Fall 2015

Investigating the Relationship Between Local Environmental Knowledge and Environmental Concern Among College Students

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INVESTIGATING THE RELATIONSHIP BETWEEN LOCAL ENVIRONMENTAL KNOWLEDGE

AND ENVIRONMENTAL CONCERN AMONG COLLEGE STUDENTS

by

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AN UNDERGRADUATE THESIS

Presented to the Faculty of

The Environmental Studies Program at the University of Nebraska-Lincoln

In Partial Fulfillment of Requirements

For the Degree of Bachelor of Science

Major: Environmental Studies

With the Emphasis of: Natural Resources

Under the Supervision of Dr. Al Williams, Jr. and Stephanie Kennedy

Lincoln, Nebraska

December, 2015

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University of Nebraska, 2015

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Our global society is becoming increasingly aware of the way the climate is changing worldwide and the consequences that will result from those changes. An individual's level of concern for the environment will likely affect how willing they are to engage in and support behaviors that aim to preserve the natural world. This study aimed to determine how local environmental literacy, degree program type and college grade level impact environmental concern. Two surveys were used in this project: one to measure environmental concern and one to measure local environmental literacy. The survey measuring environmental concern was the Revised New Ecological Paradigm scale. The demographic questions, environmental literacy test and revised NEP survey were assembled into one survey consisting of 38 questions and distributed online. A significant difference was found between average Revised NEP scores for each category of degree program. There was no significant difference between average revised NEP scores and college grade level or local environmental knowledge and revised NEP score. Students who major in agricultural sciences tend to display much lower levels of environmental concern. Ultimately, consideration and concern for the natural world is an important quality that must be expanded in all societies. Acceptance of the New Ecological Paradigm must happen for people to support and promote true environmental sustainability and responsibility. The sooner we can untangle the root causes of this important trait, the sooner we can cultivate a commonly shared, pro-ecological mindset within all societies that can be used to mitigate climate change, protect the earth, and sustain humankind.

INTRODUCTION

Environmental sociology involves the study of relationships between society and the greater ecological systems that surround it. It often aims to pinpoint positive and negative interactions between human communities and the natural world. What researchers within the field of environmental sociology aim to do is determine which factors shape people's attitudes and behavior toward the environment, what criteria humans use to assign value to the natural world and which factors are associated with increased concern for the environment. These questions play a key role in discovering the foundation of positive environmental attitudes and what motivates humans to adopt behavioral changes and support policies that aim to mitigate the environmental problems we are facing. This project will use an environmental sociology framework to explore the association between environmental concern and factors relating to education.

Our global society is becoming increasingly aware of the way the climate is changing worldwide and the consequences that are a result of those changes. Average global temperatures are increasing, sea levels are rising, and biodiversity is disappearing at troublingly high rates (Rockstrom, 2009). These are issues that have serious consequences for the natural world and humans alike. The full extent of the effects of climate change is not yet fully understood, however it is predicted that these problems will require most societies to adapt in ways in which they are currently unprepared. There are human behaviors that have contributed to climate change that need to be addressed in order to mitigate increasing global temperatures and also to adapt to whatever maybe be the "new normal" in our environment. Humans have fallen into the habit of assigning value to environmental features based on their functionality for human use and values as capital. Societies worldwide have neglected to see the value of fully intact, undisturbed ecosystems and the services they provide humans. According to Hoffman (1991), order for our moral perspectives about the environment to change, we will need to become more pro-ecological. An individual's level of concern for the environment, which is part of their environmental ethic, will likely affect how willing they are to engage in and support behaviors that aim to conserve and preserve the natural world. Accordingly, this study aims to generate new data about whether or not an individual's knowledge of the local environment in which they live, level of higher education and degree program type has the potential to affect their overall concern for the environment.

LITERATURE REVIEW

There are many potential factors involved in shaping attitudes toward the environment. Previous studies have analyzed influences such as rural versus urban upbringing, political viewpoints, socio-economic status and academic major (Beckley et al., 2009, Cutler et al., 2013, Nawrotzki and Pampel, 2013 and Dunlap, 2014). In a 2009 study, Beckley, Huddart-Kennedy, McFarlane and Nadeau concluded that Canadian rural residents displayed higher levels of environmental concern and environmentally friendly behaviors than urban residents. However, Cutler, Henley, Norman Levin and Safford concluded that in the Puget Sound region of Washington State, urban residents were more likely to display concern over loss of habitat, as well as concern about other environmental issues than rural residents. In both studies, the variation in levels of concern about environmental issues between groups in each setting were insignificant. These conflicting results indicate that differences in rural versus urban environments may not have as much impact on environmental concern as initially thought. There has also been plenty of research on the relationship between political viewpoints in America and environmental concern among Americans. It is well established that conservatives tend to be less likely to see climate change as an urgent issue. They are also more resistant to changing their attitudes when presented with scientific evidence (Dunlap, 2014). A very recent study indicated that "females, non-Whites, people with higher New Ecological Paradigm Values and political liberals" tend to display higher levels of concern for the environment (Liu, Shi and Vedlitz, 2014). It is also important to note that environmental attitudes begin formation early in life. Children with parents who converse with them about environmental issues tend be more receptive to pro-ecological worldviews. Intergenerational transmission of pro-environmental values has a clear impact on environmental concern (Meeusen, 2014). One study found that when the majority of environmental information children receive comes from television and movies, a severely negative outlook for the future of the environment is expressed by children through fear, sadness and frustration (Strife, 2012). However, no specific information about the type of environmental information that was sent or specific television programs and movies was given. None of these studies provide consistent, verifiable causes that increase environmental concern.

Many studies have examined the relationship between socioeconomic status and education on environmental concern, which has brought about interesting results. Nawrotzki and Pampel (2009) found that the relationship between environmental concern and other factors such as socio-economic status, age, and education is complex. One of their findings suggest that the mechanisms for the cause of environmental concern differ among income levels. People in the lowest and highest income brackets both display high levels of environmental concern, but for different reasons. The non-linear relationship between income and environmental concern has been identified by multiple studies, indicating that the factors causing environmental concern differ among income levels and possibly other factors as well, such as age and education (Nawrotzki and Pampel, 2009 and Choi, Kim and Park, 2012). Lower income people are more likely to live in places with lower environmental quality and are concerned about the environment because it directly impacts their health, while those with higher income can afford to be concerned about the environment. This demographic has more disposable income to use on higher quality, "greener" goods and services.

The role education plays in developing pro-ecological viewpoints is of particular interest. Arnocky and Stroink (2011) found that students majoring in outdoor recreation, parks and tourism show higher levels of environmental concern and higher levels of self-reported, pro-environmental behavior. The relationship was more significant for women than for men. However, the correlational nature of this study provides a limitation into understanding the mechanism behind environmental concern and behaviors. Did the participant's education change their attitudes and behaviors toward the environment or did they already possess these attitudes, which led them to take an interest in outdoor recreation, parks and tourism? Another study, conducted at Benguet State University in the Republic of the Philippines, showed environmental concern and commitment to sustainability did not vary across degree program or gender. The degree programs examined were statistics, mathematics, general science and physics. There were thirty participants in this study. All graduate students were knowledgeable about environmental issues and were all committed to promoting environmental concern in their classrooms as teachers (Lubrica, 2010). These results show that scientific knowledge may be associated with higher levels of environmental concern. However, this study had a small sample size and did not examine participants from non-science fields, which makes any substantial conclusions difficult to draw. Devlin and Sherburn (2004) compared the NEP scale scores of

economics majors and environmental studies majors. The results indicated that economics majors were less concerned about the environment and less likely to use an arboretum on campus, whereas environmental studies majors scored higher in environmental concern and were more likely to use the arboretum. However, this study did not examine a wide range of academic majors; it only aimed to examined two (environmental studies and economics) and a control group which contained mostly psychology majors. Also, it did not collect detailed information about the demographics associated with each participant. Also, it did not collect information about each participant's knowledge of scientific processes, which is what this project aims to do in order to demystify any relationships that are found between environmental concern and academic major.

One important piece of demographic information included in the survey content of this study is academic major. The relationship between academic major and scientific knowledge is important because there are some majors that require coursework that directly impacts environmental knowledge of the local area in which a student lives. Students that exhibit high levels of environmental knowledge may also exhibit high levels of environmental concern. Majors such as biology, environmental studies and geology teach concepts such as nitrogen and carbon cycles, ecology and evolution, and how energy and matter flow from one Earth system to another. Due to the fact that some majors may increase knowledge that contributes to environmental knowledge, there may be a strong link between specific majors and environmental concern.

Measuring environmental concern will be an important aspect of this project. The most common method is to use the New Ecological Paradigm (NEP) scale, which was developed by sociologist Riley Dunlap in order to gauge environmental concern (Dunlap, 2008). The NEP scale is a fifteen question survey designed by Riley E. Dunlap that uses Likert answering strategies. This paradigm has several parts that ultimately state that the current, dominant set of attitudes humans have with respect to the environment are not beneficial to our society and are a hindrance to making the inevitable transition to sustainable energy practices and policies. The NEP is contrasted by the dominant social paradigm (DSP), which is American society's dominant set of environmental ethics and our dominant practices of assigning value to the natural world. The DSP, according to its creators, is "the prominent world view, model, or frame of reference through which individuals or collectively, a society, interpret the meaning of the external world" (Ehrlich and Pirages, 1974). One signature aspect of the DSP is that it tends to be anthropocentric. It states that

humans must find a new way of interacting with the natural world, namely, adopting pro-ecological attitudes and behaviors. The NEP is a measurement of how receptive an individual is to dismissing the DSP and adopting pro-environmental viewpoints.

Due to the fact that the root of adopting pro-environmental viewpoints stems from environmental concern, the NEP is an appropriate way of measuring environmental concern. The revised NEP scale has been utilized in over 300 studies to measure environmental concern, making it the most widely used measure of environmental concern by quite a margin. The NEP scale has what is known as strong "known group validity," meaning groups which display attitudes and behaviors that reflect environmental concern, such as environmental activists, researchers, and students, consistently score high on this scale. This increases the validity of the revised NEP scale as a reliable way measure of environmental concern. (Dunlap and Van Liere, 1978). The revised NEP scale has also shown a positive correlation between perceived seriousness of ecological problems and support for pro-environment policies. Also, the revised NEP scale has shown to be able to distinguish between environmentalists and non-environmentalists worldwide (Dunlap, et. al, 2000).

The goal of this project is to answer the following questions: "Does local environmental knowledge influence an individual's level of concern for the environment?" "Does college grade level influence a person's level of concern for the environment?" and "Does degree program types influence a person's level of concern for the environment?" It is hypothesized that college students with higher levels of local environmental knowledge, upperclassmen and science majors will display higher levels of environmental concern reflected by the degree to which they subscribe to the New Ecological Paradigm.

METHODS

Two surveys were used in this project: one to measure environmental concern and one to measure local environmental literacy. The survey measuring local environmental literacy consisted of sixteen multiple choice questions covering the following topics: soil, water, climate, and biosphere. There were four possible choices for each question. The survey measuring environmental concern was the Revised New Ecological Paradigm scale. The NEP consisted of fifteen statements with a Likert response format in which the possible answers were: strongly disagree, disagree, neutral, agree and strongly agree. All five answer possibilities for the NEP were weighted to equal either 1 or 5, where strongly disagree equals 1 and strongly

agree equals 5. A high score on the Revised NEP would indicate a high level of environmental concern. A short list of demographic information was also created for the participants to answer, which included the following information: gender, age, degree program, years spent residing in Lincoln, NE and grade level.

The demographic questions, environmental literacy test and revised NEP survey were assembled into one survey consisting of 38 questions. This survey was published online using the survey creating website Survey Monkey. An introduction to the survey was published along with the survey itself contain information about consent and how to contact the researchers. The introduction also informed the participants that a prize of 20 dollars in cash would be awarded to a random participant who completes the survey. A link to the survey was provided by Survey Monkey, allowing the survey to be sent online to potential participants.

To recruit current UNL students to participate in this project, an email containing the survey was sent to a variety of professors within the following departments at the University of Nebraska-Lincoln: environmental studies, math, physics, sociology, English, art and music. This email asked each faculty member to send the survey link to their students or post the survey link on their class blackboard pages. Another email was sent to all the students in the following classes: BIOS 205, PHYS 109 and ENTO 400, asking the students to participate in the project by providing the link to the survey and information about the cash prize drawing for completed surveys. The survey was available to be taken from October 13, 2015 to November 4, 2015. A response number of 78 responses were gathered.

For the analysis of degree program type and environmental concern, five categories of degree program were examined. The categories were: humanities, applied sciences/chemistry, environmental studies/fisheries and wildlife, biology and agricultural sciences. The analysis of environmental concern and college grade level utilized five categories for grade level. The categories were: freshmen, sophomore, junior, senior and graduate.

A correlation test and regression were conducted in Microsoft Excel to determine the strength and direction of the relationship between local environmental knowledge and environmental concern. A single factor ANOVA test was conducted in Microsoft Excel to determine whether there were any significant differences between college grade level and environmental concern. Another single factor ANOVA test was conducted in Microsoft Excel to determine the significance of the relationship between degree program type

and environmental concern. Lastly, a multivariate analysis was conducted in R to determine if any

independent variables are interacting with one another to influence environmental concern outcomes.

RESULTS

There was a significant difference found between average Revised NEP scores for each category of

degree program ($p<0.05$). The categories were: humanities, applied sciences/chemistry, environmental

studies/fisheries and wildlife, biology and agricultural sciences). As expected, environmental studies

students and fisheries and wildlife students scored higher than all the other groups with a group average

Revised NEP score of 3.635. Biology and pre-med students scored slightly below the environmental

studies/fisheries and wildlife students with an average score of 3.6. Students in non-science programs,

called "humanities" in this project, scored an average of 3.52 and in applied science and chemistry

programs scored an average of 3.51. Lastly, the lowest scoring group by quite a margin was agricultural

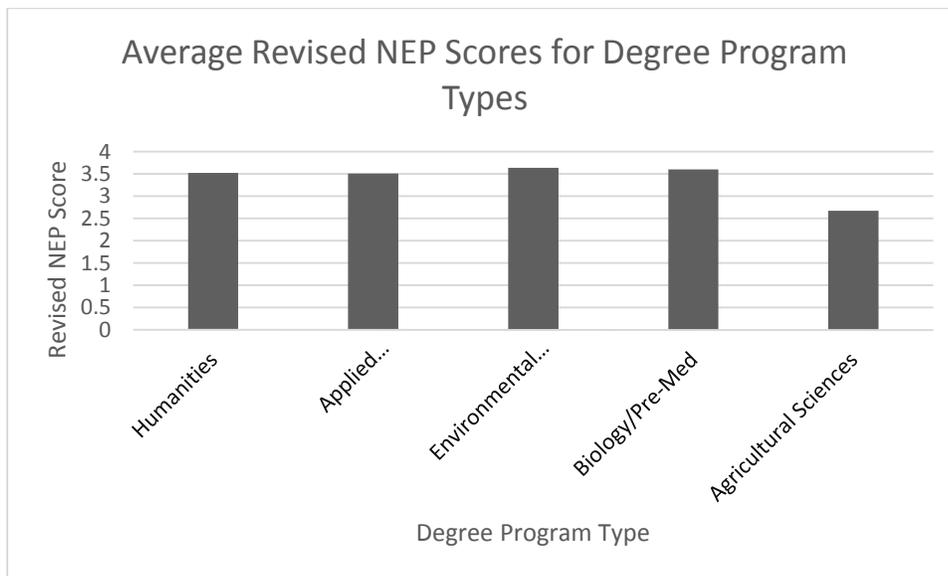science students, with an average revised NEP score of 2.67.

Figure 1. Average Revised NEP Score for Degree Program Type. This bar graph shows the average NEP score for five degree program cohorts: Biology/Pre-med, Agricultural Sciences, Environmental Studies/Fisheries & Wildlife, Chemistry/Applied Science and Humanities.

There was no significant difference between average revised NEP scores for the following five

college grade levels: freshman, sophomore, junior, senior and graduate. Freshman scored 3.067,

sophomores scored 3.6, juniors scored 3.507, seniors scored 3.442, and graduate students scored 3.65.
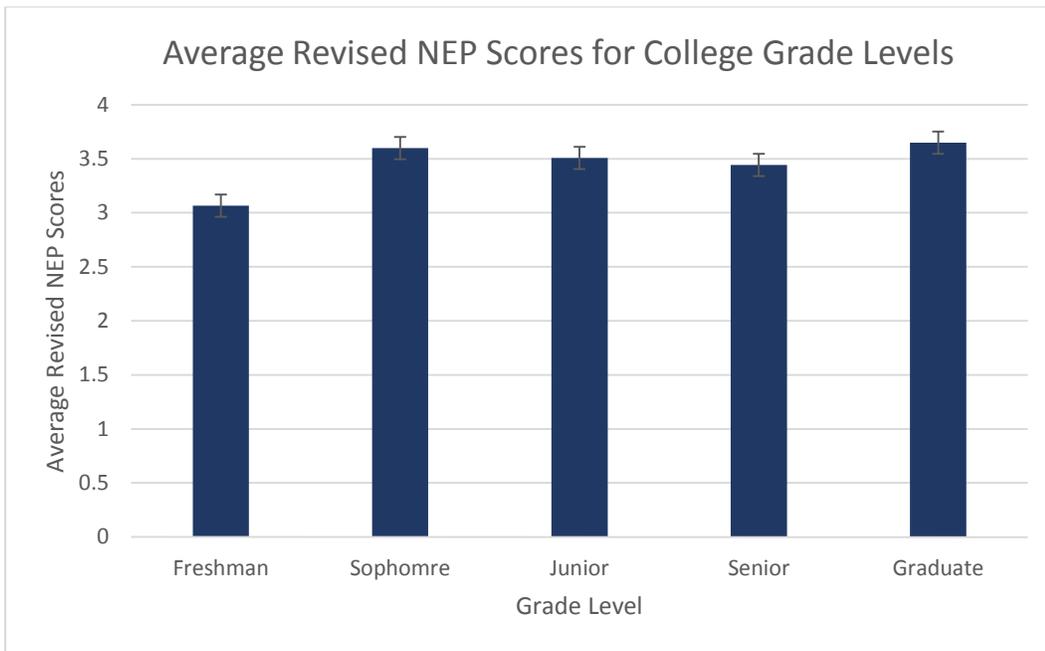
Figure 2. Average Revised NEP Score of College Grade Levels. This bar graph shows the average NEP score for the following college grade level groupings: freshman, sophomore, junior, senior, and graduate level.

There was no significant relationship between local environmental literacy and revised NEP score.

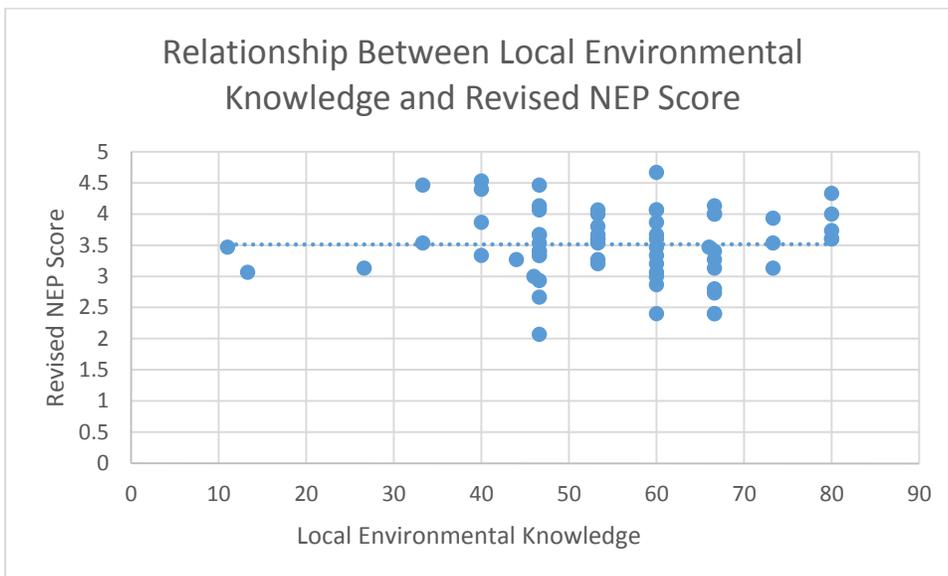The correlation co-efficient was slightly below zero (-0.00626) and the p-value was greater than 0.05.

Figure 3. Relationship between Revised NEP Score and Local Ecological Literacy. This scatter plot compares each participants' score on both the NEP survey and the ecological literacy test.

DISCUSSION

Based on this study, it appears that local environmental knowledge is not significantly related to an individual's level of concern for the environment. It can then be stated that local environmental knowledge does not affect environmental concern. College grade level is also displays no significant relationship to an individual's level of concern for the environment and therefore does not affect concern. However, it was found that environmental concern is significantly related to degree program type. Students who major in agricultural sciences tend to display significantly lower levels of environmental concern.

It is difficult to determine why agricultural science students might display less concern about the environment. It is possible that agricultural science students feel they might care about the environment to the extent that it affects farming practices but perhaps subscribe mainly to the dominant social paradigm (DSP). The DSP is a traditional, anthropocentric ideology in western culture. It promotes human ingenuity and the idea the environment is simply a resource that humans must use to suit their needs. It is possible that this mentality is dominant and even promoted within commercialized agricultural industries in the United States. However, the results were consistent with past studies that have examined environmental concern and degree program. Environmental studies students scored highest on the revised NEP scale, as they did in the study conducted by Arnocky and Stroink (2011), who also found environmental studies students scored much higher on the revised NEP scale. However, the results of this study were not consistent with the results found by Lubrica (2010), who did not see any major differences in environmental concern across degree programs. However, this study did not include students in agricultural science programs.

The lack of a significant correlation between local environmental knowledge and environmental concern could be due to a number of factors. The survey was distributed online, so it is possible that some respondents looked up the answers to questions they did not know. The environmental knowledge portion was also multiple choice, so there could be some inaccuracies related to guessing. The knowledge test was created from scratch specifically for this project and has not been widely used in any capacity, so there is no way to know if this test is an accurate or reasonable measure of environmental concern. Perhaps a more extensive local environmental knowledge test distributed to participants in person would provide better results.

The lack of significant difference in environmental concern between college grade levels could actually be an important finding. It is possible that environmental concern does not increase with increased higher education. Also, it is possible that environmental concern only increases throughout particular degree programs.

For future research, it would be beneficial to examine a different kind of environmental knowledge. Perhaps knowledge of earth systems, ecology and climate change would impact a person's concern for the environment, rather than facts about local environmental conditions. A survey aiming to measure environmental literacy would ask conceptual questions, rather than pointed questions about local environmental facts and figures. It could be also be beneficial to study environmental concern as it relates to one or two concepts at a time. Examples of important concepts to test against environmental concern could be knowledge of population dynamics within ecological systems or evolutionary theory.

CONCLUSION

Ultimately, the null hypothesis was rejected regarding the relationship between environmental concern and local environmental knowledge as well as the relationship between environmental concern and college grade level. The null hypothesis regarding the relationship between environmental concern and degree program type was accepted, noting that agricultural science students scored significantly lower on the revised NEP scale than any other degree program.

The root cause of environmental concern is certainly complex. It is possible that many factors play a key role in cultivating concern for the environment within a person, as determined by acceptance of the new ecological paradigm. Surely education plays a role but the type of education is still to be determined. Does knowledge of climate change yield the most impact on environmental concern? Does knowledge of ecology or earth systems impact environmental concern? Perhaps education is a variable that is influenced by other variables, such as time spent participating in outdoor recreational activities. Clearly, many questions have yet to be answered about how to influence environmental concern. As noted by Harraway, et. al (2012), "It may never be possible to separate the impact of broader life experiences from that of specific educational experiences."

Consideration and concern for the natural world is an important quality that people should be encouraged in all societies. Acceptance of the New Ecological Paradigm must happen for people to support and promote dedicated environmental sustainability and responsibility. The sooner we can untangle the root causes of this important trait, the sooner we can cultivate a commonly shared, pro-ecological mindset within all societies that can be used to mitigate climate change, protect the earth and sustain humankind.

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APPENDIX I

TABLES

SUMMARY: REVISED NEP
SCORES FOR DEGREE
PROGRAM TYPES

Groups	Count	Sum	Average	Variance
Humanities	18	63.4	3.522222	0.115163
Applied Science/Chemistry	10	35.06667	3.506667	0.480198
Environmental Studies/Fisheries and Wildlife	13	47.26667	3.635897	0.221197
Biology/Pre-Med	17	61.2	3.6	0.378333
Agricultural Sciences	7	18.7	2.671429	0.14164

Table 1. Statistical summary of data describing the average revised NEP scores for 5 degree program cohorts. Included is the number of participants in each group, the sum of all scores in each group, the average scores for each group and the variance of scores within each group.

ANOVA: REVISED NEP
SCORES FOR DEGREE
PROGRAM TYPE

Source of Variation	SS	df	MS	F	P-value
Between Groups	5.171526	4	1.292882	4.898179	0.001745
Within Groups	15.83709	60	0.263951		
Total	21.00862	64			

Table 2. Results of the single factor ANOVA test for revised NEP scores for each degree program type.

SUMMARY: AVERAGE
REVISED NEP SCORES FOR
COLLEGE GRADE LEVEL

Groups	Count	Sum	Average	Variance
Freshman	5	15.33333	3.066667	0.371111
Sophomre	20	72	3.6	0.339649
Junior	20	70.13333	3.506667	0.20276
Senior	8	27.53333	3.441667	0.412619
Graduate	12	43.8	3.65	0.300707

Table 3. Statistical summary of data describing the average revised NEP score for 5 college grade levels. Included in the summary is the number of participants for each category, the sum of all revised NEP scores for each category, the average revised NEP score for each category, and the variation of scores within each category.

ANOVA: REVISED
NEP SCORES FOR
COLLEGE GRADE
LEVEL

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.411	4	0.35275	1.176727	0.330182	2.525215
Within Groups	17.98633	60	0.299772			
Total	19.39733	64				

Table 4. Results for the single factor ANOVA test for average revised NEP score for college grade level.

Results from Multivariate Analysis				
	Estimate	Std Error	t Value	Pr(>|t|)
GenderMale	-0.255368	0.162606	-1.57	0.122
GenderOther 0.122073 0.572179 0.213 0.832	0.122073	0.572179	0.213	0.832
Graduate	0.579508	0.42059	1.378	0.7174
Junior	0.323662	0.290366	1.115	0.27
Senior	0.394473	0.328155	1.202	0.234
Sophomore	0.432117	0.2859	1.511	0.136
Age	-0.003146	0.021712	-0.145	0.885
Knowledge	-0.003146	0.034345	-0.035	0.972
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
Residual standard error: 0.5538 on 56 degrees of freedom				
Multiple R-squared: 0.1146, Adjusted R-squared: -0.0119				
F-statistic: 0.9059 on 8 and 56 DF, p-value: 0.5183				

Table 5. Multivariate Analysis. A multivariate analysis was conducted to determine how the following factors could potentially be interacting with one another: grade level, local environmental knowledge, age and gender. There were no significant relationships found among these variables.

APPENDIX II

NEW ECOLGOICAL PARADIGM SCALE

1. We are approaching the limit of the number of people the Earth can support.

2. Humans have the right to modify the natural environment to suit their needs

3. When humans interfere with nature, it often produces disastrous consequences.

4. Human ingenuity will insure that we do not make the Earth unlivable.

5. Humans are seriously abusing the environment.

6. The Earth has plenty of natural resources if we just learn how to develop them.

7. Plants and animals have as much right as humans to exist.

8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.

9. Despite our special abilities, humans are still subject to the laws of nature.

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.

11. The Earth is like a spaceship with very limited room and resources.

12. Humans were meant to rule over the rest of nature.

13. The balance of nature is very delicate and easily upset.

14. Humans will eventually learn enough about how nature works to be able to control it.

15. If things continue on their present course, we will soon experience an ecological catastrophe.

APENDIX III

LOCAL ENVIRONMENTAL KNOWLEDGE TEST

1. What is the dominant soil type in southeastern Nebraska?
    A) Mollisol
    B) Ultisol
    C) Entisol
    D) Aridisol

2. What role does soil bacteria play in helping plants grow?
    A. Provides food
    B. Provides water
    C. Carbon fixation
    D. Nitrogen fixation

3. What key feature of the Nebraskan landscape makes the soil optimal for agriculture and is responsible for dark soil color?
    A. Flat land
    B. Grass lands
    C. Many rivers, streams and lakes
    D. Land used for animal agriculture and cropland

4. What type of climate is Lincoln, NE situated in?
    A. Humid continental, mild summer
    B. Semi-arid
    C. Humid subtropical, no dry season
    D. Humid continental, hot summer

5. How many days per year, on average, does Lincoln, NE have temperatures above 32 degrees Celsius?
    A. 58
    B. 312
    C. 162
    D. 217

6. What is the average rainfall in Lincoln, NE over the past 10 years, in inches?
    A. 55.2
    B. 29.5
    C. 14.7
    D. 67.7

7. How many feet above sea level is Lincoln, NE?
    A. 4,869 ft
    B. 627 ft
    C. 1,219 ft
    D. 3,271 ft

8. Which species is not an invasive species to southeastern Nebraska?
    A. Mason Bee
    B. Gypsy Moth
    C. Varroa Mite
    D. Pine Shoot Beetle

9. Which of the following is a migratory bird species that moves through Nebraska annually?
    A. Sandhill Crane
    B. Redwinged Blackbird
    C. American Crow
    D. Bald Eagle

10. Which grass species is not native to Nebraska?
    A. Buffalo Grass
    B. Kentucky Bluestem
    C. Western Wheatgrass
    D. Little Bluestem

11. What is the dominant form of land cover in southeastern Nebraska?
    A. Grassland
    B. Cropland
    C. Urban (Occupied by humans; towns and cities)
    D. Open Shrub land

12. How large is the watershed Lincoln, NE is situated in?
    A. 2,016 square miles
    B. 400 square miles
    C. 5,798 square miles
    D. 1,492 square miles

13. What is the name of the watershed Lincoln, NE is situated in?
    A. Lower Missouri Watershed
    B. Lancaster Co. Watershed
    C. Region 5 Watershed
    D. Salt Creek Water Shed

14. Which process is not an effective way to sanitize water so that it is safe for human consumption?
    A. Boiling
    B. Water disinfection tablets
    C. Freezing and thawing
    D. Distillation

15. Which of the following is a source from which water can become contaminated?
    A. Malfunctioning waste water treatment systems

B. Agricultural runoff, such as fertilizer and animal waster
C. Naturally occurring chemicals and minerals in streams and aquifers
D. All of the above