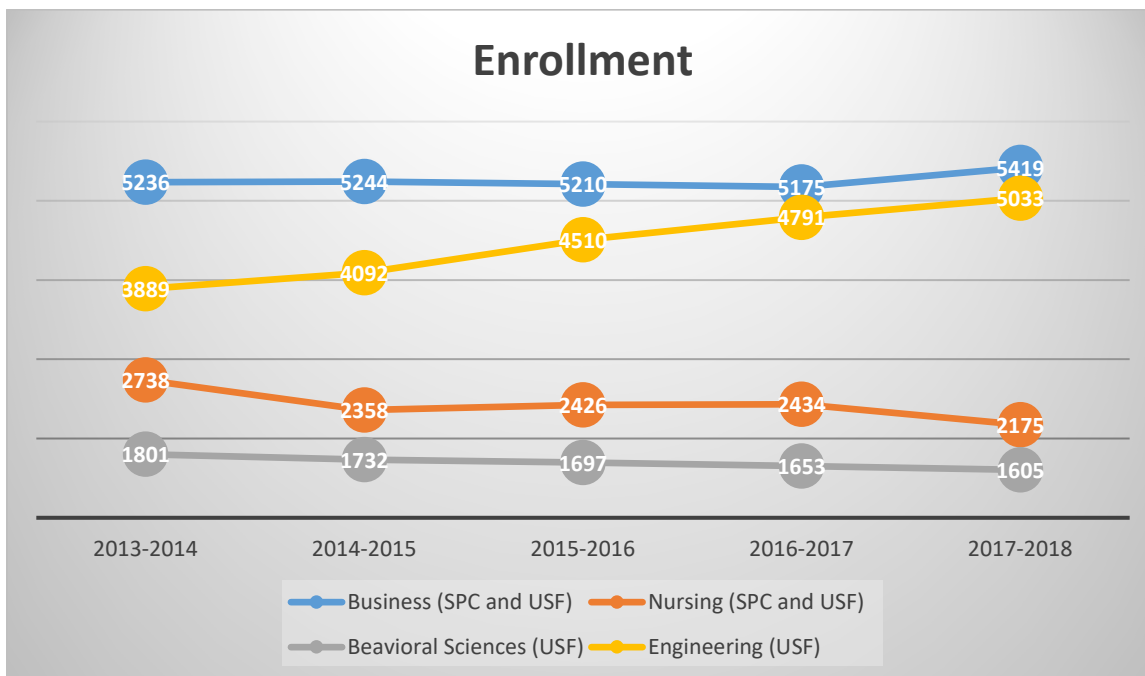
Keeping the same goal in mind, I came up with a new method. I decided to investigate enrollment for the past 5 years at SPC and USF. I would then pick the 4 majors with the largest enrollment and compare those numbers to projected job openings within those fields in the Tampa Bay Area and/or Florida. Also considering that 1 of the respondents felt as if they could not find a job that paid well enough, I also decided that I should look at where Florida falls on the cost of living index. I will pay attention to how much these jobs pay to see if they would pay enough for someone to live in Florida and start a family.

Majors with the Largest enrollment:

After my investigation I found that Business, Engineering, Behavioral Sciences (i.e. Psychology), and Nursing were the majors with the largest enrollment between SPC and USF.

SPC Fact Book <http://go.spcollege.edu/central/ir/index.htm>

USF Fact Book <https://www.usf.edu/ods/data-and-reports/system-facts.aspx>



Note: Enrollment for business majors consistently increased for SPC. It decreased for USF up until 2017, then increased again for the 2017-2018 school year. Enrollment for Nursing consistently decreased for both SPC and fluctuated for USF.

Conclusions drawn from fact books:

I was not able to find how many students graduated with a degree in each major each year from USF. Due to this I could only conclude how well new students replaced people who graduated, dropped out, or switched majors each year; but I could not compare the number of new students to the number of graduates. For example, between the 2013 – 2014 school year and the 2014 – 2015 school year I can conclude that new students who were majoring in business replaced people who graduated, dropped out, or switched majors by 100.08%. I cannot tell how many students graduated with this major and entered the work force.

Predictions:

There would probably need to be more job openings than what I predicted for each major if you also consider the competition they would face from people business graduates who want to move to the Tampa Bay area or are just willing to take a job wherever they get one. My predictions also do not account for graduates at USF or SPC in the years before 2019.

The enrollment for business was consistent, there was an overall 3.5% increase in enrollment within the past 5 school years. I averaged the number of enrollees over the past 5 years and that came out to about 5,257 students. Predicting that these many students will graduate somewhere in between now and the next 5 years, the Tampa Bay Area would need to have 5,257 job openings that require a bachelor's degree in business by 2024 for all these graduates to get a job within the field they majored in and stay in the Tampa Bay area.

Enrollees for engineering consistently increased drastically. Enrollment went up by 29.4% within the last 5 school years. Due to this, I concluded that averaging the number of enrollees over the past 5 school years would not be the best option. Instead I based my prediction off enrollment of the most previous school year. Enrollment for Engineering hit its highest point so far in the 2017 – 2018 school year at 5033 enrollees. Predicting that there will be 5033 students graduating with a degree in engineering, there will have to be 5033 new job openings that require a bachelor's in engineering by 2024 for all these graduates to get a job within the field they majored in and stay in the Tampa Bay area.

Enrollees for nursing consistently decreased drastically. Enrollment went down by 20.6% within the last 5 school years. Due to this, I concluded that averaging the number of enrollees over the past 5 school years would not be the best option. Instead I based my prediction off enrollment of the most previous school year. Enrollment for nursing hit its lowest point so far in the 2017 – 2018 school year at 2175 enrollees. Predicting that there will be 2175 students graduating with a degree in nursing, there will have to be 2175 new job openings that require a



bachelor's in nursing by 2024 for all these graduates to get a job within the field they majored in and stay in the Tampa Bay area.

Enrollees for behavioral sciences consistently decreased significantly. Enrollment went down by 10.9% within the last 5 school years. Due to this, I concluded that averaging the number of enrollees over the past 5 school years would not be the best option. Instead I based my prediction off enrollment of the most previous school year. Enrollment for behavioral sciences hit its lowest point so far in the 2017 – 2018 school year at 1605 enrollees. Predicting that there will be 1605 students graduating with a degree in a behavioral science, there will have to be 1605 new job openings that require a bachelor's in a behavioral science by 2024 for all these graduates to get a job within the field they majored in and stay in the Tampa Bay area.

Week 6: 4/29 – 5/3

Comparing enrollment to new job openings:

It is possible to get a job as some sort of financial specialist with a degree in business, but it is not likely because of the competition one would face with other people with degrees in finance or accounting. I limited my search to jobs in business operations. There was a national projection of 598,800 new job openings in business operations from 2014-2024 according to the Bureau Labor if Statistics. Out of all the jobs under business operations, a management analyst looked like the most obtainable and desirable job for someone graduating with a bachelor's degree. There is projected to be 208,500 openings within the US. The 10th percentile pay is \$45970 a year, the median is \$81320 a year and the 90th percentile pay is \$150220 a year. Florida makes up for 6.5 % of currently employed management analysts. If Florida were to keep that percentage between 2014 and 2024, that would mean there would have been about 13,553 job openings for a management analyst in Florida. Based off my prediction of students graduating with business degree, if they were all to go for this job and get it they would take up 38.8% of the new jobs for that position in Florida. There is not a high likelihood of that happening because there are still a lot of other graduates in Florida that they will be competing with. Another thing to note is that there were 364,000 degrees in business awarded nationally in in the 2014-2015 school year according to the National Center for Education Statistics, and only a national projected job opening of 598,000 jobs from 2014-2024 in business operations. This means that many people will likely need to get jobs that will require them to learn and obtain more skills in things such as finance, so they can get other jobs, or they will need to open their own business to stay within the field they majored in.

The most common career for someone who has a bachelor's in nursing is a registered nurse. There is a national 438,100 job growth projection for registered nurses from 2016 – 2026



according to the Bureau of Labor Statistics. This does not account for the new jobs that could possibly open from people leaving their job as a registered nurse for various reasons. Florida make up for 6.02% of nurses in America. If Florida were to keep this same percentage for new jobs in nursing in America, there would be 72,774 new jobs openings for registered nurses from 2016-2026. If the number of people I predicted to have a nursing degree from SPC and USF from 2019-2024 go for and get these jobs, they would make up about 3% of the new nursing jobs in Florida from 2016 – 2016. There is a great likelihood of that happening despite any competition they might face from people with nursing degrees at other schools.

I was very surprised by what I've found out about majoring in behavioral sciences. The most common behavioral science degree is Psychology. Psychology majors are not only limited to careers as counselors or social workers. They can also achieve careers in marketing and public relations. One career I investigated was market research analysts and marketing specialists. There is projected to be 138,300 job openings nationally from 2016-2026. Florida makes up 5.5% of those currently employed in this occupation. If Florida keeps this percentage, about 7,607 jobs in this occupation will be available between 2016-2026. If everyone I predicted to have gotten this degree goes for a job in this field and gets it, they would take 21.1% of new jobs in market research analysis and specialization. There is not a great likelihood of this happening. There are still many other careers someone can achieve with a degree in psychology, but it is also important to note that there were 118,000 degrees in Psychology awarded in the 2014 – 2015 school year according to the National Center for Education Statistics. I have not been able to find anything with job growth projections that covers all or a good number of careers that people can obtain with a bachelor's degree in psychology. Determining the probability for jobs for a psychology major in the Tampa Bay area will require deeper investigation.

After looking at various sites I have found that mechanical engineering is the most common type of engineering. There are projected to be 25,300 new jobs nationally for Mechanical engineers in between 2016 and 2026. Florida currently makes up 2.5% of mechanical engineers in the US. If Florida keeps this percentage there will be 633 new jobs for mechanical engineers in Florida. According to the Florida Department of Economic Opportunity, there will be 5,237 new jobs in Heavy construction and civil engineering between 2018 and 2026. In my prediction of 5033 students graduating with a degree in engineering between 2019 and 2024, there are no specifications of the number of enrollees in each type of engineering. To determine the likelihood of an engineering major at USF to get a job in Florida I would need to know the most common types of engineering at USF, so I could compare those to projections for those careers in Florida.

Comparing wages in these fields to the cost of living in Florida:

Florida has a score of 110.9 on the cost of living index which is 10.9 % higher than the national average. So, it is not surprising that according to the Economic Policy Institute, it is estimated that it would cost \$77,064 for a family of 2 adults and 2 children to live comfortably in the Tampa/St. Petersburg/Clearwater metro area.

Occupation	Annual Mean Wage in Florida
Management Analyst	\$79,630
Registered Nurse	\$66,210
Marketing Analyst and Specialist	\$66,310
Mechanical Engineer	\$86,800

Note: This data was collected from the Bureau of Labor Statistics.

A person with any of these jobs in Florida would most likely be able to take care of themselves. A registered nurse or marketing research analyst and specialist would need to find some form of supplemental income from another person or themselves to take care of a family of 4. A management analyst and mechanical engineer would be able to take care of a family of 4 on their own.

Conclusions:

Based off the research done I have determined that there is an oversaturation of business majors in the Tampa Bay Area. This means that many business majors from USF and SPC would have to move out of Florida to get a job within their major or open a business to stay in Florida and still work within their major. If a person can obtain the most common job for business operations, a management analyst, they would be able to take care of themselves and a family of 4. There is not an oversaturation of nursing majors in the Tampa Bay area. If not all, most nursing majors from USF and SPC will be able to find a job in nursing in Florida. If a person obtains a career as a Registered Nurse, they could take care of themselves but would need supplemental income to support their family. I was not able to conclude if there was an oversaturation of engineering and/or psychology majors. If a person obtains a career as a marketing research analyst and specialist, they could take care of themselves but would need supplemental income to support a family of 4. If a person can obtain a job in mechanical engineering, they would be able to take care of themselves and a family of 4.

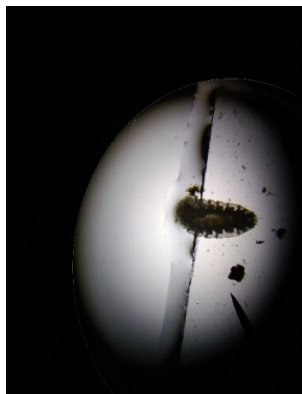
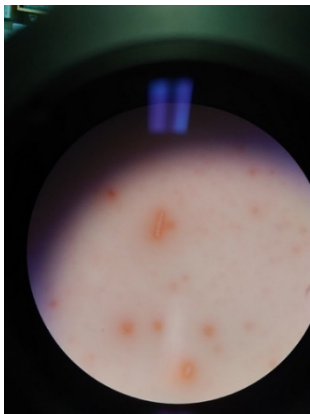
Solution:

One possible solution for oversaturation in certain majors would include aptitude and personality tests. At SPC it is required for every student to take smart start. In smart start we have to take an aptitude/personality test. We could take these tests and see if a student who is



majoring in an oversaturated field also has strengths in another area. The advisor could then speak to them and share with them that there is a great possibility that they will not be able to find work within their major. They could then share other majors the student could do well in, based off their strengths, that are not oversaturated. Or the conversation could encourage the student to take up a minor in something else which would increase their possibilities for careers and make them more competitive in their field.

Environmental Science Research Project





**Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program
Student Research Final Report**

Name: Georgette Rutherford

Professor: Erin Goergen, PhD

Date: 3/3/2018

Outline of Responsibilities

- Attending a weekly research meetings and/or participating in ecological restoration at Moccasin Lake Park
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor either by phone or in person on a weekly basis for status updates and determination of the following week's goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Weekly Reports & Data

Week 1 (January 10th): Met with Dr. Goergen to discuss the research projects being conducted out at Moccasin Lake and to get ideas of what projects can be conducted.

Week 2 (January 14th): Met with Dr. Goergen to develop an experimental design to determine if leaf litter from an invasive species, Caesar weed (*Urena lobata*), had different colonization of stream macroinvertebrates when compared to leaf litter from a native species, wild coffee (*Psychotria nervosa*).

Week 3 (January 21st): Read background material on community ecology and succession. The research project was focusing on community ecology, and community assembly in particular. Community ecology examines the relationships between different populations of species living in the same environment. Community assembly is related to community ecology and more specifically examines factors that influence construction of a community. This reading relates to the project because we examined colonization by stream invertebrates in 2 different species leaf litter. One of the species is a native to Florida, Wild coffee (*Psychotria nervosa*) and a second was a non-native invasive species, Caesar weed (*Urena lobata*). The question we were addressing is what type of macroinvertebrates would colonize the leaf litter, and did it differ by leaf substrate.

Week 4 (January 28th): Construction of leaf litter bags. Materials used to conduct the litterbags included 11 white mesh plastic bags. Each type of leaf litter was places separately into mesh bags until they were slightly more than half full of plant tissue.



Figure 1. These are examples of how we had installed the leaf litter bags put them along the banks of the stream in pairs, 1 bag of wild coffee and 1 bag of Caesar weed.

Week 5 (February 4th) : First visit to Moccasin Lake Nature Park (Lat & Longitude: 27 degrees 58 48N/82 degrees 43 30W) to install leaf litter bags and to collect biotic and abiotic data. Abiotic variables measured using the Earth Echo water sampling kit included:

1. Water temp
2. Turbidity
3. Dissolved oxygen
4. pH

Observations about the area and vegetation were also recorded. There were an abundance of different plant species around the outer banks of the stream. Examples are Elephants ear (*Colocasia esculenta*), Oak tree (*Quercus* spp), Papyrus sedge (*Cyperus papyrus*), muscadine grape (*Coccoloba uvifera*), Ostrich fern (*Matteuccia struthiopteris*), small taro, Cherry laurel tree (*Prunus caroliniana*), Caesar weed (*Urena lobata*), and native wild coffee (*Psychotria nervosa*).

Table 1. Results of abiotic water sampling at Moccasin Lake

Water Temp:	20 degrees C
Turbidity:	0 JTU
Dissolved Oxygen:	4PPM at 42%
pH:	7.5

A water sample was brought back to the lab and used to inoculate NA plates to look for bacteria present in the stream water.



Figure 2. Measuring the pH of the stream water at Moccasin Lake Nature Park with the Earth Echo kit and the initial bacterial culture obtained from plating the water sample.

Week 6 (February 11th): Subculture of bacterial colonies was examined and bacterial colonies were stained. The first stain used was a negative stain, which is used for cells that are too delicate to withstand heat-fixing and also for visualizing individual bacterium morphology. The second stain used was a capsule stain, which stains extracellular structures surrounding the cell wall. An example of this is with the first pink picture on the left that has an extracellular structure (figure 1).

Techniques used

Nigrosin: Obtain 2 microscope slides, apply 1 drop of nigrosin stain on the one end of one slide. Then add bacterial colony to the stain and use the second slide to evenly spread the stain out on the first slide. Allow the stain to air dry and then observe under 1000x on the microscope.

Capsule stain: Obtain 2 microscope slides, apply 1 drop of Congo Red stain on the one end of one slide. Then add bacterial colony to the stain and use the second slide to evenly spread the stain out on the first slide. Air dry the sample, then add Maneval's stain and let it sit for 60s before rinsing with distilled water. Observe with microscope at 1000x and record results.

Stain results:

1. Plate B – Color (Pink)
2. Plate A- Color (Cream)
3. Plate A-Color (White Furry)
4. Plate B-Color (Purple)
5. Plate B-Color (Yellow)
6. Plate A- No growth

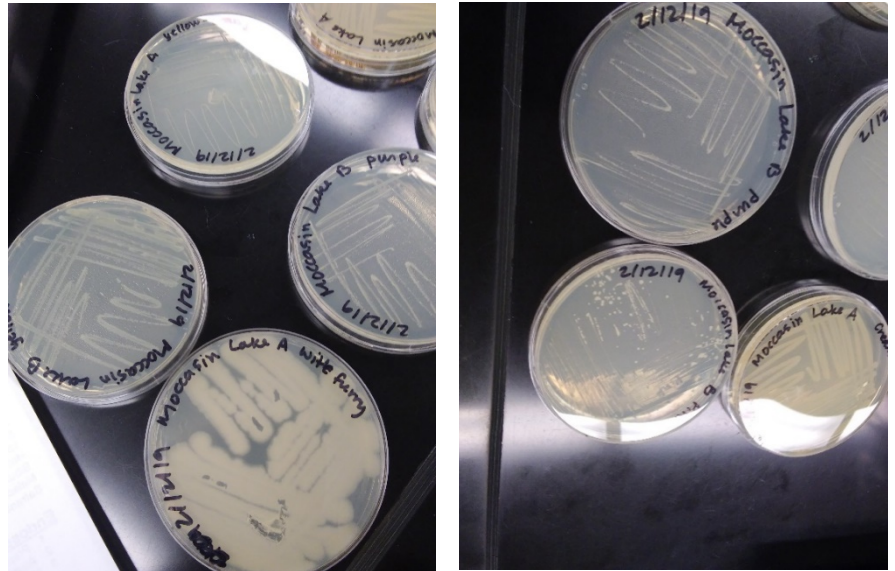


Figure 3. Results of colony isolation from stream water samples collected on 2/4/19.

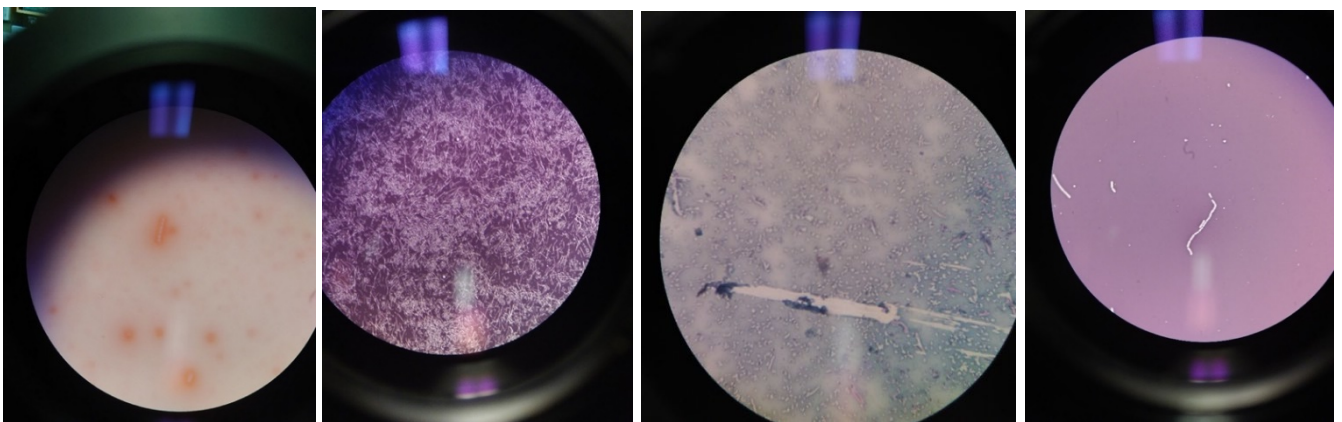


Figure 4. Photos from L to R: Capsule staining used with Congo Red and Maneval drops. Negative staining using Nigrosin drops.

Week 7 (February 22nd): Collecting water samples to look for organisms present in the stream and record abiotic measurements. Results of the water sampling indicate that the water was very tannic and yellow but there was a difference when one of the weeks it had rained and on the week of February 22nd the water was less tannic and more of a light yellow.

Table 2. Results of abiotic water sampling at Moccasin Lake Park

Water Temp:	22 degrees C
Turbidity:	0 JTU
Dissolved Oxygen:	4PPM /42%
pH:	8



Figure 5. Representative organisms found in stream water samples collected on 2/22/19. Observed 1st image is a type of diatom in the middle left bottom of image, the middle image is a leech (Phyla Platyhelminthes) the last image is a crustacean.

Week 8 (March 4th): Collection of leaf litter bags. Four of each leaf litter type (Wild coffee and Caesar weed) were brought back to the lab and examined for colonization by organisms. The difference between the two species in terms of plant tissue were that in the Caesar weed bags there was on average less diversity of organisms and also different numbers of each species. In the Caesar weed, we found more mosquito larvae, worms, and clams. In contrast, the Wild coffee had more gastropod snails and shrimp compared to the Caesar weed.



Figure 6. From left to right container with Wild coffee, Caesar weed, Wild coffee, Caesar weed.

Conclusions

The leaf litter from the invasive species had a different colonization of stream macroinvertebrates when compared to the leaf litter from the native species. Through observations and experimentation, we found that the native leaf litter had an average of 3.5 different species, nonnative species had an average of 3 different species present. Examples: Clams, mosquito larvae, and worms were more common in the Caesar weed. Gastropods, dragonfly larvae, and shrimp were more common in the wild coffee. There was a slight increase in water temperature, turbidity, and pH in week 7 but the dissolved oxygen stayed the same. After it rained, the water was less tannic and there was a faster flow of water. Another interesting observation was that while the wild coffee survived being in the water with mild to strong flows of the stream, the Caesar weed (*Urena lobata*) was almost completely decomposed after a few weeks.

Techniques Utilized

Field sampling techniques learned:

- Collecting water samples for plankton analysis with a plankton tow
- Collecting data on stream dissolved oxygen, pH, temperature, and turbidity

Ecological lab techniques learned:

- Use of compound and dissecting microscopes

Microbiological techniques learned:

- Staining of bacterial cultures (negative stain and capsule stain)

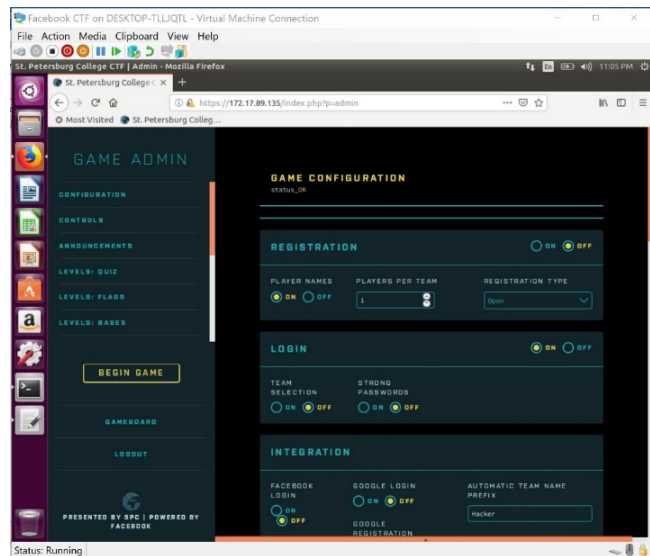
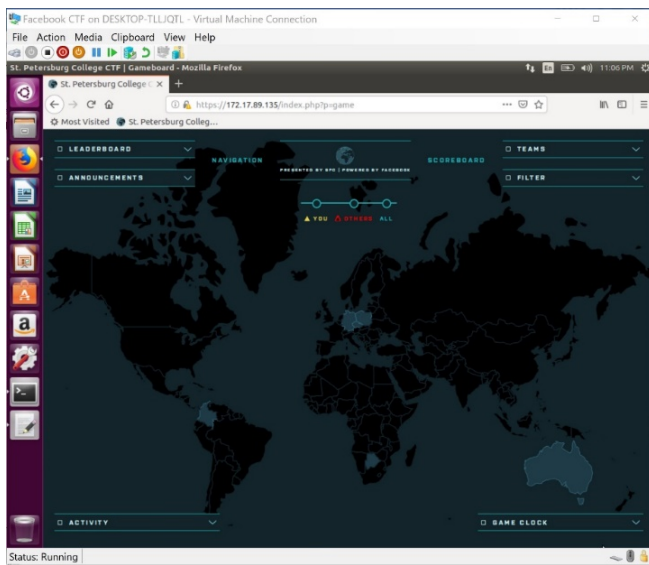
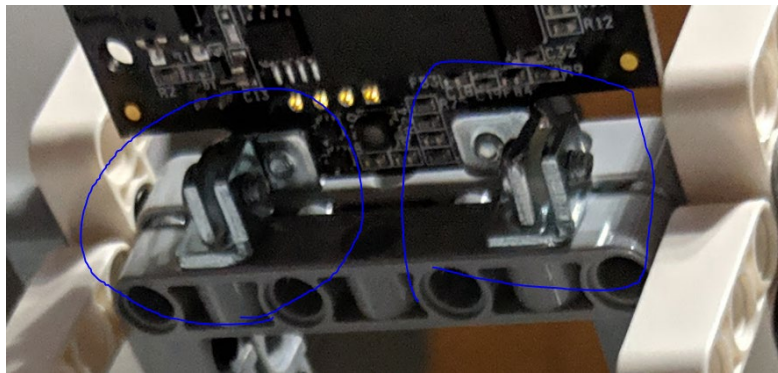
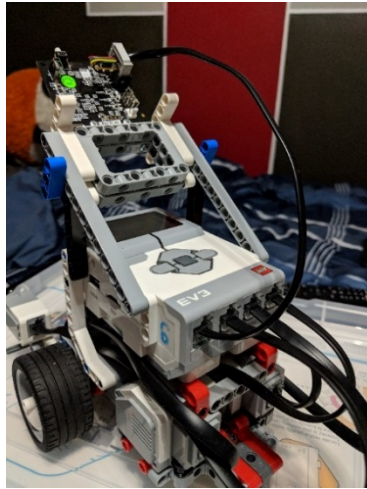


Protocols Utilized

PROTOCOL – Analysis of water samples for abiotic measures using Earth Echo Water kits.

1. Temperature: Using water sample, by emerging the bottle in the water for 3 minutes then record temperature of water by reading the color palate on the sample collection jar.
2. Dissolve oxygen: 2 tablets and shake wait 5 minutes to read results and compare the sample to the color comparison chart then to the first week results if any changes. Cold water can hold more dissolved oxygen than warm water, calculation of saturation %.
3. pH: 1 tablet shake and wait 5 minutes to read results compare to the color comparison chart and if the water is too high or too low macroinvertebrates organisms would die, move away and stop reproducing. The water on average should have a Ph of 6.5 to 8.0 being acidic or basic quality of the water.
4. Turbidity: emerge the sample collection jar and fill to the white line located inside of jar than compare the color comparison chart looking down to the secchi disk sticker measure the clarity of the water using JTU- Jackson Turbidity units.

Technology Research Projects





Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program Student Research Final Report

Name: James Fernandez

Professor: Dawn Ellis, MS

Date: 5/16/2019

Abstract

Lego Pixycam is a camera that is used with the Lego Mindstorm EV3 kit. The goal for this project was to see if it was able to transmit images to a monitor wirelessly similar to Nasa's Mars Curiosity Rover. Unfortunately, the camera was unable to achieve that goal as it wasn't designed for that purpose. I found another camera called Vision Subsystems v5, this would be the latest version that can capture an image and save it to a MicroSD card provided by the purchase. I outlined some steps in order to continue the project in case we want to continue using the Pixycam, but the result we want is not possible. If we still want to find the right device for the Lego kit, I suggest the Vision Subsystem as that is a cheaper alternative. However, depending on what can be done, it will require more information on what we can achieve with either camera.

Keywords: Lego, Pixycam, Lego Mindstorm EV3, Mars Curiosity Rover, Nasa, Vision Subsystems

The goal for this research project is to attempt to see if the Pixycam is able to transmit an image to the monitor of a computer via a wireless connection. Unfortunately, the Pixycam is unable to capture and transmit images wirelessly to a monitor because the Pixycam wasn't intended for this goal. The specifications provided by Robotshop say, "Pixy CMUcam5 Image Sensor (compatible with LEGO Mindstorms) is a fast vision sensor you can quickly "teach" to find objects, and it connects directly to Arduino and other controllers." (RobotShop). I believe the device wasn't built with a radio frequency signal to transmit an image, as that is needed for a device to send data wirelessly. However, with the information that I found so far with the Pixycam it has proven that this device will be unable to achieve the goal we truly want. Some forums I read explained that the best attempt for achieving goal is by screen capturing on your pc with the Pixycam attached Since the Pixycam is unable to do what we want it to do, I did find a similar camera that works with the Lego Mindstorm kit called the "Vision Subsystem v5". The device uses a microSD chip in order to save video or pictures to it autonomously (Vision Subsystem). Not only can it do that it does much more than the Pixycam, like tracking faces and eyes, built in Infrared blocking filter, PC not needed for autonomous operation, and it comes with the microSD to be able to save the feed that has produced by the camera (Vision Subsystem). This is the best alternative for us to reach the goal for capturing images. You can teach Pixycam to find an object and you can teach it to move that object, using the sensor kits,



to a specific place. However, with the kit sensors, the EV3 brick can't be taught to find a specific object directly. What the kit sensors are capable of doing, is allowing the device to find obstacles and avoid/change course via a guide. The kit can also use the camera to help find and complete its tasks. The Pixycam is helpful for a few tasks including:

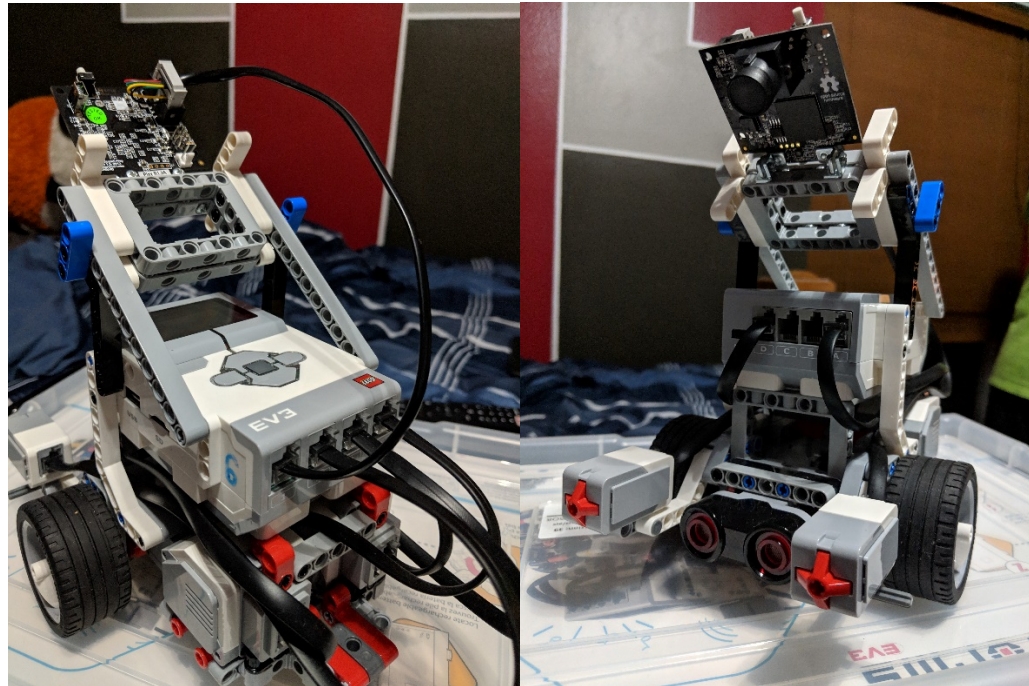
- Object detection
- Proximity reading

An example of object detection can be found on YouTube. For instance, a guy drew a figure eight line on paper so that the camera would follow the line. He also created directional pictures to turn the vehicle right or left. When the Camera recognized these pictures it would turn the direction instructed when the lines crossed. As for the proximity reader, I found that the camera can calculate the distance an object was at and it would keep its distance from the object without losing sight of that object.

STEPS

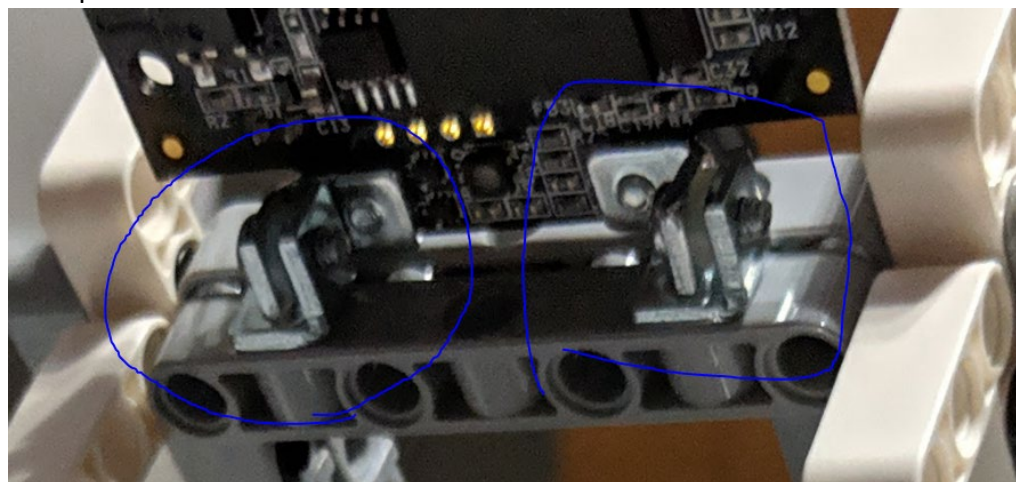
- I. Building your Lego Mindstorm EV3;
 - a. Follow the instructions booklet provided by the Lego kit to build the Vehicle.
 - b. Install the Lego Mindstorm Education EV3 program to your PC and connect the EV3 using the existing USB that the kit came with to install the latest firmware.
 - c. Once you have completed the following, test all the attachments by following the tutorial (provided by the program) to see if they are in working condition and learn what each one is used for.
- II. Installing the Pixycam;
 - a. Before we go building the attachment to the vehicle lets install the latest firmware to the pixycam.
 - b. Follow the directions given from this link <https://www.charmedlabs.com/pixystart>
 - c. Make sure you also download Pixymon from those instructions as that is needed in order for us to have the camera learn from the object you want it to follow.
- III. Building the stand for the Pixycam;
 - a. Find the right parts that the Lego kit comes with and find a way to have your camera face the direction you want it to go.

Example:



- b. Use the screws and L-Brackets provided by the Pixycam to attach your camera to the stand.

Example:



- c. Attach the jack to port 1 on the EV3 Brick.



Continuation:

Based on my research, the project could go anywhere depending on what the Principal Investigator would want to do. Since the goal of my research was to see if the camera can transmit data remotely to a monitor, the next steps would depend on whether we would be using the Pixycam or the Vision Subsystem v5. The Pixycam is meant to track an object that it was set for, but outside of that there's not much else its designed for. The Vision Subsystem v5 is capable of capturing video or an image and it gets stored into a microSD card for later use. Since Neither of these 2 cameras will transmit an image remotely to a monitor, I would suggest that on the next phase; The Principal Investigator tests a lego kit that is based on an Arduino or RaspberryPi device. While the cost may be an issue, these kits would allow for more customization for the result we seek to achieve.

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RobotShop. (n.d.). Retrieved May 13, 2019, from <https://www.robotshop.com/en/pixy-cmucam5-image-sensor-compatible-with-lego-mindstorms.html>

Vision Subsystem v5 for NXT or EV3 (with fixed lens). (n.d.). Retrieved May 13, 2019, from <http://www.mindsensors.com/vision-for-robots/191-vision-subsystem-v5-for-nxt-or-ev3-with-fixed-lens>



Tampa Bay Bridge to Baccalaureate (TB B2B) STEM Program Student Research Final Report

Name: Lionel Plaisance IV

Professor: John Duff, PhD

Date: April 3, 2019

Report

The purpose of this project was to determine whether it was possible to develop and host a Cybersecurity capture the flag event (CTF) at St. Petersburg College. As part of this eight-week research project, the Principal Investigator (Dr. John Duff) and I set out to examine different CTF platforms and determine what resources we could leverage. This included both open source and proprietary software and other materials. We examined various platforms and decided on the best one to use for our purposes based on ease of use, flexibility, and scalability. We also researched and attempted to develop best-practices involving the development and selection of questions for the competition and endeavored to plan out the specifics of the event (including event planning and execution). Over the course of the eight-week project, we worked diligently to uncover solutions to these problems and lay the foundation to continue the process of bring a SPC capture the flag event to fruition.

Before delving deeper into our findings, we had to answer one very important question: “Why should SPC bother researching how to implement a CTF?” There were several answers to this question, but the two answers that resonated closely to our initial question were that:

1. CTF competitions can help participants develop and apply their cybersecurity knowledge/skills and encourage and foster teamwork, a valued soft-skill.
2. CTF platforms can be used in a classroom or other instructional setting for a variety of applications and can be used to train students for future competitions.

With these two answers to the question at hand, we delved deeper into the project. Due to the complexity and the potential size of the project, work was broken up into several stages, with each stage building upon one another. At the time of this report Stages 1 through 5 (out of 9 forecasted stages) have been reached. What follows is a brief synopsis of Stages 1 through 5 and the focus of each phase of the project:

- Stage 1 – Outline the purpose and general timeline of the project
 - Determining the Who, What, When, Where, Why, and How of the project.
- Stage 2 – Researching available software and resources

- What software is out there? What makes it good/bad? Flexibility?
- Stage 3 – Sourcing and creating questions
 - Initial polling of CTF competitors (student input)
 - Initiated request for instructor-created questions
- Stage 4 – Determining best approach to bringing the event to production
 - Testing the platform and questions using a cloud service and a school-based server
- Stage 5 – Initial trial and implementation of the production platform
 - Practice run of the production platform with test-players
 - Identifying and resolving issues with the platform
 - Initial polling of CTF competitors (professional input)

Having outlined the stages of the project that have been reached, it would be best to go into a bit more detail regarding Stage 1. This stage contained the bulk of our initial questions, the answers to which laid out the guidelines and limitations of our project. The questions that needed to be answered included the following:

- How easy is the platform to use at the competitive and administrative level?
- Who was our intended audience?
- What types of challenges would be appropriate for our audience? Do we want to separate Jeopardy™ style CTF and capture the flag event or does a blended event work better?
- What resources will we need to leverage based on our time table?
- What type of digital/physical security will be needed for the event?
- Should we provide tools/software for our participants to use or can they/should they bring their own?
- Will this be a BYOD event?
- Will this be an individual or team-based event?
- Do we want to preserve the event for future use?

In addition, two main features that we desired in a CTF platform were:

- Flexibility and extensibility of the program to fit a variety of needs, now and in the future
- Ease of use and implementation

Keeping in mind the answers to these questions, in Stage 2 of the project, we set out to perform research on the different platforms that were available for use and whether one or

more of them met the necessary criteria. That said, my research led me to the following applications as potential candidates for this project. There were several to choose from, but we were able to narrow down the selection to three platforms. They were:

- **PicoCTF** (<https://github.com/picoCTF/picoCTF>)
- **FBCTF** (<https://github.com/facebook/fbctf>)
- **LibreCTF** (<https://github.com/easyctf/librectf>)
- **NightShade** (<https://github.com/UnrealAkama/NightShade>)

When all was said and done, Facebook CTF was determined to be the best candidate for the project based on the following criteria:

- It was easy to install and load the program onto a test platform
- The forums maintained by the developer on GitHub were active (good sign!)
- It was open-source with a license that would allow the college to run the software without having to request permission for use from the developer
- The platform has three modes: flag, quiz, and king-of-the-hill, meeting one very important need; the ability to provide a beginner or intermediate challenge for participants
- The platform used an easy to use GUI (Graphical User Interface) on the administrative and participant accounts.
- No advanced coding is needed (for the most part) to prep and load questions into the program or to initiate a competition

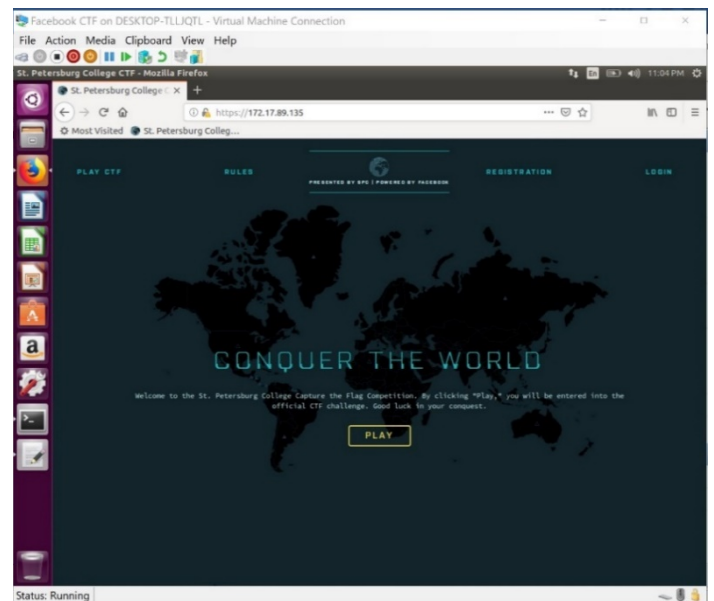


Figure 1 - FBCTF Log-in Page

- The platform was brand-able, meaning that we could add our logo to some aspects of the platform

Sourcing and creating/locating questions for use in the platform was our priority upon reaching Stage 3 of the project. Luckily, the cybersecurity community is very generous and several schools and organizations that have previously run CTF events have made past event questions available for public use. Several of the sample questions that were utilized for this project were

sourced from GitHub repositories (such as Example Quiz Questions (provided by FBCTF and NeverLAN CTF’s Flag question repository), with the links available at the end of this report. While we felt that the sample questions that were available to us would be enough to conduct a test of the platform, we also wanted to source questions from people with cybersecurity/CTF competition experience. To that end, Dr. Duff reached out to current SPC faculty to come up with several questions for the project. Their contributions to the project are forthcoming and we are expecting them toward the end of the project. While Dr. Duff initiated contact with the professors and instructors at the college, I decided to poll students in the cybersecurity club and ask them about their past experiences and recommendations regarding the planning and creation of a successful CTF event. The link to the survey hosted from my personal Google Drive can be found at <https://forms.gle/Gdwiu31nCXLMpdcX8>. My intention with this survey was to poll participants in the test runs of the CTF platform and gather their feedback regarding the platform and the questions. I also plan on sending out a similar survey to seasoned cybersecurity professionals in order to gain insight into their expectations and wants in a CTF program. The question that I hope to answer with this particular survey is, “If CTF competitions are meant to gauge and showcase a participant’s ability to think critically and respond effectively to real-world scenarios, what types/complexity of scenarios and questions do you feel need to be included in a good CTF competition?”

Stage 4 was next and in this stage, we were primarily focused on determining best approach to bringing the event to production. This included performing initial installs and testing the platform, loading questions into the software, and determining whether we wanted to run the platform/competitions using a cloud service or a school-based server.

Determining the location of the server was a critical step. We weighed the benefits and feasibility of cloud vs. an on-campus server options to host the event. While both options worked for our purposes, in order to conduct testing and initial implementation, we decided to proceed with on-campus hosting. Overall, initial installation and testing went smoothly.

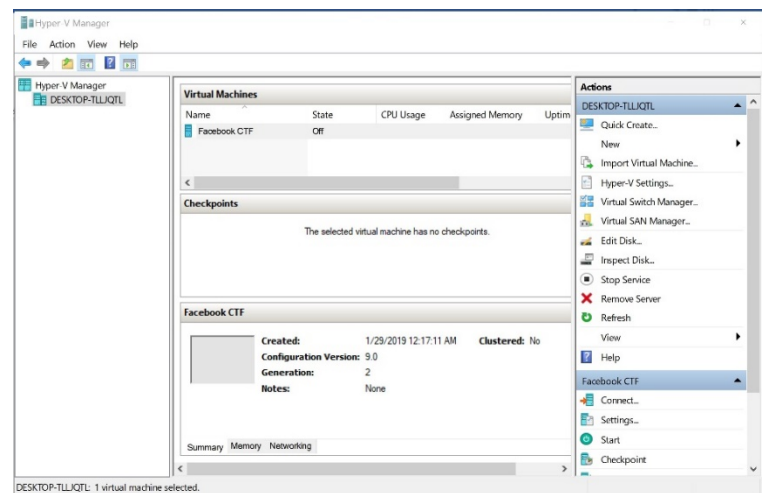


Figure 2 - FBCTF Installed on Personal VM

Listed below are quick notes regarding each of the tests conducted:

- Test 1 – Installed VM (Windows Hyper-V) with platform on my personal Laptop, VM contained Ubuntu 16.4.x OS (Success)
- Test 2 – Installed on VM using AWS using the same Ubuntu 16.4.x OS. Performed by Dr. Duff (Success)
- Test 3 – Installed on an existing server at the College using the same OS. Performed by SPC Staff (Partial Success)

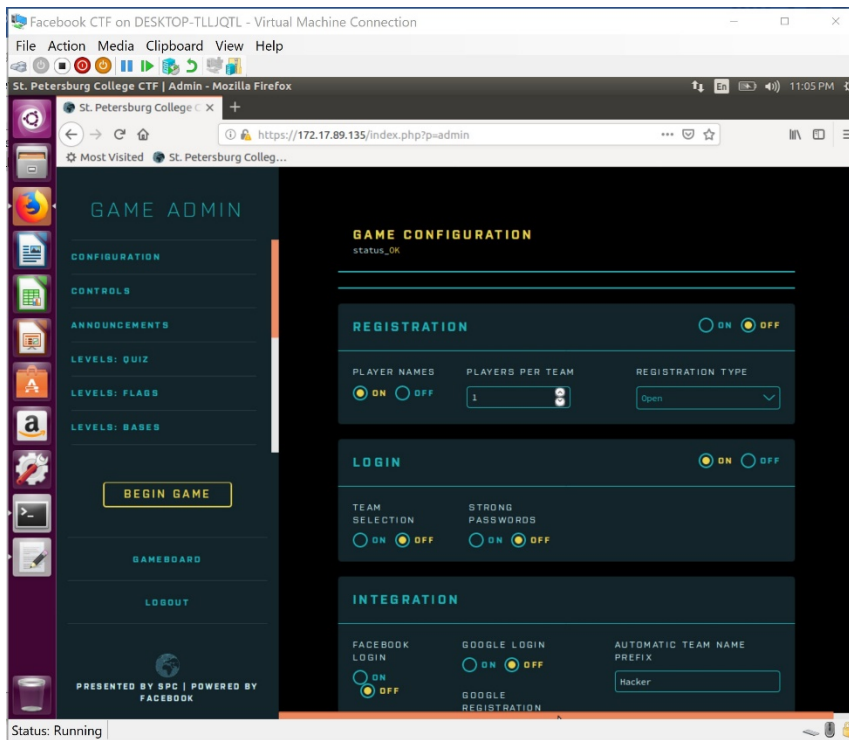


Figure 3 - FBCTF Admin Console

As previously stated, the above tests were preliminary tests to determine the viability of installing and loading the platform. The focus of the tests was to determine if the program worked as stated by the developer and to ensure the platform ran smoothly. Each of the tests included loading questions, starting test games, testing questions, and gauging the potential user experience with the GUI.

Stage 5 was the last stage that we reached and as of the date of this report, has yet to be completed. This stage encompasses the initial trial and implementation of the production platform using SPC Cybersecurity Club students as “beta” testers. The practice run of the production platform with the test-players is being designed to help Dr. Duff and I identify and resolve issues with the platform. As of the writing of this report, the school server-based platform has been loaded with practice questions and we are working out some bugs (specifically with remote logins into the school server) before initiating our first test run with participants. Upon the successful test run, data will be gathered, and additional tests may be needed before the platform is ready for production. Dr. Duff and I have also discussed the next stages of the program and will be leveraging the talent of the Cybersecurity club in the creation and submission of test questions for the final product.

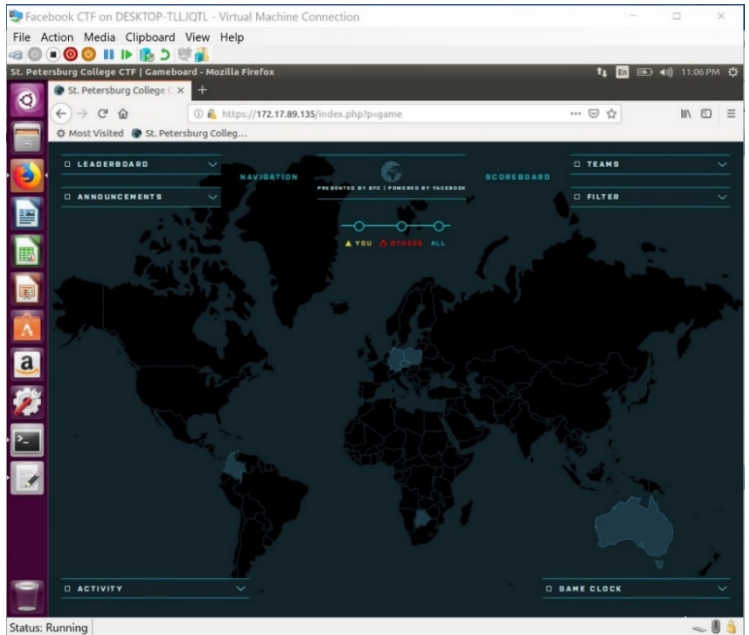


Figure 4 - FBCTF Game Board

Conclusion

In conclusion, it is possible to host and run a CTF from scratch; the concept is sound and that there are platforms and resources available that are more than capable of getting the job done. There are numerous resources available to suit everyone’s needs and it is my hope that the information and experiences that we compile and document through the course of this project will be able to assist other colleges and cybersecurity students develop their own CTF competition. Overall, I feel that the original questions that we asked as part of this project have been answered and I am happy to say that we are well on our way to seeing a completed, production ready CTF platform available for use by Q3 or Q4 of 2019.

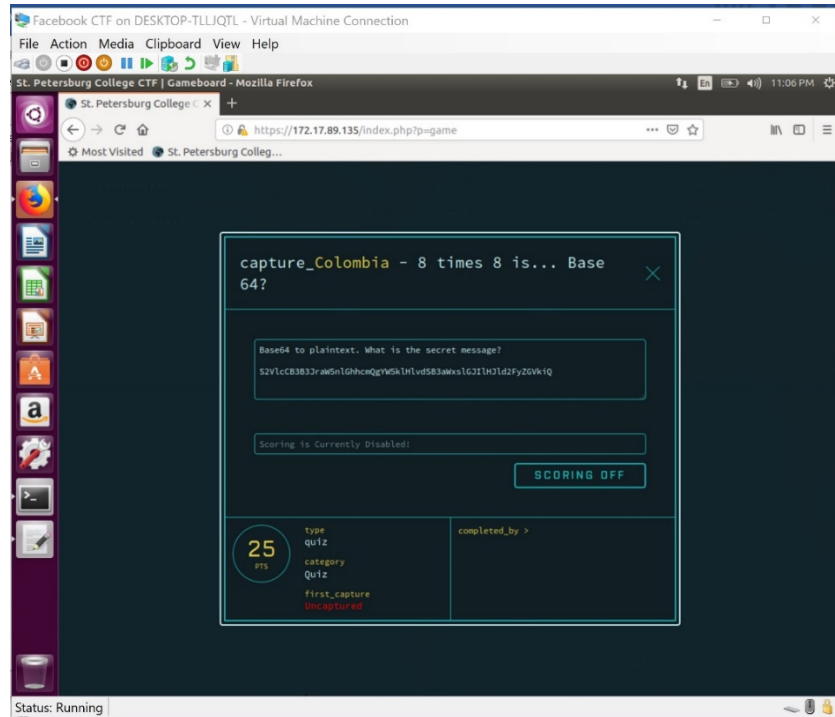


Figure 5 - FBCTF Sample Question

References

Below you will find the links to all of the sites and resources that I leveraged throughout the course of the research project. Please feel free to contact me directly at lpkais1@live.spcollege.edu with any questions regarding the information below:

- FBCTF Sample trivia Questions:
<https://www.dropbox.com/s/6v08hl86xiez1r/Example%20Trivia%20Questions.docx?dl=0>
- NeverLan CTF Repository Page: <https://github.com/NeverLAN-CTF>
- Suggestions for running a CTF:
<https://github.com/pwning/docs/blob/master/suggestions-for-running-a-ctf.markdown>
- Captf – A privately hosted page with several archived CTF events: <https://captf.com/>
- A helpful guide on where to source CTF questions:
<https://github.com/facebook/fbctf/wiki/FAQ#where-can-i-find-challenges-for-the-fbctf-platform>



- Pico CTF Open Source Repository Page: <https://github.com/picoCTF/picoCTF-Platform-2/blob/master/GettingStarted.md#devenv-novagrant>
- LibreCTF Open Source Repository Page: <https://github.com/easyctf/librectf>
- NightShade Repository Page <https://github.com/UnrealAkama/NightShade>
- HackTheArch: An open source scoring server: <https://github.com/mcpa-stlouis/hack-the-arch>
- Facebook CTF Repository Page: <https://github.com/facebook/fbctf>
- Infosec Institute: Tools and Resources to prepare for a CTF: <https://resources.infosecinstitute.com/tools-of-trade-and-resources-to-prepare-in-a-hacker-ctf-competition-or-challenge/#gref>
- Awesome CTF Repository Page. Contains lists of CTF resources and available platforms: <https://github.com/apsdehal/awesome-ctf#create>




Contact Information

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Appendix A

St. Petersburg College


National Science Foundation Louis Stokes Alliance for Minority Participation (LSAMP) Tampa Bay Bridge to Baccalaureate Alliance (TB-B2B)

Undergraduate Research Experience (URE) Model

Purpose: A goal of the National Science Foundation Louis Stokes Alliance for Minority Participation (LSAMP) Tampa Bay Bridge to Baccalaureate Alliance (TB-B2B) grant, is for each College in the TB-B2B alliance to provide undergraduate research experiences (UREs) to students during their first and second years of undergraduate studies.

Background: In 2018, St. Petersburg College (SPC) developed and implemented a model for providing undergraduate students at SPC with UREs. The model was shared with other institutions within the TB-B2B alliance.

Undergraduate Research Experience Model:
The model includes a ‘Student Research Commitment and Agreement’ form which was developed to ensure consistency, accountability, student learning outcomes, and impartiality across all STEM Degree Majors (See Appendix A).

The learning activities (highlighted bullets) in the ‘Student Research Commitment and Agreement’ are revised by faculty based on the respective research project agreed upon by faculty and student during their first meeting. Submitting a compiled report (last bullet) of the research/activities completed each week, including results observed, assumptions, and/or conclusions, learning achieved, etc., is a required component of every research project. A research report submitted by a B2B student in 2018 is presented in Appendix B.

Communications:
Several weeks before a semester begins, Tier 1 B2B students who have not yet completed a research project, are informed that 8-week research opportunities within their STEM major will be available during the following semester, and will include a paid stipend of \$250.

Faculty members who teach within the various STEM programs and have expressed a desire to conduct student research projects are contacted throughout the year, to ensure that sufficient faculty are available to conduct student research each semester.

Students who respond stating they are interested and available to complete a research project, are provided the name of a faculty in their field, and are directed to schedule a meeting with the faculty to discuss their research interests as well as the faculty member’s research interests. During a student’s first or second meeting with the faculty, the research project and learning activities are agreed upon, the learning activities are included in the agreement form, and the form is signed by both faculty and student.

March 2019 Undergraduate Research Experience Model developed by Magaly Tymms 1



STEM TRANSFER
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St. Petersburg College



Academic Effectiveness

Student Research Dissemination:

Each of the student research reports submitted at the conclusion of the respective research project will be included in an Annual B2B Student Research brochure, and shared with students, faculty, and the Alliance partners.

Throughout the year, students who have completed a research project will be encouraged to present their findings at local and national conferences. Students will receive guidance to develop poster presentations, and funding provided for travel and accommodations as available.



STEM TRANSFER
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St. Petersburg College



Academic Effectiveness

Contact Information

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St. Petersburg College



Academic Effectiveness

Appendix A



STEM TRANSFER
BRIDGE TO BACCALAUREATE

Congratulations! You have been offered a Student Research opportunity in the TB B2B STEM program.

Timeline: 8-week Session (March 25 – May 3)

Upon completing the learning activities listed below, you will receive a \$250 stipend.

- Attending a weekly microbiology research meeting Tuesdays from 4:00-5:00PM
- Performing primary literature research and/or laboratory experiments
- Meeting with Professor Ulrich either by phone or in person on a weekly basis for status updates and determination of the following week's goals
- Completing compiled report of the research/activities done each week (e.g. results observed, assumptions, and/or conclusions, learning achieved)

Note that the stipend may be subject to taxes, and student financial aid may be affected.

Do you wish to "Accept" or "Decline" this opportunity?

- Accept
 Decline

I fully understand that to receive the \$250 stipend, I must complete the activities listed above during the 8-week period of March 25 – May 3. If I am unable to be present for any mandatory activity, I will alert Professor as soon as I am aware.

Please sign below attesting to your understanding and agreement of these requirements.

Student

Professor

St. Petersburg College is committed to equal access/equal opportunity in its programs, activities, and employment. For additional information visit www.spcollege.edu/eaeo/. St. Petersburg College is an Equal Opportunity Employer.