



Effective Climate Change Education: Predicting and Cultivating Hope

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Theoretical Framework

Hope has been identified as one of the important learning outcomes for educational and Extension programs.^{1,2,3,4} People who are hopeful are more likely to be actively engaged in problem solving. We wished to explore whether learning about climate change and forests changed hopefulness in high school students.

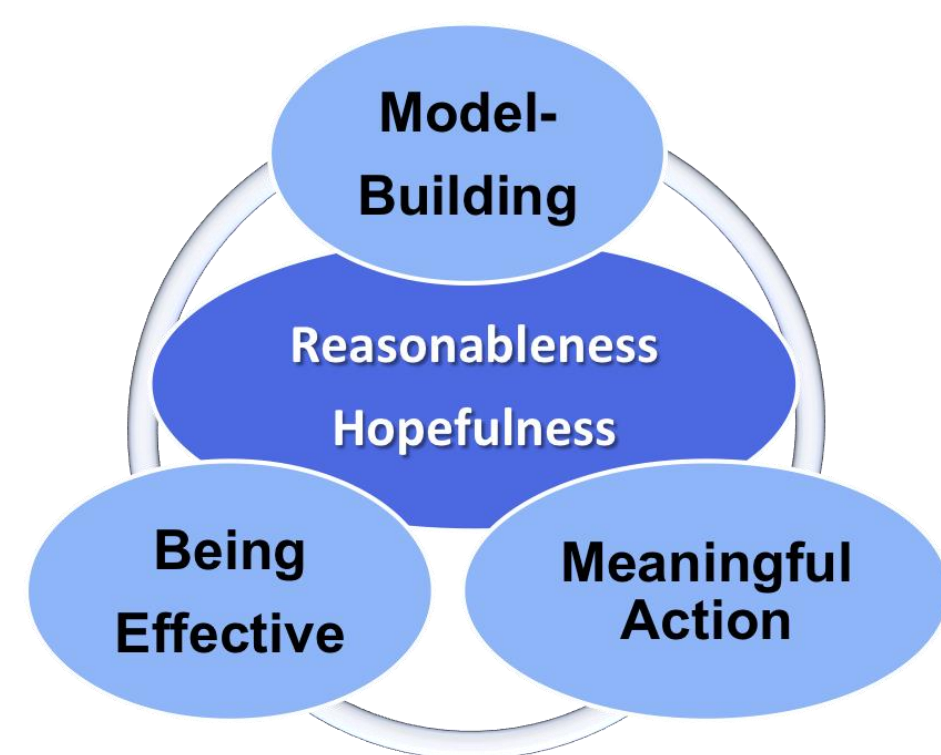


Figure 1. The Framework of Reasonable Person Model



Photo by Jessica Ireland

The study is guided by the *Reasonable Person Model* (Figure 1), which suggests that effective mental models help people process information and make sense of their world, and people are more likely to be hopeful in environments that offer enhance clarity and understanding and offer opportunities to make a difference.⁵

Research Questions

1. What are the effects of individual knowledge, school mean knowledge, working forest, on individual Hope scores, when controlling for gender and grade level?
2. How do students from schools in counties with working forests differ from the without working forests in term of hope, after controlling for knowledge?
3. Does student hopefulness change after exposure to four activities on climate and forests?



All Photo by Jessica Ireland

- References
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Participants

The population of interest is high school students (9th -12th graders) from southeastern United States. This sample is comprised of 700 high school students from 18 high schools in XX states. Data were collected during fall 2013 and early January 2014 during a curriculum evaluation. The population was equally divided by gender (50% male). About 65% of students were 11th and 12th graders and 35% were 9th and 10th graders.

Procedures and Measures

Following approval from the University of Florida Institutional Review Board, the researcher mailed the instruments, parental consent forms, and assent scripts to teachers. The teachers collected parental consent forms and administered the students' pre and posttests before and after they instructed the four activities. The four activities were from PINEMAP/PLT secondary module.⁶

Student-level Variable

- Gender
- Grade level
- Prior knowledge and perception of climate (PK)

School-level Variable

- Proximity to working forests (Prox) as determined by USFS Timber Product Output Database
- School mean knowledge (MEAN PK)

Data Analysis

To answer research question 1 and 2, we used multilevel linear models to estimate the regression coefficients. Multilevel modeling allows researchers to disentangle the effects from different-level predictors and do not assume that the samples are randomly collected from the population⁷.

Student-Level Model:

$$Hope_{ij} = \beta_{0j} + \beta_{1j}[PK_{ij} - (MEAN PK_j)] + \beta_{2j}(Gender_{ij}) + \beta_{3j}(Grade_{ij}) + r_{ij}$$

School-level Model:

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(MEAN PK)_j + \gamma_{02}(Prox)_j + u_{0j} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j} &= \gamma_{20} \\ \beta_{3j} &= \gamma_{30} \end{aligned}$$

We analyzed four models by using Mpuls Version 7.11⁸ and compared models with deviance statistics. The four models are: 1) One-way ANOVA Model; 2) Means-as-Outcomes Model; 3) Random Regression Models; and 4) Intercepts-as-Outcomes Model (final model).⁶

We used dependent t-test to answer RQ 3.

Results

Regarding RQ1 and 2, results from the multilevel models suggest that

- 13.5 % of the variance among student's hope scores was due to school variations
- one-unit increase in student prior knowledge and perception on climate change leads to a 2.08-unit increase in hope scores when controlling for gender and grade
- the strength of association between student PK and hope is consistent across schools
- students from schools in counties with working forests are 3.34-unit higher than the without working forests in term of hope, after controlling for school mean knowledge, gender, and grade (Table 1)

Regarding RQ3:

- dependent t-test from students' pre and posttest suggest that four activities on climate and forests significantly increased students hope (t=2.90, df=222, p<.01)

Table 1 Regression coefficients for the multilevel model analysis for hope

Variables	Model I	Model II	Model III	Final Model
Within				
Intercepts	59.39	-27.65	59.39	-13.45
Grade				1.23
Gender				-0.19
PK			2.07***	2.08***
Between				
MEAN PK		7.53***		6.14***
Prox				3.34*
Random effects				
Level 1 Hope variance	108.47	108.89	89.90	90.14
Level 2 Hope variance	16.96	3.56	17.52	1.77
PK-Hope slope			0.01	
Covariance			-0.26	
Model Fit				
Deviance	5299.47	5283.31	5171.43	5147.05
		16.16	111.88	24.38
df	3	4	6	8
		1	2	2
Prob. Chi square		<0.001	<0.001	<0.001

*p<.05; **p<.01; ***p<.001

Discussion

The findings support the theory, *Reasonable Person Model*⁵ that individual mental models and environments are important correlates of hope among high school students when general background (gender and grade level) are taken into account. Hope plays an important role in engaging people in problem solving. As Bandura suggested earlier, if we can help people see the connections between today's decision and tomorrow's impacts and build their capacity and confidence in working towards solutions, even a brief exposure to well-designed activities about solutions can significantly change hopefulness.



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