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EnvS 110: Research Project

Attitudes and Behaviors of First-Year Students at SJSU Across Different Academic Colleges

Introduction and Background

Background: Student sustainability knowledge, attitudes, behaviors within first year students at San Jose State University (SJSU) were surveyed. The survey results were then totaled and compared by linear regressions to assess sustainability knowledge, attitude and behavior of the relationship of different colleges. Sustainability knowledge is the foundation that engraves positive behavioral impacts. Climate change literacy is important because, while citizens understand the threat, the lack of overarching knowledge can be overwhelming, which sometimes paralyzes populations with fear or confusion. In a report titled, Psychology of Sustainable Behavior, Christie Manning underscores the threats that provoke fear and vulnerability linked to behavior. In response to fear, individuals sometimes engage in "emotion-focused coping". Manning describes this form of coping to be, "an attempt to control the uncomfortable emotion (fear) through denial, apathy, resignation, repression, etc. However, when people either know of no hopeful solution, or they are incapable of taking the actions necessary (e.g., because of money, addiction, physical limitations), their fear and worry through denial gives them relief" (Manning, 2009, 25). Since sustainability literacy has the potential to highlight hopeful solutions and create avenues for necessary behavior, then it has the potential to dismantle emotion focused coping and latent confusion.

Sustainability literacy or knowledge plays an important role for future generations to provide resources for themselves as well as conserving said resources to meet needs. Without

public knowledge, there is no real sense of urgency regarding the climate crisis, resulting in minimal implementation methods. Rapid expansion of quality education (especially in rural areas) should be prioritized in order to increase the capacity in which knowledge influences behavior (Batie, 2013, 137).

Once people understand climate science, the facts will no longer be up for political debate. The politicization of science has made it difficult for individuals to make choices in certain settings based on knowledge, which infringes on ones perceptual knowledge (Lupia, 2013, 1). This latent construct influences behavior when misinformation charges logical fallacies that undermine research and science. This is why understanding the link between knowledge and behavior is a cornerstone in the progression of positive environmental action. How environmental knowledge is framed and presented to individuals at SJSU might shift students attitude and impact a graduates career decision and other behavior.

One variable that appears to be associated with engaging in environmental behavior is lower income. Sometimes students would choose the sustainable alternative because second hand is cheaper, or buying less resources is within budget and they don't have a choice to spend more on the things that contribute to global waste. This was demonstrated in a 2013 study conducted at SJSU by Matthew Lambert that measured behavior through the lens of each students ecological footprint. The study found that a large percentage of students at SJSU lived within walking distance of the university, greatly contributing to a decrease in their ecological footprint compared to any other student. It was also reported that students live on a fixed income and therefore are more frugal with their money, and this aligns with sustainable behaviors and a

smaller ecological footprint based upon carbon used (Lambert, 2013, 24). While this baseline for behavior has already been measured on the SJSU campus, this study kept previous SJSU research in mind when measuring the knowledge, attitudes and behavior of students.

Since the initial study by Lambert, the California State University (CSU) Chancellor's Office passed two policies that are intended to shift water waste and energy on campus to have minimal impacts. The two policies are CSU Sustainability Policy from 2014. The CSU Sustainability Policy enacts action within university sustainability, climate action plan, energy independence and procurement, energy conservation and utility management, water conservation, waste management, sustainable procurement, sustainable food service, sustainable building practices and physical plant management (California State University, 2014, 1). The newest sustainability related policy is the CSU Single Use Plastics Policy from 2018. This policy eliminates single-use plastic water bottles, plastic straws, single use carry out bags, polystyrene, and to replace all single use materials that are first reusable, then locally compostable and/or recyclable (California State University, 2018, 1). This updated infrastructure and policy change throughout the campus may also normalize sustainable behavior of the students. As the above studies have depicted, environmental, economic, and social aspects all play a significant role in the limits of sustainability. However, the purpose of this survey was to analyze the relationship between knowledge, attitudes and behaviors at SJSU rather than the intrinsic societal variables.

Research Questions and Hypothesis:

1. Is there a statistically significant difference in knowledge, attitudes, and behavior based on academic college?

2. Is there a statistically significant relationship between knowledge and behavior?

3. Is there a statistically significant relationship between knowledge and attitudes?

4. Is there a statistically significant relationship between attitudes and behavior?

Hypothesis (1): There is a statistically significant difference of first year students scores among different colleges.

  1a): There is a statistically significant difference of first year students in knowledge among different colleges.

  1b): There is a statistically significant difference of first year students in attitudes among different colleges.

  1c): There is a statistically significant difference of first year students in behavior among different colleges.

Hypothesis (2): There is a statistically significant relationship between sustainability knowledge and behavior of students at SJSU.

Hypothesis (3): There is a statistically significant relationship between sustainability knowledge and attitudes of students at SJSU.

Hypothesis (4): There is a statistically significant relationship between sustainability attitudes and behavior of students at SJSU.

Methods

Data collection: Students completed a survey that inquires about demographics, sustainability knowledge, attitudes and behavior (Appendix I). The authors used questions from a textbook assigned to the Introduction to Environmental Science course at SJSU and questions that were found on Sustainability Tracking and Rating Systems (STARS) reports from other universities. The surveys were sent out to one randomly selected class that was offered within every department within the Fall 2019 semester (Appendix II). We used a random number generator to select one course within each SJSU department to identify "sample points" within the student population. The Qualtrics survey was sent out to the randomly selected faculty members that were randomly selected from each department and were encouraged to share the survey with the students of the indicated class. Students were incentivised for participating in the survey, if they provided an email they were entered to win a $25 gift card. The survey was open for students to participate for 54 hours.

Students indicated their demographic characteristics such as year and department. Knowledge questions were multiple choice. For each knowledge question that was answered accurately, the student was assigned one point. When knowledge points were accumulated, it represented the students knowledge score. The highest knowledge score possible was 5/5. Attitude and behavior questions were answered using a Likert scale that ranged from 1-5 which measures the level in which a student agrees/ disagrees with sustainable prompts in a quantitative fashion. Students were then given a score based upon how many knowledge questions they answered correctly, and how strongly the student self reported their attitude and behavior. For instance, a behavior

question could ask, "I carry a reusable coffee mug and utensils with me", and the students would have the option to choose on a scale of 1-5 which would depict the likelihood of them practicing the said behavior. One would depict, "Never true for me" while five would depict "Always true for me". Based upon this numbering scale students received points that were totaled to indicate their score for behavior and attitudes. The highest possible score to receive in both the attitudes and behavior categories separately was 25/25.

Data analysis: The results were exported from qualtrics and compiled in an Excel spreadsheet. Each students score and demographic was considered and their department indicated which college they were grouped into.

To address Hypothesis 1, a one-way ANOVA single factor was used to compare alpha 0.05 in order to find the P-value of the three variables. This test was done three separate times for each variable, and we compared scores across colleges on campus. If the P-value was less than alpha the difference in average mean of the estimated population between the three categories, a post-hoc test of a t-test was run. An unpaired t-test was used to test for statistically significant differences between colleges. Descriptive Statistics was used to consider the mean and standard error knowledge of each college to compare to the highest possible score. With the mean and standard error, a bar graph comparing the colleges was created.

To address Hypothesis 2, linear regression was used to describe the relationship between the two variables knowledge and behavior. The independent variable was knowledge and the dependent variable was behavior based on the compiled scores of the survey. Any r-square greater than 0.5

was considered a strong correlation. The p-value was used to find if the variables were statistically significant. If the p-value was less than 0.05 it indicated that there was a significant relationship between knowledge and behavior. The linear regression of this data set was represented in a line fit plot that illustrates the relationship.

To address Hypothesis 3, the same data analysis approach was used as Hypothesis 2 to test the independent variable as knowledge and the dependent variable as attitude.

To address Hypothesis 4, the same data analysis approach was used as Hypothesis 2 to test the independent variable as attitude and the dependent variable as behavior.

Results

Hypothesis 1a evaluates the difference of first year students in knowledge among different colleges. The Anova p-value for knowledge was less than alpha, it was 0.005. The t-test for knowledge of different colleges depicts that, of the 15 t-tests were run between the different colleges, there was a statistically significant difference in 9 of them. See Table 1 for the p-values of the different colleges. The mean and standard error of each colleges knowledge score out of 5 are displayed in figure 1. The highest scoring college was the College of Science (4.33 +/- .33) the lowest scoring college was Undeclared/Unsure with a score of 1, but only one person within that college completed a survey so a standard error could not be found. The College of Science had a statistically significant higher score when compared to all of the other colleges.

Table 1. Knowledge t-tests p-value results. Statistically significant p-values are bolded.

	Applied Science and Arts	Education	Humanities and the Arts	Science	Social Science	Undeclared/ Unsure
Applied Science and Arts						
Education	0.128					
Humanities and the Arts	**0.023**	1.29				
Science	**0.021**	**0.016**	**0.036**			
Social Science	**0.022**	0.119	0.5	**0.036**		
Undeclared/ Unsure	**0.002**	**0.030**	N/A	**0.018**	0.333	
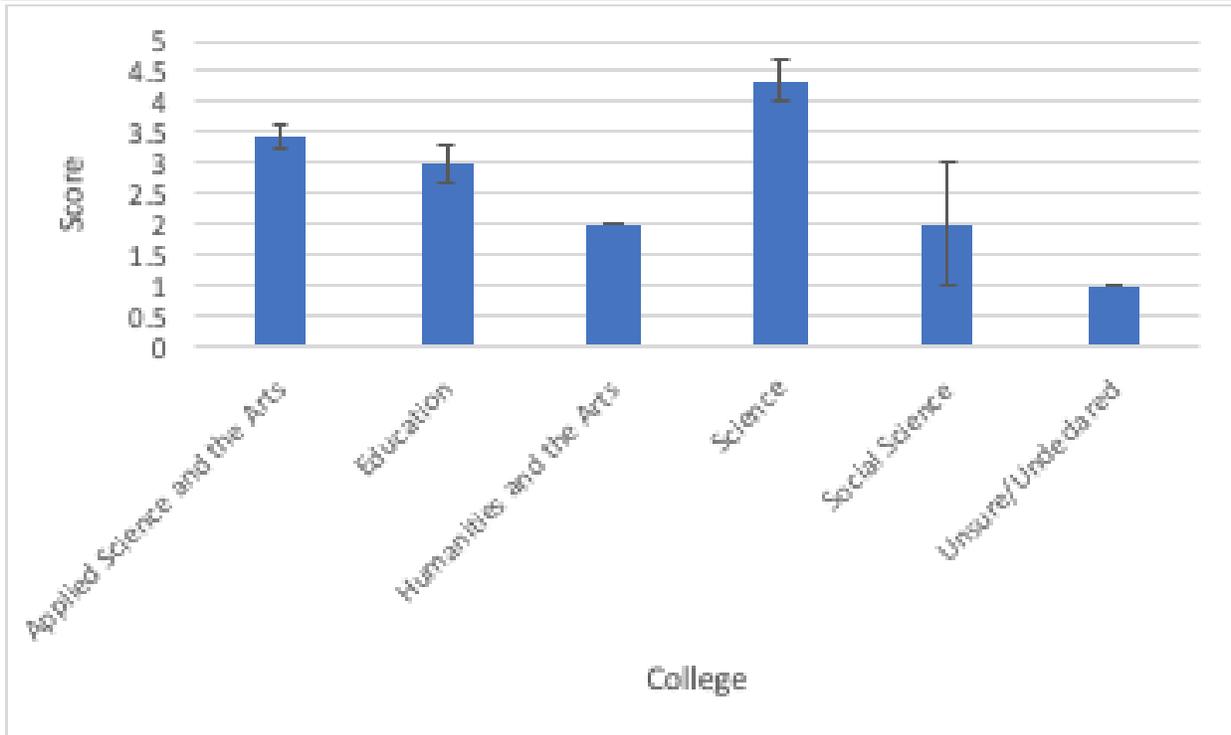
Graph 1. Mean and standard error of each college's knowledge score (Mean +- SE).

Hypothesis 1b evaluates the attitudes of first year students among different colleges. With a p-value of 0.921, it was greater than alpha. There was no significant difference between each colleges attitude score as shown in Graph 2. The College of Social Science had the highest mean score out of 25, (19.5 +/- 5.5). The College of Education had the second highest mean score (19.4 +/- 1.34). The college with the lowest mean score of attitude was the College of Humanities and the Arts with a score of 16, but only one student completed the survey so a standard error could not be found.
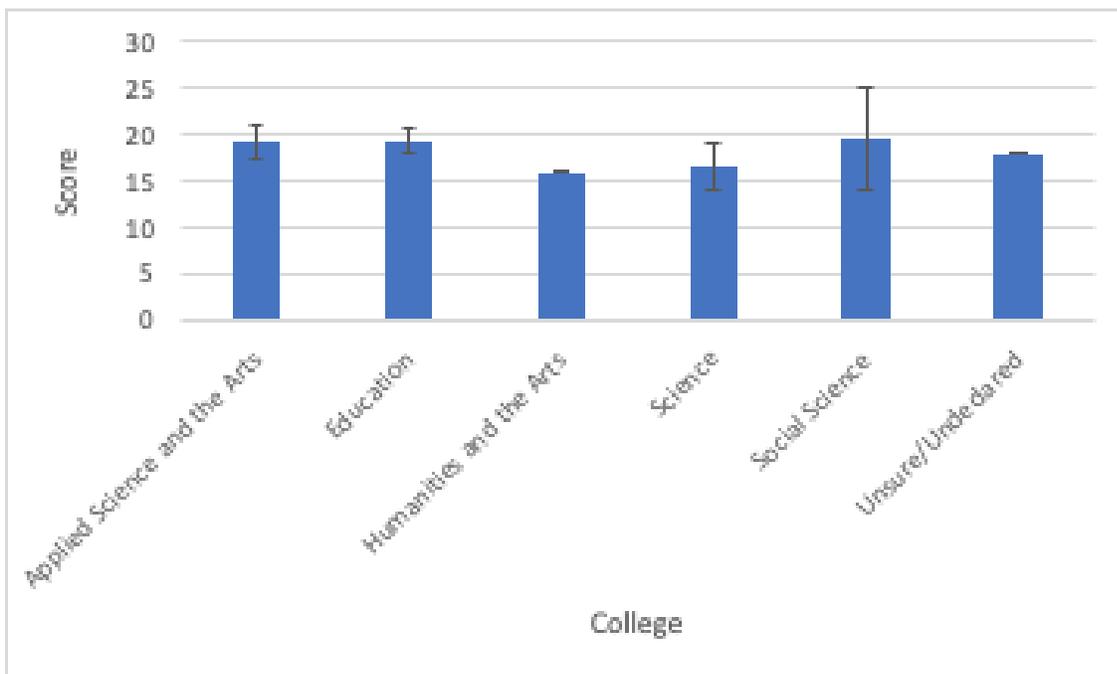
Graph 2. Mean and standard error for each colleges attitude score (Mean +- SE).

Hypothesis 1c evaluates the difference of behavior among different colleges. The p-value from the ANOVA was less than alpha, the p-value was 0.041. The p-values for behavior of different colleges depicts this, as shown in Table 2. Thee t-test for behavior of different colleges depicts that, of the 15 t-tests were run between the different colleges, there was a statistically significant

difference in 4 of them. The mean and standard error of each colleges behavior score out of 25 are displayed in Graph 3. The highest scoring college was the College of Social Science (19 +/- 6). The smallest scoring college was the Undeclared/Unsure with a score of 1, but only one person within that college completed a survey so a standard error could not be found.

Tabel 2. Behavior t-test p-value results. Statistically significant p-values are bolded.

	Applied Science and Arts	Education	Humanities and the Arts	Science	Social Science	Undeclared/ Unsure
Applied Science and Arts						
Education	0.227					
Humanities and the Arts	0.390	0.447				
Science	0.144	0.389	0.317			
Social Science	**0.012**	0.054	0.272	0.101		
Undeclared/ Unsure	**0.029**	**0.044**	N/A	**0.025**	0.166	
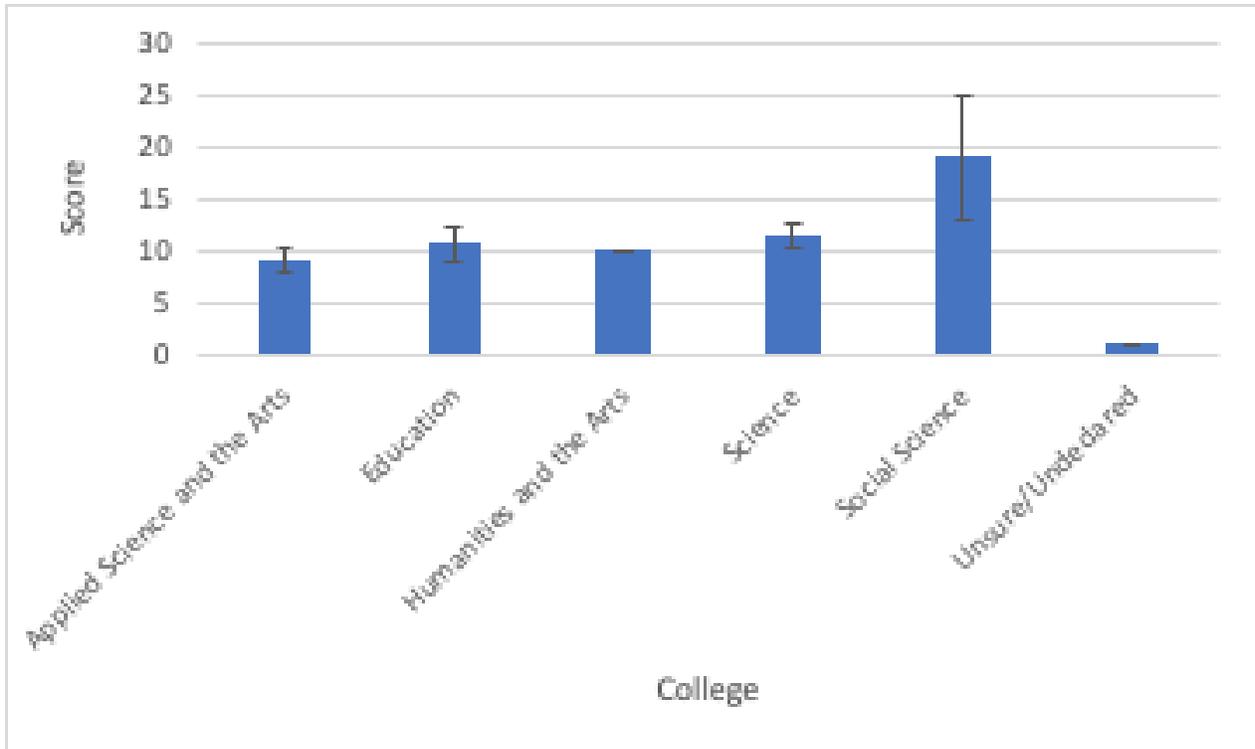
Graph 3. Mean and standard error for each colleges behavior score (Mean +- SE).

Hypothesis 2 evaluates the relationship between sustainability knowledge and behavior of students at SJSU. The observed p-value was 0.988, and this was greater than alpha. The r-square value is 4.95 x10^{-06} the relationship is not as strong as shown in Graph 4.
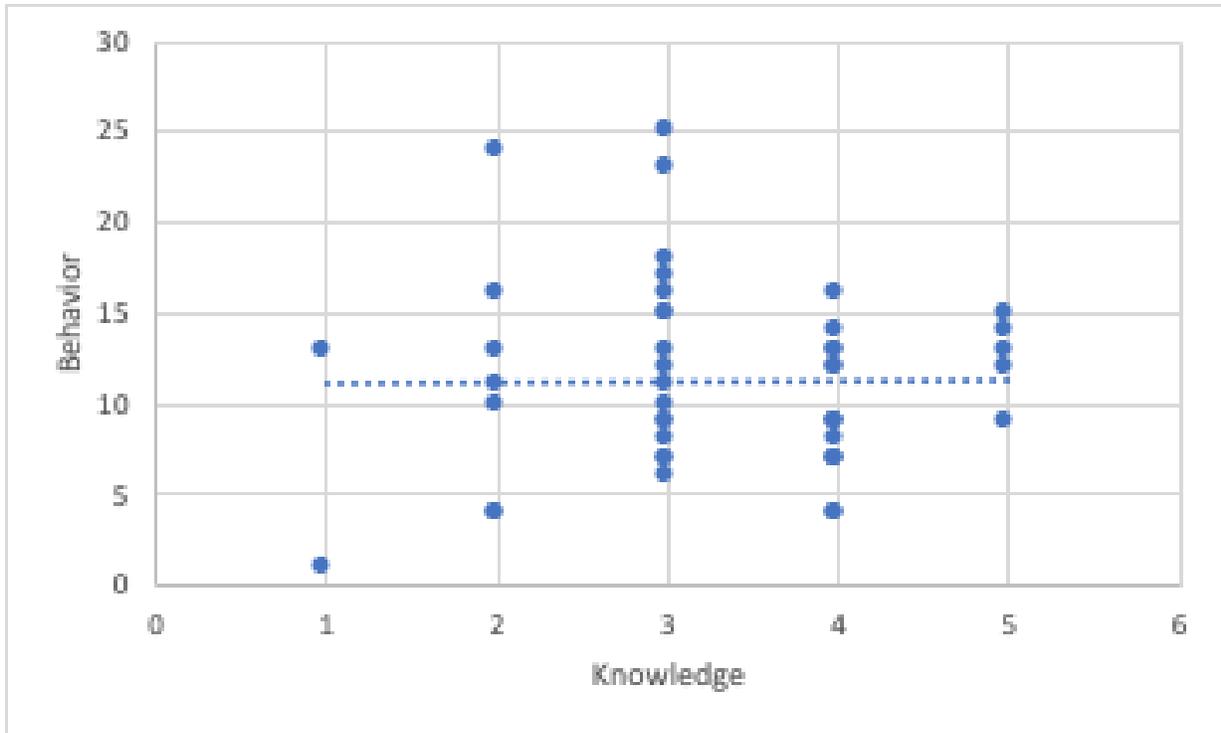
Graph 4. The estimated behavior score in relation to knowledge of students at SJSU.

Hypothesis 3 evaluates the relationship between sustainability knowledge and attitudes of students at SJSU. There was not a statistically significant relationship between sustainability knowledge and attitudes of students at SJSU as demonstrated in Graph 5. This was indicated by observing a p-value of 0.350, this value was less than alpha. The strength of the relationship was not strong, with an r-square of 0.019.
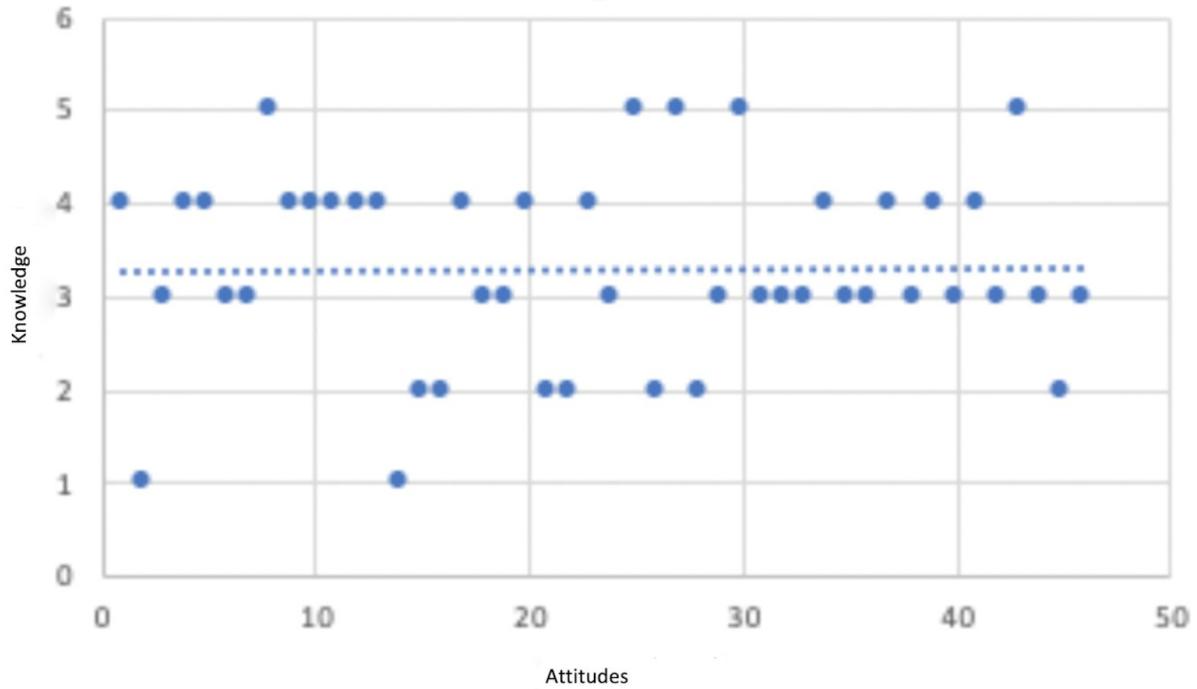
Graph 5. The estimated knowledge score in relation to attitudes of students at SJSU.

Hypothesis 4 evaluated the relationship between sustainability attitudes and behavior of students at SJSU. There was a statistically significant relationship between sustainability attitudes and behavior as shown in Graph 6. The p-value was 0.004, and this value was less than alpha. The strength of the relationship was not strong, with an r-square of 0.168.
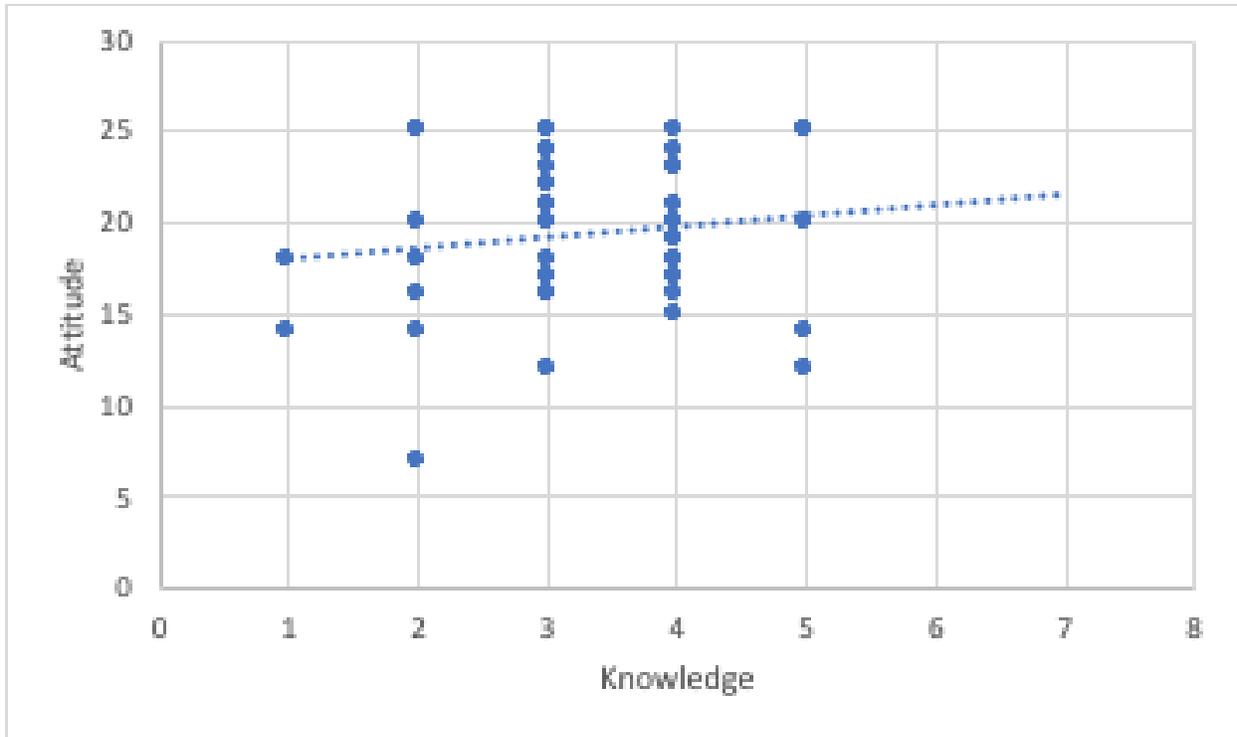
Graph 6. The estimated attitude score in relation to knowledge of students at SJSU.

Discussion

Hypothesis 1a was supported. There was a statistically significant difference of first year students in knowledge among different colleges. This highlights that there was a trend of preexisting sustainability knowledge depending on the college that first year students were enrolled within. The College of Science had the highest knowledge score. Hypothesis 1b was not supported. There was not a statistically significant difference of first year students in attitudes among different colleges. Every college mean score was relatively high. This shows that individuals who attend college have a concern about what the effects of climate change might have on some part of their lifestyle and communities. The College of Social Science had the

highest score for attitude and behavior among first year students. Hypothesis 1c was supported. There was a statistically significant difference of first year students in behavior among different colleges.

Hypothesis 2 was not supported. There was not a statistically significant relationship between sustainability knowledge and behavior of students at SJSU. This indicates that one's perceptual knowledge does not influence behavior. This could be for an array of different reasons, for example, an individual may be informed on climate science but simultaneously lack the finances to buy an electric car or solar panels. Similarly, individuals may take the bus because they cant afford a car in the first place, this behavior is considered to be more sustainable, but it's not correlated with overarching knowledge. Many external factors come into play when gauging the link between knowledge and behavior and for this reason there is no statistically significant relationship between these variables in such a short survey.

Hypothesis 3 was not a statistically significant relationship between sustainability knowledge and attitudes of students at SJSU. This could be partially due to the fact that there are distinguishable differences in general sustainability knowledge and the need to engage in climate change action and mitigation. Additionally, our results may have varied if there was more time for data collection, we saw this as one of our limitations.

Hypothesis 4 was supported. There was a statistically significant relationship between sustainability attitudes and behavior of students at SJSU. In the big picture, this indicates that

preexisting attitudes regarding climate science can certainly be influenced by external factors that are ultimately reflected in one's behavior. Evidence of these factors are emphasized in Christie Mannings report titled, Psychology of Sustainable Behavior, where studies indicated that if ones attitude is fear based through, then individuals may experience "emotion- focused coping" through denial(Manning, 2009, 25). Additionally, this report explained that individuals who are exposed to environmental degradation were more likely to behave sustainably when they were exposed to and reminded daily of the hazards affiliated with environmental degradation. This is an example of an external factor that morphes attitude while simultaneously influencing behavior.

Recommendations for future studies of knowledge of first year students should use previously identified survey questions that are accepted by the scientific community to measure sustainability knowledge. In the future, this survey would be able to show the link between knowledge and attitude and then attitude and behavior in order to add to the evidence in support of requiring a sustainability focused course as a general education requirement for graduation. More time should be allowed for students to reply to the survey in the future, maybe four weeks. More incentives should be gathered to incentivise students participation in the survey. The survey if sent to randomly selected classes from each department should be sent from a person of authority at the university, such as the chancellor, the academic senate, or the Office of Sustainability. If the survey is given to everyone before orientation and just before graduation, a recognizable email sender is not needed.

Future similar studies should send sustainability surveys to students at their first year at SJSU and just as they are about to graduate so that you are able to gauge the knowledge gained through a students academic career. This would allow for the mean scores with the intervention of their courses to be evaluated and compared to one another, to measure if SJSU addresses sustainability in an effective manner that also builds climate leaders in Silicon Valley.

Appendix I Survey content

<u>Demographics</u>
<u>Classification:</u>
Freshman
Sophomore
Junior
Senior
Graduate
Other
<u>If you would like to be entered into a raffle for participating in this survey, please provide your</u>
<u>email below:</u>

‗‗‗‗‗‗‗‗‗
<u>Are you in your first year at San Jose State University?</u>
Yes / No
<u>Department your degree is offered within:</u>
Aerospace Engineering Department

Aerospace Studies Department (Air Force ROTC)
African American Studies Department
American Studies Program
Anthropology Department
Applied Data Science Department
Art and Art History Department
Athletics (Intercollegiate)
Aviation
Behavioral Sciences Program
Biological Sciences Department
Biomedical Engineering Department
Business
Chemical and Materials Engineering Department
Chemistry Department
Chicana and Chicano Studies Department
Child and Adolescent Development, Department of
Civil and Environmental Engineering Department
Communication Studies Department
Computer Engineering
Computer Science Department
Creative Arts Program

Dance
Design Department
Donald and Sally Lucas College and Graduate School of Business
Economics Department
Education - Communicative Disorders and Sciences, Department of
Education - Counselor Education, Department of
Education - Ed.D. Educational Leadership
Education - Educational Leadership, Department of
Education - Special Education, Department of
Education - Teacher Education, Department of
Electrical Engineering Department
English and Comparative Literature
Environmental Studies, Department of
Film and Theatre, Department of
General Engineering
Geography
Geology Department
Global Studies
Health Science and Recreation Department
History Department
Hospitality, Tourism, and Event Management
Humanities Department
Industrial and Systems Engineering
Information School
Interdisciplinary Studies
Jewish Studies Program
Journalism and Mass Communications
Justice Studies Department
Kinesiology Department
Latin American Studies Program
Linguistics and Language Development Department
Mathematics and Statistics Department
Mechanical Engineering Department
Medical Product Development Management
Meteorology and Climate Science Department
Military Science Department (Army ROTC)
Music and Dance, School of
Nuclear Science Program
Nursing, School of
Nutrition, Food Science and Packaging Department
Occupational Therapy Department
Philosophy Department
Physics and Astronomy Department
Political Science Department
Psychology Department

Recreation Program
School of Social Work
Science Education Program
Sociology and Interdisciplinary Social Sciences Department
Technology
Urban and Regional Planning Department
Women, Gender and Sexuality Studies
World Languages and Literatures
Undeclared
Not Sure
<u>Knowledge</u>
What factors influence the human population's impact on earth?
      a) amount of materials used per person
      b) use of technology
      c) family size of 2 or more kids
      d) all of the above
      e) none of the above

Fragmentation and destruction of habitats threatens the survival of thousands of plant and animal species worldwide. Which of the following contributes most to habitat loss?
    a) Over-hunting/harvesting
    b) Human development
    c) Mining
    d) Logging

Which of the following is a resource that is renewable on the scale of your lifetime?
      a) Oil
      b) Iron ore
      c) Trees
      d) Coal
      e) Don't know

What are the three R's of the recommended behaviors for decreasing the amount of garbage gathered by people?
    a) Reduce, Reuse, Recycle
    b) Rot, Refuse, Recycle,
    c) Reuse, Refuse, Re-think
    d) Reduce, Reuse, Rot,

Which of the following are greenhouse gases, trapping heat in the Earth's atmosphere and contributing to global warming?
      a) Methane CH_4
      b) Carbon Dioxide CO_2
      c) Water Vapor H_2O
      e) All of the above

Carbon doxide gas is the main man-made contributor to greenhouse effect, but there are many other heat-trapping gases. Which of the following is NOT a greenhouse gas?
    a) Water vapor H_2O
    b) Nitrous oxide (laughing gas) N_2O

c) *Ozone O_3*
d) Methane (natural gas) CH_4

The EPA defines Environmental Justice as "Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

Which of the following is the best example of environmental justice?
a) Urban citizens of a highly populated area change land zoning so that toxic wastes are taken to rural communities in order to protect the largest amount of people.
b) The government dams a river, flooding Native American tribal lands located in the flooded area without their consent.
c) *All stakeholders from an indigenous community are involved in setting a quota for the amount of wood they can take from a protected forest next to their village*
d) Multinational corporations build factories in countries where environmental and human rights laws are less strict and allow for a higher margin of profit.

What is the primary source of energy on Earth?
a) Fossil fuels
b) Wind
c) Sun
d) Caffeine

While climbing a mountain, you would always gain
a) Precipitation
b) Temperature
c) Latitude
d) Elevation

Attitudes:

How strongly do you agree or disagree with the following points of view?

Access to clean water is a universal human right.

| 1 | 2 | 3 | 4 | 5 |

Strongly Disagree   Strongly Agree

Education and higher education should include sustainability knowledge and behavior.

| 1 | 2 | 3 | 4 | 5 |

Strongly Disagree   Strongly Agree

I am concerned about the increase of sea level rise, extreme weather events, droughts, floods, and fires caused by climate change.

| 1 | 2 | 3 | 4 | 5 |

Strongly Disagree   Strongly Agree

I am concerned about the environmental impact of my transportation.

| 1 | 2 | 3 | 4 | 5 |

Strongly Disagree   Strongly Agree

I value knowing that my food is grown locally and is organic.

| 1 | 2 | 3 | 4 | 5 |

 Never true for me   Always true for me

Behavior

How often do you practice the following behaviors?
I unplug chargers and other small electronic devices when not in use.

	1	2	3	4	5
Never true for me					Always true for me

I have spent time gardening.

	1	2	3	4	5
Never true for me					Always true for me

I compost food waste.

	1	2	3	4	5
Never true for me					Always true for me

I carry a reusable coffee mug and utensils with me.

	1	2	3	4	5
Never true for me					Always true for me

I shut down my computer at the end of the day everyday.

	1	2	3	4	5
Never true for me					Always true for me

This survey referenced STARS surveys by:
Thompson Rivers University
University of Illinois at Urbana-Champaign
College of the Atlantic
San Jose State University
Loyola Marymount University

Appendix II Faculty members randomly selected and contacted via email

Draft of email to be sent:

Subject:

Hello,

The Office of Sustainability and Department of Environmental Studies encourages you to invite your students to participate in a confidential survey that assesses the relationship of sustainability knowledge, attitude and behavior of SJSU students.

One of the classes you instruct has been randomly selected to represent your department. We would so appreciate if you could please forward the survey to the class you instruct below to be completed by Friday 11/22/2019 along with a short personal note encouraging them to participate. This investigation is also part of a class project, so any support you provide will make a significant contribution to the undergraduate learning experience.

The link to share with your students is here.

Or students can follow this link:
https://qtrial2019q4az1.az1.qualtrics.com/jfe/form/SV_6M4nzSQT6Uqbi5f

Or you can display this QR code during class:

We are happy to share the results of our study with you in December.

In appreciation,
Morgan Webster Environmental Studies '21
Rachel Blake Environmental Studies '20

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