**SUstainability Literacy 2013**

1.3.14

*Introduction*

In August of 2013 Seattle University assessed the sustainability literacy of incoming freshman. The class of 975 new students were invited to complete the SUSTLIT survey on-line. SUSTLIT is a standardized questionnaire designed to assess aptitude in sustainability. The scale was developed and its psychometric properties assessed, using SU students.[[1]](#footnote-1) Results from that development process are available; but, because they were not intended to be a targeted sample, they do not necessarily represent any specific group at Seattle University. This data collection was, therefore, intended to be the benchmark in a series of annual surveys of incoming freshman, to be supplemented with periodic assessments of graduating seniors. Over time, these results will provide an assessment of our progress toward our goal of educating all students in sustainability.

*SUSTLIT*

The questionnaire measures knowledge, attitudes, and behavior about sustainability. Sustainability is defined across six dimensions of knowledge: climate change, energy, planetary assets, systems, environmental, and organizational influences, plus a set of definition questions. The six knowledge dimensions are assessed with four to eight items. There are also eleven definition questions, eleven attitude items, and sixteen behavior measures.

Measuring sustainability literacy is a challenge. Most efforts to date have been limited to behavior checklists (Do you buy organic vegetables? Do you use public transportation?) and general attitude questions (How good or bad do you think it is that carbon emissions be regulated?) SUSTLIT has both the behavior checklists and an array of attitude questions; but, most of the items assess knowledge. A difficulty lies in the frequent lack of certainty about important bits of sustainability knowledge. For some items, the objective truth of the statement may be somewhat debatable--"Human behavior plays a significant part in climate change", for example. For others, the objective truth may be clear, but the issue reflects values that may not be held by all--"It is important to preserve plants and animals that are threatened by extinction", for example. SUSTLIT was designed with care to assess knowledge that is agreed upon to a reasonable certainty or that reflects the values associated with sustainability, broadly defined.

All the knowledge items are 5-point Likert scales (strongly disagree-strongly agree). Likert scales are appropriate for measuring knowledge when there is not an objectively clear right or wrong response. Statements on SUSTLIT are worded such that about half reflected correct understanding of sustainability and half incorrect. Reported scores, therefore, were recoded such that higher numbers reflected more correct responses--stronger agreement indicating higher sustainability literacy.

*Results*

The 975 members of the 2013 incoming class were sent e-mail messages asking for participation, with a link to the SUSLIT questionnaire. After two follow-up messages, a sample of 196 usable responses were obtained, for a response rate of just over 20%. The size of the sample is more than adequate. If we assume the standard certainty level, 95%, use the observed standard deviation for most of the sub-scale averages (from Obermiller and Atwood 2013), about .5, and propose an acceptable error of .1 units on a 0-5 scale, the necessary sample size is about 100.[[2]](#footnote-2) Using those estimates, the sample of 196 has statistical power of about 75%. Power to detect an effect of .2 scale points goes up to 99%.

The sample is sufficiently large to assure a good estimate of the underlying population parameters, but is it representative of the *intended* population, the incoming class? Questions of bias due to non-response generally cannot be answered empirically. The one measure we have, students' colleges, indicated the sample was representative on that characteristic. The reported intended colleges were 18% Business, 36% Arts & Sciences, 28% Science & Engineering, 8% Nursing, 8%, Mateo Ricci. These proportions do not differ statistically from the school proportions for the population, respectively 17%, 45%, 25%, 8%, and 6% (χ2 = 2.89, p=.80).

The more important dimension of representativeness is interest in sustainability. Respondents self selected into the sample, and it is arguable that the sample were more interested in the topic than the population. We have no way to test or assess this bias, but we should be sensitive to it as we proceed. Some evidence from teacher evaluations, however, is encouraging. As schools have increasingly moved away from in-class, required evaluations to on-line, voluntary responses, the move has been studied well. Voluntary responses have been shown to be good estimates whole class means with samples of at least 20%.

A copy of the complete questionnaire with average scores for the individual questions is appended; averages for the subscales are presented in Table 1.

Table 1

Knowledge, Attitude, and Behavior Subscale Means\*

|  |  |
| --- | --- |
| Climate Change | 3.73 |
| Energy | 3.41 |
| Planetary Assets | 3.80 |
| Systems | 4.24 |
| Environmental Justice | 4.02 |
| Business | 3.93 |
| Definitions | 3.41 |
|  |  |
| Attitudes | 3.71 |
| Behaviors[[3]](#footnote-3) | 2.94 |

\*Means are for 1-5 scales; higher numbers indicate more sustainability literacy.

*Discussion*

In isolation, these results tell us little. As with any "test", the score depends upon both the level of learning and the level of difficulty of the questions. Any teacher can design tests that are easy enough to produce high scores or hard enough to produce low scores. Our aim in developing SUSTLIT was level of difficulty appropriate to university undergraduates, but we have no certainty what that level is. Thus, although we are encouraged that all the knowledge and attitude scales were on the positive side of the scale, and Behavior was at least very close to it, we should not conclude that incoming freshman are already sustainability literate.[[4]](#footnote-4) The scores in Table 1 are all higher than the scores from the samples used in the development of the scale. It is possible that incoming freshman are indeed more literate than the undergraduates used in that work, but significant changes were made in SUSTLIT as a result of the development process; so, comparisons with those initial scores are not appropriate.

Just as we cannot draw conclusions about the absolute level of sustainability literacy reflected by the scores, we should not compare across dimensions. The scores do not, for example, suggest that our sample know more about systems principles than they do about energy. It is not only conceivable but likely that items for the sub-scales differ in difficulty. The items for different sub-scales were edited and judged in common by the authors of this report, but they tended to originate from different sources.

The scores will become meaningful when the survey is repeated. We hope to see improvements both in future incoming classes and across repeated measures of those classes while they are at SU.

We are encouraged by the score of 2.10 on the overall perceived knowledge item, "In general, I think I know everything I need to know about sustainability." The item suggests that students think there is more to know and, one hopes, are open to learning.

Behavior items lend themselves to specific interventions, and SUSTLIT suggests several areas for improvement. The lowest score, for example, was for choosing bicycling for local travel. Promotions or incentives might be designed to encourage behavior shifts while students are at SU.[[5]](#footnote-5) Other behaviors showed high levels of "not applicable" (purchasing coffee/tea, seafood, beef), and we might consider more appropriate items.

*Applications*

Our current plans are to administer SUSTLIT annually to incoming freshman, then to administer it again to upper classmen (graduating seniors, ideally). Over time, we will have a measure of trends and the effect of the SU experience on sustainability literacy.

We may also want to use SUSTLIT for more specific assessments, of environmental/sustainability programs, extra-curricular activities, even courses. Results of these more specific applications should be included in the archive of results.

Sustainability literacy is an evolving construct. New data are emerging and new implications are being drawn. A consequence is that SUSTLIT must be modified regularly. The modification is required to keep pace with changes in the underlying construct. The risk of modification is that changes in the instrument will be confounded with changes in population scores. To mitigate that problem, we must take care to revise/change the items modestly--fewer than 10% per year--and be sensitive to maintaining a constant level of difficulty.

*Report prepared by Carl Obermiller, assisted by April Atwood.*

**Appendix**

**SustLit Items and Means from Entering Freshman Class 2013**

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| --- | --- |
| **Climate Change** | **Mean\*** |
| 1. Most scientists believe that climate change is happening. | 4.19 |
| 2. Human behavior plays a significant part in climate change. | 4.29 |
| 3. The lives of many people living near the Pacific Ocean are threatened by the melting of glaciers in Greenland. | 3.40 |
| 4. Climate and Weather mean pretty much the same thing. | 3.99 |
| 5. The fact that we cannot predict climate accurately, even a few years into the future, proves that we do not understand what factors influence climate. | 3.35 |
| 6. Recent mild winters prove that climate change is not happening. | 3.99 |
| 7. Change in atmospheric carbon dioxide over the past 100 years has been a slow steady increase. | 2.87 |
| **Average** | **3.73** |

\***(higher numbers, more sustainable)**

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| --- | --- |
| **Energy** | **Mean\*** |
| 1. Increasing the use of wind turbines could eliminate our dependence on foreign oil within a few years. | 2.81 |
| 2. Water (hydroelectric) is considered a "renewable" energy source. | 3.98 |
| 3. Coal is considered a "renewable" energy source. | 4.22 |
| 4. The largest use of energy per year in a typical US home is lighting. | 2.95 |
| 5. A typical home refrigerator requires more energy per year than a typical desktop personal computer. | 3.55 |
| 6. Most electricity in the US is produced by burning coal. | 3.35 |
| 7. The origin of all fossil fuels is the decomposition of dinosaur bones. | 3.28 |
| 8. Wind energy is theoretically possible but not a practical source of renewable energy. | 3.16 |
| **Average** | **3.41** |

\***(higher numbers, more sustainable)**

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| --- | --- |
| **Planetary Assets** | **Mean\*** |
| 1. The major cause of coral bleaching--the death of coral reefs--is chemical spills in the oceans. | 2.67 |
| 2. There is no need to conserve water because water is constantly being replenished by the earth's natural water cycles. | 4.23 |
| 3. Fewer people in the world have access to clean water than have access to cell phones. | 3.87 |
| 4. Switching from meat to vegetable meals in the U. S. can make more clean fresh water available to people in developing countries. | 3.10 |
| 5. The amount of high quality, fertile land for growing food products, worldwide, is constantly decreasing. | 3.91 |
| 6. It is important to preserve plants and animals that are threatened by extinction. | 4.40 |
| 7. The earth, plants, and animals exist only for the support of humans. | 4.23 |
| 8. Soil erosion peaked during the Dust Bowl (1930s); in today's world, it is no longer a problem. | 3.94 |
| **Average** | **3.80** |

\***(higher numbers, more sustainable)**

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| **Systems** | **Mean\*** |
| 1. We will always have enough resources.  When something runs out, we find it somewhere else or find something else that works just as well. | 4.17 |
| 2. What we do today affects the lifestyles of future generations. | 4.70 |
| 3. My responsibility is to myself and my family, not to the world or to the future. | 4.10 |
| 4. The best way to deal with waste is to seal it away so that it cannot affect us. | 4.02 |
| **Average** | **4.24** |

\***(higher numbers, more sustainable)**

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| **Environmental Justice** | **Mean\*** |
| 1. The best measure of the quality of life for an individual is material wealth. | 4.37 |
| 2. The best measure of the quality of life for a society is gross national product. | 3.99 |
| 3. Abuses of the environment disproportionately diminish the lives of the poor. | 3.49 |
| 4. My decisions and actions affect me and those close to me, not other people or places around the globe. | 4.20 |
| **Average** | **4.02** |

\***(higher numbers, more sustainable)**

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| **Organizations** | **Mean\*** |
| 1. Businesses should be concerned not only with making profits but also with the welfare of their employees and the communities in which they operate. | 4.43 |
| 2. Businesses must be profitable to survive. | 3.77 |
| 3. The only proper objective of business is to maximize its profits. | 3.57 |
| 4. Businesses should pay their employees and their suppliers fair compensation, even if that is more than the market requires. | 3.96 |
| 5. Businesses have an obligation to make positive contributions to society. | 3.96 |
| 6. I am willing to pay more for products from business that are socially responsible. | 3.84 |
| **Average** | **3.93** |

\***(higher numbers, more sustainable)**

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| **Definitions of Terms** | **Mean\*** |
| 1. On foods, the label "organic" means the food is not genetically modified. | 3.28 |
| 2. On meats, the label "free range" means the animal had access to the outdoors. | 3.59 |
| 3. On meats the label "grass fed" means the animal had some grass in its diet. | 3.65 |
| 4. On coffee or other products, the label "Fair Trade" means the products are extra high quality. | 3.61 |
| 5. On appliances, the label "Energy Star" means the products are made of recycled materials. | 3.39 |
| 6. On products, the label "natural" has no legal meaning. | 3.48 |
| 7. On products, the label "recyclable" means that the material in the product can be used to make more of the same product. | 3.16 |
| 8. On products, the label "made of recycled material" means that the product is of low quality. | 4.13 |
| 9. A "carbon tax" would prevent the manufacture or sale of products that add carbon to the atmosphere. | 3.02 |
| 10. A "carbon cap and trade policy" would set a limit on the total amount of carbon added to the atmosphere. | 3.37 |
| 11. A business practices "triple bottom line" planning when it focuses on unit sales, dollar sales, and market share. | 2.84 |
| **Average** | **3.41** |

\***(higher numbers, more sustainable)**

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| **Overall Knowledge** |  |
| 1. In general, I think I know everything I need to know about sustainability. | 2.10 |

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| **Attitude Measures** | **Mean\*** |
| 1. People should recycle and reuse, even if it is less convenient. | 4.38 |
| 2. People should choose a method of transportation other than driving a car alone, even if it is less convenient. | 3.82 |
| 3. People should be willing to lower the quality of their lives in order that other people in the world can live better. | 3.47 |
| 4. People should be willing to spend more to get products and services that are better for the environment. | 3.69 |
| 5. People should be willing to spend more to get products and services, if that is what it takes to make life better for other people. | 3.63 |
| 6. People should support higher taxes, if that is what it takes to make life better for other people. | 3.26 |
| 7. In general, I think climate change issues are among the most important challenges in the world today. | 3.53 |
| 8. In general, I think energy issues are among the most important challenges in the world today. | 3.72 |
| 9. In general, I think environmental threats are among the most important challenges in the world today. | 3.69 |
| 10. In general, I think social justice issues are among the most important challenges in the world today. | 4.02 |
| 11. In general, I think the effects of businesses on society are among the most important challenges in the world today. | 3.63 |
| **Average** | **3.71** |

\***(higher numbers, more sustainable)**

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| **Behaviors (never-every single opportunity)** | **Mean\* (not applicable)** |
| 1. When you buy produce, you buy organic produce. | 3.26 (11) |
| 2. When you buy coffee, or tea, you buy shade grown coffee or tea. | 2.50 (57) |
| 3. When you buy seafood, you buy seafood certified as sustainable. | 3.13 (67) |
| 4. When you buy seafood, you buy farm-raised seafood. | 2.55 (67) |
| 5. When you buy eggs, you buy organic eggs. | 3.25 (28) |
| 6. When you buy dairy products, you buy organic dairy products. | 3.15 (22) |
| 7. When you buy meat, you buy organic meat. | 2.93 (39) |
| 8. When you buy beef, you buy grass-fed beef. | 2.99 (50) |
| 9. When you buy paper products, you buy recycled-content paper products. | 3.26 (10) |
| 10. Choose mass transit as a means of local travel. | 2.95 (11) |
| 11. Use car/van pool for travel to work or school. | 3.20 (15) |
| 12. Choose bicycling for local travel. | 2.23 (17) |
| 13. Choose walking for local travel. | 3.51 (10) |
| 14. Consider the working conditions of product producers, before buying. | 2.63 (8) |
| 15. Boycott a company because of its social practices. | 2.39 (13) |
| 16. Voted for or supported a candidate because of his/her position on environmental issues. | 3.07 (53) |
| **Average** | **2.94** |

\***(higher numbers, more sustainable)**

1. Obermiller, Carl and April Atwood (2013) "Sustainability Literacy: Scale Development" working paper, Albers School of Business, Seattle University. [↑](#footnote-ref-1)
2. The error term, E in the sample size determination equation, n = ((z\*s)/E)2, is problematic in most social science. The typical criterion is practical significance--what is the smallest meaningful effect size. We expect that we would be pleased to be able to identify a difference of .1 scale points on a 5-point scale. For example, to test an hypothesis about two means, with a sample of 100, a difference of .2 scale points would be statistically significant. [↑](#footnote-ref-2)
3. Behavior measures are complicated by the "not applicable to me" option, which was the response of from 4 to 33 per cent of participants. Eliminating those who responded "not applicable to me", the average was computed over the 16 behaviors. [↑](#footnote-ref-3)
4. We want to guard against a ceiling effect, however, and may want to consider making the items more difficult in future adjustments to the scale. Further, with repeated administrations, we may identify specific items that are simply too easy. On this administration, for example, the item "What we do today affects future generations" resulted in a mean of 4.70, indicating little discriminatory power. [↑](#footnote-ref-4)
5. Note, however, that the behaviors of incoming freshmen may change after they arrive on campus for a variety of lifestyle reasons, in addition to increases in sustainability literacy. Mass transit, for example, may become a more reasonable option for students, in the city without the family car. [↑](#footnote-ref-5)