Assessing the impact of the ACMES STEM summer camp on 6-8th graders' environmental perceptions

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INTRODUCTION

- The Assimilating Computational and Mathematical Thinking into Earth and Environmental Science (ACMES) STEM Summer Camp reached out to students interested in STEM entering grades 6-8 in Fall 2019.
- Studies show that early exposure to environmental education can help students become more aware of urgent environmental threats (Arcury and Johnson 1987; Bodzin 2012).
- Constructive, extracurricular activities with peers help improve environmental awareness (Karahan and Roehrig 2015).
- Research analyzing the relationship between children's perceptions of the environment and relevant contributing factors is scarce; this study aims to address this gap
- Camp participants were asked to complete surveys before and after a trip to Stokes State Forest to provide insight on potential factors affecting environmental perception after engaging in collaborative activities with their peers.

Figure 1. Images from the ACMES 2019 STEM Summer Camp. Participants played STEM-based games, visited different labs to gain deeper understanding of scientific processes, and visited Stokes State Forest for a day of nature.

OBJECTIVES

- Analyze different factors contributing to environmental perception in children after participating in collaborative, constructive activities with their peers after a day-long outing in nature.
- Determine the effectiveness of the ACMES Summer Camp program in positively affecting participants' environmental views.

DATA AND METHODS

- Survey
  - Compare survey results (n=41) conducted before and after an excursion to Stokes State Forest;
  - Included questions about feelings of being in nature, human impact on nature, and outlooks concerning environmental issues.
- Statistical data analysis
  - Cochran-Armitage trend test – test for trends in binomial proportions
  - Contingency analysis with chi squared values – determines whether relationships are significant
  - Cochran-Mantel-Haenzel (CMH) test – used for data presented in a 2x2 matrix, tests for differences
  - Variable clustering – method that groups related questions together for data reduction to single variables

RESULTS

- Contingency analysis and the Cochran-Armitage test suggest a significant relationship between respondents and the ordinal-response questions "I am optimistic about the future" and "Nearly all human activity is damaging to the environment."

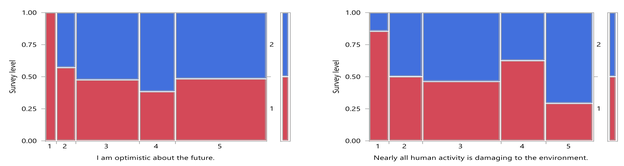

Figure 2. Results from the Cochran-Armitage test. "1" (in red) represents responses from the pre-survey while "2" (in blue) represents the post-survey. Values 1-5 on the horizontal axis represent beliefs ranging from 1 ("Strongly disagree") to 5 ("strongly agree").

- Contingency analysis, CMH, and Cochran-Armitage (Fig. 3) were run to determine relationships between questions and respondents' feelings of safety and perception of human impact on the environment.
- Variable clustering narrowed data to the most relevant (Fig. 4), determining the input for more refined regression model.

Test	Value	Relevant Factors
Contingency Analysis Likelihood Ratio	0.088	Grade, human impact on environment
CMH	0.097	Grade by level, strength of opinion
Cochran Armitage Trend Test	0.097	Optimism about the future, time in nature

Figure 3. Results from applied statistical tests.

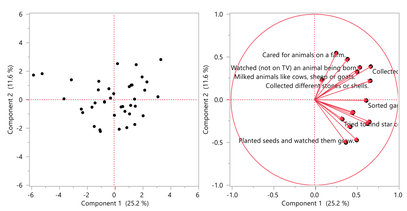

Figure 4. Results from cluster analysis, showing the survey questions that were reduced together to eliminate redundancy

DISCUSSION

- After the trip to Stokes, respondents were more optimistic about the future and more strongly agreed that humans negatively impacted the environment.
- 6th grade campers responded more positively to the camp than 7th and 8th graders.
- Boys felt safer in the woods after spending more time in them; perhaps exposure to nature is helpful in improving environmental perceptions.
- Contingency analysis and the CMH test shows respondents in grade 6 strongly feel that human activity damages the environment more than those in grades 7 and 8.
- The Cochran-Armitage Trend test shows that respondents felt more optimistic about the future after the excursion.
- The cluster analysis is helpful in reducing redundant variables, leading to a deeper analysis determining the effectiveness of camp leaders.

CONCLUSIONS AND FUTURE WORK

- Perhaps the ACMES STEM Summer Camp and other similar programs should target children in grades 6 and below for maximum impact and consider utilizing different outreach methods for 7th and 8th graders.
- This research suggests younger campers might be more flexible in changing their existing perceptions.
- Campers were more optimistic about the future and more strongly agreed that humans negatively impacted the environment after the excursion, suggesting that the ACMES camp may be helpful in environmental education.
- Future research can also delve into understanding how respondents feel about prospective career options in STEM.

REFERENCES

Arcury, T. A., and T. P. Johnson. 1987. Public environmental knowledge: A statewide survey. The Journal of Environmental Education **18**:31-37.

Bodzin, A. 2012. Investigating urban eighth-grade students' knowledge of energy resources. International journal of science education **34**:1255-1275.

Karahan, E., and G. Roehrig. 2015. Constructing media artifacts in a social constructivist environment to enhance students' environmental awareness and activism. Journal of Science Education and Technology **24**:103-118.

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