

What leads to better outcomes in environmental education?

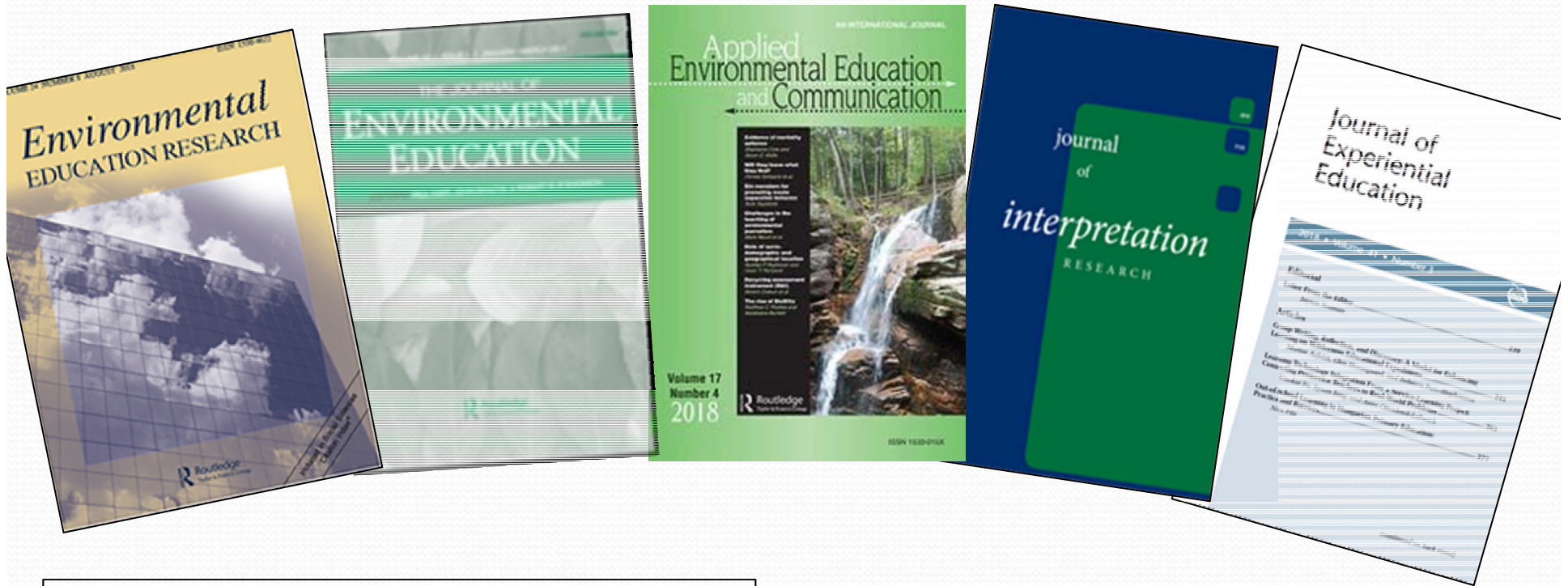


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Best Practices



Systematic literature review

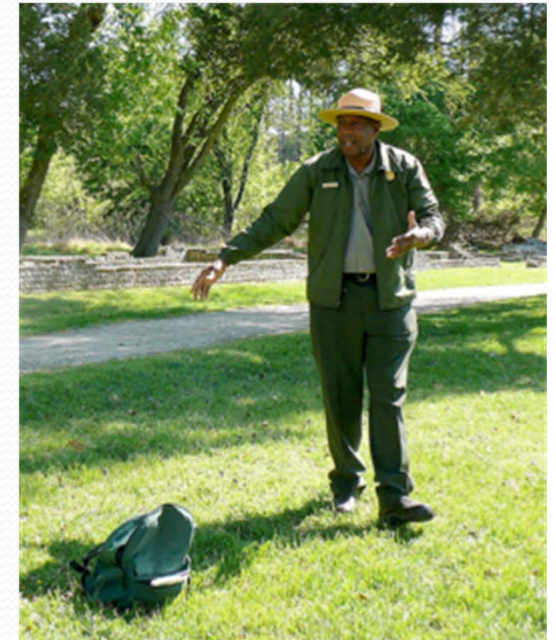


Stern et al. 2014. Environmental education program evaluation in the new millennium: what do we measure and what have we learned? *Environmental Education Research* 20(5): 581-611

Skibins, J.C., Powell, R.B., and M.J. Stern 2012. Exploring empirical support for interpretation's best practices. *Journal of Interpretation Research* 17(1): 25-44.

Empirical study of live interpretive programs in the Parks

- 24 park units
- 376 live interpretive programs
- 3,603 retrospective visitor surveys
- 56 program characteristics



Lesson learned

- Reliable observation is possible
- 15 factors emerged that were most linked to positive outcomes
 - Confidence of the Interpreter
 - Authenticity of the interpreter
 - Organization of the story
 - Relevance, responsiveness
 - Not focusing on just the facts!

Stern and Powell 2013. Journal of Interpretation Research. 18(2)



A group of children and adults are gathered on a sandy beach, focused on a project on the sand. The children are wearing swimwear and are actively engaged in the activity. The adults are also participating, with one person in a blue shirt leaning over the group. The background shows the ocean and a clear sky.

What practices lead to better outcomes in EE programs?

But what is “success”?

Is there a set of crosscutting outcomes for all EE?

Environmental literacy

- Knowledge
- Dispositions
- Attitudes
- Skills
- Behaviors

Tbilisi Declaration, Hungerford, Volk, McBeth, NELA, and many others



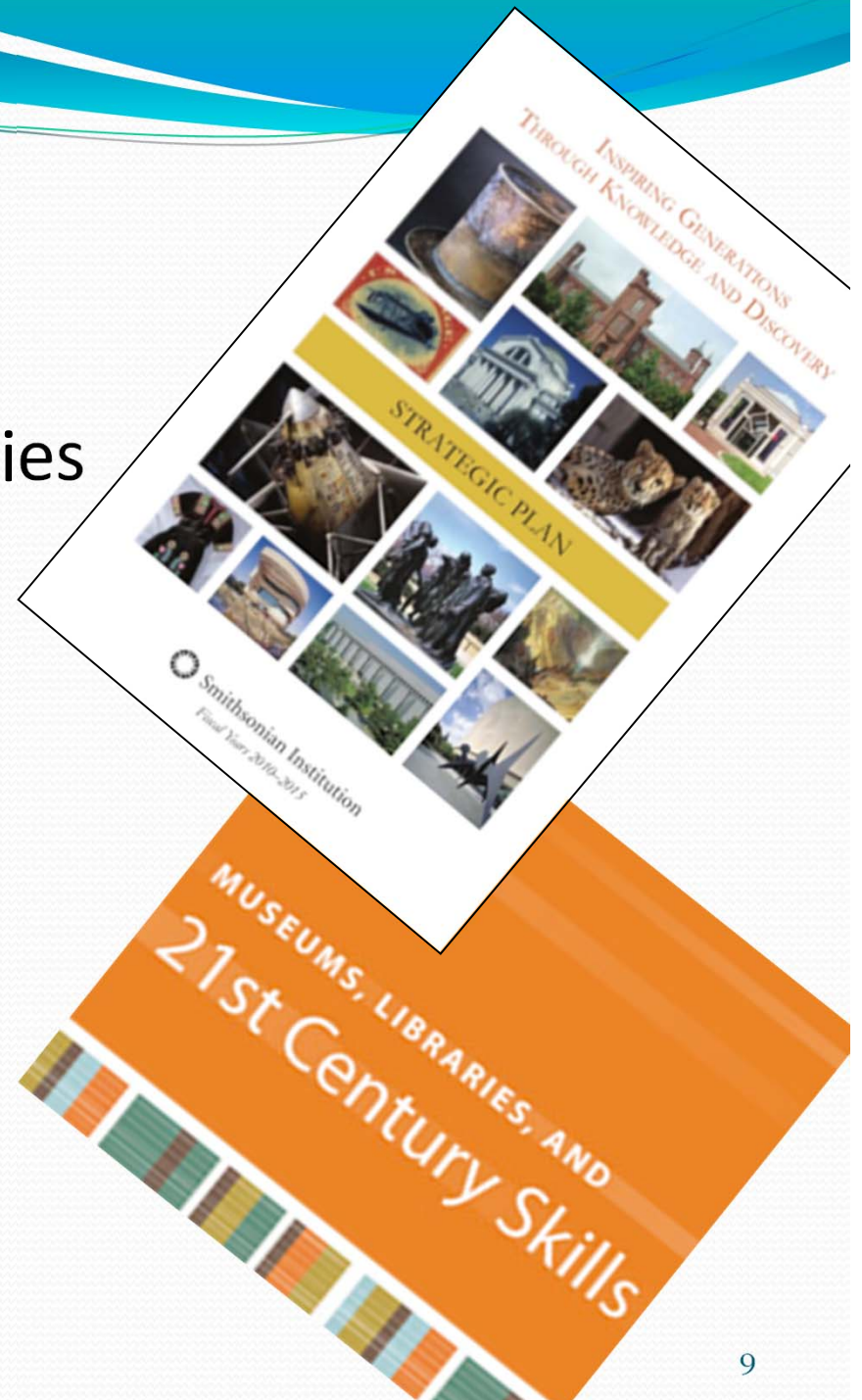
Educational standards



21st Century Skills

A broad list of societal literacies

- Critical thinking
- Communication
- Collaboration
- Creativity



Positive youth development

- Emotional/social Intelligence
- Five Cs
 - Competence, confidence, character, connection, caring
- Twelve student strengths-
 - Mind (Curiosity, Self-control, Zest)
 - Heart (Purpose, Social/emotional Intelligence, Gratitude)
 - Will (Grit, Growth, Optimism)



Crosscutting Outcomes for EE:

The potential to be transformational



Big Challenges

1. Defining Aspirational “Success”
2. Crosscutting (Relevant)
3. Measuring Outcomes:
 - Variability and sensitivity
 - Addressing skew and social desirability bias



Defining “Success”

- NPS Advisory Board Education Committee
- NAAEE Advisory Group
- Clark, Heimlich, Ardoin, & Braus Delphi Study
- National Park Foundation Learning Alliance
- ANCA: Association of Nature Center Administrators



EE21 outcomes

- Participatory process

Enjoyment

Behavior
change

Self-
efficacy

Learning

Env.
attitudes

Interest/
motivation

21st Century
skills

Connection
to place

Env.
behaviors

Meaning

Cooperation

School
behaviors

Pilot Studies



Great Smoky Mtns



Everglades NP



NC Natural Science



USFS Snorkeling



Glen Helen, OH



NorthBay, MD



Cuyahoga NP



Oregon outdoor schools

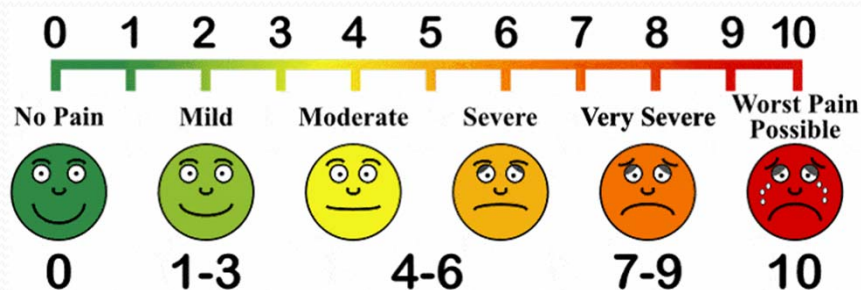
Psychometric Testing: Statistical fit!

- Confirmatory factor analysis (CFA)
 - Consistent 10 factor model for each sample
 - Measurement invariance: configural, metric, structural
 - Moderate skew (M=6-7) on 11 point scales!
- Revised survey
 - 8-10 minutes
 - 2-5 items per construct
- Logistical
 - Retrospective only for national study

Confirmatory Factor Analysis Results of final 10 Factor EE21 Scale						
	S-BX2	df	CFI	SRMR	RMSEA*	
Great Smoky Mountains National Park-Appalachian Highlands Science Learning Center Rho=.974; Chronbach's Alpha=.950	529.8964	419	.980	.040	.029	.020-.036
Everglades National Park- Rho=.928; Chronbach's Alpha =.898	480.8516	414	.918	.058	.032	.016-.044
NC SCIENCE MUSEUM Rho=.977 Chronbach's Alpha=.960	581.2041	418	.945	.051	.051	.041-.061
NorthBay Rho=.985; Chronbach's Alpha =.966	519.4756	419	.978	.036	.031	.021-.040
Multnomah Education Service District Outdoor School Rho=.975; Chronbach's Alpha =.959	529.3274	418	.941	.050	.044	.031-.054
Glen Helen Rho=.973 Chronbach's Alpha =.951	476.2794	416	.943	.060	.031	.013-.044
**Cuyahoga Valley Environmental Education Center Rho=.964 Chronbach's Alpha=.942	497.1663	407	.909	.064	.045	.029-.058

EE21 outcomes

- 12 Outcomes
- 2 Single Items and 10 Scales
- 11 point scales
- Administrative Script



Enjoyment

Behavior
change

Self-
efficacy

Learning

Env.
attitudes

Interest/
motivation

21st Century
skills

Connection
to place

Env.
behaviors

Meaning

Cooperation

School
behaviors

EE21: Available for your use

- Retrospective for shorter programs
- Pre-Post for longer programs
- Powell, R.B., Stern, M. J., Frensley, B.T., & Moore, D. (2019) Identifying and developing crosscutting environmental education outcomes for adolescents in the 21st Century (EE21). *Environmental Education Research*. DOI: 10.1080/13504622.2019.1607259



STUDENT SURVEY

This survey asks questions about today's field trip. Your answers will help us to do important future field trips. This is not a test. Please do all right or wrong answers. Answer with your best opinion. Thank you for your time.

1. Your school's name _____ Your grade level _____

2. How would you rate this field trip on a scale from 0 to 10? Circle a number.

0 1 2 3 4 5 6 7 8 9 10

3. As a result of this field trip, do you intend to do anything differently in your life? Circle a number.

0 1 2 3 4 5 6 7 8 9 10

4. In the left-hand column, circle the number that matches how much you agreed with each statement before attending this field trip. In the right-hand column, circle the number that matches how much you agree with each statement after attending this field trip.

BEFORE ATTENDING **AFTER ATTENDING**

1. I am more interested in the environment. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

2. I am more motivated to learn about the environment. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

3. I am more confident in my ability to make a difference in the world. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

4. I am more likely to participate in environmental activities. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

5. I am more likely to share my knowledge of the environment with others. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

6. I am more likely to take action to protect the environment. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

7. I am more likely to become an environmental steward. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

8. I am more likely to become an environmental leader. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

9. I am more likely to become an environmental activist. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

10. I am more likely to become an environmental advocate. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

11. I am more likely to become an environmental leader. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

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166. I am more likely to become an environmental advocate. 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10

167. I am more likely

What leads to better outcomes?

- Systematic observation of 334 EE programs in 24 states (plus DC) by 90 unique program providers
 - Day field trip programs
 - Middle school kids (grades 5-8)

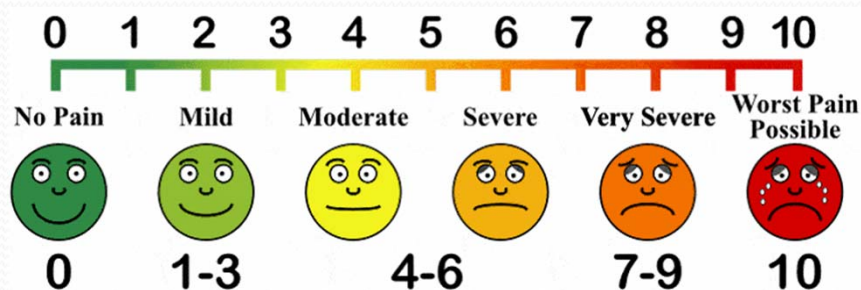


- What program characteristics are most powerfully linked to outcomes across a range of contexts?



EE21 outcomes

- Participatory process
- Extensive pilot testing
- Statistical validation
- **Blue = EE21 scale**



Enjoyment

Behavior change

Self-efficacy

Learning

Env. attitudes

Interest/motivation

21st Century skills

Connection to place

Env. behaviors

Meaning

Cooperation

School behaviors



Program variables

- Educator characteristics
 - Passion, comfort, apparent knowledge . . .
- Pedagogical approaches
 - Investigation-focused, play-based, personal relevance, issue-based, reflection, storytelling, central message, social-ecological connections . . .
- Contextual factors
 - Group size, environmental context, weather, role of visiting teachers and chaperones . . .

PROGRAM LEVEL SHEET

Date: _____ Provider: _____

Program name: _____

Number of lead instructors _____ Total time on-site(min.) _____ Number of _____

Weather 1 2 3 Description of weather: _____

Critical event -1 0 1 Description of event: _____

Visiting teacher role: _____ Chaperone (passive) _____ Participant _____ Support _____

_____ Disciplinarian _____ Other Explain: _____ Group size: _____

Program type (check all that apply):

_____ Stations (same instructor) _____ Stations (mult. instructors) _____ Traditional immersive
 _____ Recreation focus _____ Science focus _____ Art focus
 _____ Citizen science _____ Service program _____ Other Explain: _____

Short description (shot summary of setting, activities, in-between activity time, central message(s), and _____

Instructors' intended goals (check all that apply):

_____ Knowledge _____ Attitudes _____ PYD
 _____ Develop skill(s) _____ Place connection _____ Entertainment/enjoyment
 _____ Interest _____ Intentions/behaviors _____ Other (write in space) _____

Full day variables

Staging	1	2	3	Transitions
Intro Quality	1	2	3	4
Conclusion Quality	1	2	3	4
Intro/Concl. Link	1	2	3	4

"Today, we're going to be scientists" 0 1

Instructor identities

0 = not present
 1 = at least one, but not all lead instructors

Friend 0 1
 Coach/Facilitator 0 1
 Encyclopedia 0 1
 Authority 0 1
 Submissive 0 1
 Bare minimum 0 1
 Other 0 1

Write in: _____

Live animals 1
 Captive 0 1
 Animal(s): _____

Negative climate variables

0 = never 1 = seldom or more
 Disrespect
 Inequity
 Inattentiveness
 Impatience
 Below, 0 = no; 1 = vague/unclear
 Advocacy bias

ACTIVITY REVIEW

Program name: _____ Observer(s): _____

Visiting teacher role: _____ No role _____ Participant _____ Support _____ Disciplinarian _____ Co-teaching _____ Primary

Prof. appearance	0	1				Group work	1	2	3	4
Gender match	0	1	NA			Verbal engagement	1	2	3	4
Educator comfort	1	2	3	4		Question quality	1	2	3	4
Apparent knowledge	1	2	3	4	NA	Inaccuracy	0	1		
Instructional clarity	1	2	3	4		Discussion-based	1	2	3	4
Content clarity	1	2	3	4		Multiple viewpoints	1	2	3	4
Eloquence	1	2	3	4		Traditional lecture	1	2	3	4
Audibility	1	2	3	4		Just the facts	1	2	3	4
Visibility	1	2	3	4		Relevance	1	2	3	4
Humor quality	1	2	3	4		Group reflection	1	2	3	4
Humor quantity	1	2	3	4		Individual reflection	1	2	3	4
Sarcasm	1	2	3	4		21 st Century skills	1	2	3	4
Passion	1	2	3	4		Issue-based	1	2	3	4
Sincerity	1	2	3	4		Systems thinking	1	2	3	4
Personal sharing	1	2	3	4		Place-based	1	2	3	4
Formality	1	2	3	4		Experiential cycle	0	1		
Affinity-seeking	1	2	3	4		Inquiry-based	1	2	3	4
Emotional support	1	2	3	4		Investigation-focused	1	2	3	4
Responsiveness	1	2	3	4						

Negative climate

Disrespect 0 1 2
 Inequity 0 1 2
 Inattentiveness 0 1 2
 Impatience 0 1 2
 Advocacy bias 0 1 2

Identity of lead instructor

☐ Friend ☐ Authority ☐ Other:
☐ Coach/Facil. ☐ Submissive
☐ Encyclopedia ☐ Bare minimum

Physical comfort 1 2 3
 Physical exertion 1 2 3 4
 Student disruptions 1 2 3 4
 Class management 1 2 3 4
 False audience assumption 1 2 3 4
 Appropriate logistics 1 2 3 4
 Time management 1 2 3 4
 Pace -1 0 1 2
 T/C Engagement 1 2 3 4
 Student autonomy 1 2 3 4
 Free exploration 1 2 3 4
 Free time on-task 1 2 3 4
 Affective messaging 1 2 3 4
 Role play 1 2 3 4
 Story-telling 1 2 3 4
 Hands-on 1 2 3 4
 Sensory 1 2 3 4
 Play-based 1 2 3 4

Circle appropriate answers:

Clear research questions are present. Yes/no By student/By instructor
 Hypotheses are formed. Yes/no By student/By instructor
 Data is collected. Yes/no By student/By instructor
 Data collection clearly linked to question or hypothesis? Yes/no
 Hypotheses are tested. Yes/no By students/By instructor
 Valid conclusions are drawn. Yes/no By students/By instructor
 Any clear flaws in research/interpretation? Yes/no N/A

Organization

Technical difficulty 1 2 3 4
 Quality of intro 1 2 3 4
 Quality of conclusion 1 2 3 4
 Intro/conclusion linkage 1 2 3 4
 Transitions 1 2 3 4
 Sequence 1 2 3 4
 Unrelated content 1 2 3 4
 Central message(s): 1 2 3 4

Quality 0 1 2 3 4 5 6 7 8 9 10

Student group characteristics


Morale 1 2 3 4
 Baseline knowledge 1 2 3 4
 Participation 1 2 3 4
 Overall positive engagement 1 2 3 4

Context characteristics

Novelty of setting 1 2 3 4
 Immersion 1 2 3 4
 Beauty 1 2 3 4
 Perceived threat 1 2 3 4
 Naturalness 1 2 3 4
 Outdoors 1 2 3 4

Live animals 1 2 3 4 Captive: _____ Non-captive: _____

Animals



Variable	Definition	Scores			
Passion	The educator's apparent level of enthusiasm for the lesson content and the overall authentic emotional connection with which the material is delivered	1 Educator seems completely detached/disinterested from the lesson	2 Educator shows low levels of passion overall	3 Educator shows moderate levels or sporadic instances of high passion	4 Educator seems extremely passionate about the lesson
Free Exploration	Degree to which students were encouraged to explore the environment in their own way	1 No efforts made to incorporate free exploration	2 Minimal efforts to incorporate free exploration	3 Moderate efforts to incorporate free exploration	4 Major efforts to incorporate free exploration for most of the program
Relevance	Degree to which the lesson content references or makes explicit connections to the students' experience outside the realm of the instruction.	1 No efforts made to create relevance	2 Minimal efforts to create linkage to students' lives, perhaps just through simple analogy.	3 Moderate efforts to create direct relevance to students' lives	4 Major efforts to link the experience directly to students' personal lives at home
Central message(s)	There is a clearly communicated central message (or messages) that demonstrates why what they learned should matter to them.	No effort or not present.	Some effort made but unclear, ambiguous, or difficult to discern actual central message.	Easy to detect central message but not fully developed or not clearly meaningful.	Clearly communicated and well-developed central message.
Play-based	Degree to which the lesson actively engages students in games or competition as an intentional teaching technique.	1 No efforts made to incorporate play-based learning	2 Minimal efforts to incorporate play-based learning – possibly a short game.	3 Moderate efforts to incorporate play-based learning. A game(s) made up a meaningful portion of the program.	4 Most of the program was play-based.

Methods overview

- Systematic observations of programs
- Immediate post-experience surveys with participants
- Surveys with teachers
- Interviews with educators



What leads to better outcomes?

**The anticipation is
killing me!**





Preliminary findings

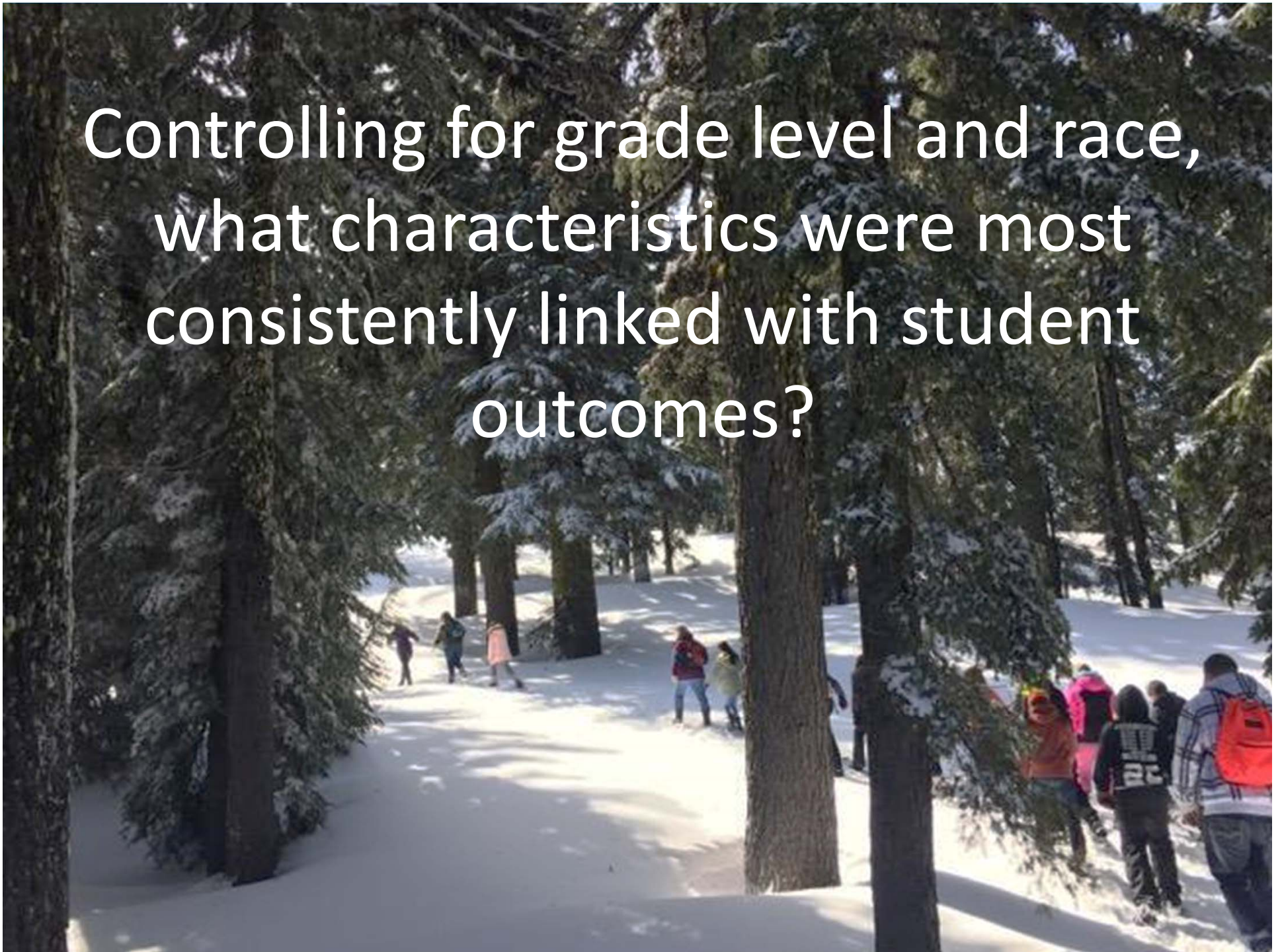
- The findings that follow are based on ongoing analyses
- Just because some elements are not shared here, does not mean they are not also important to program success (they may not have varied in our observations, or we may not have measured them!)

Demographic considerations

- Strong effects of grade level, race, and socioeconomic context
 - Lower grades → more positive outcomes
 - Latinx audiences → more positive outcomes
 - Lower economic classes → more positive outcomes



Controlling for grade level and race,
what characteristics were most
consistently linked with student
outcomes?



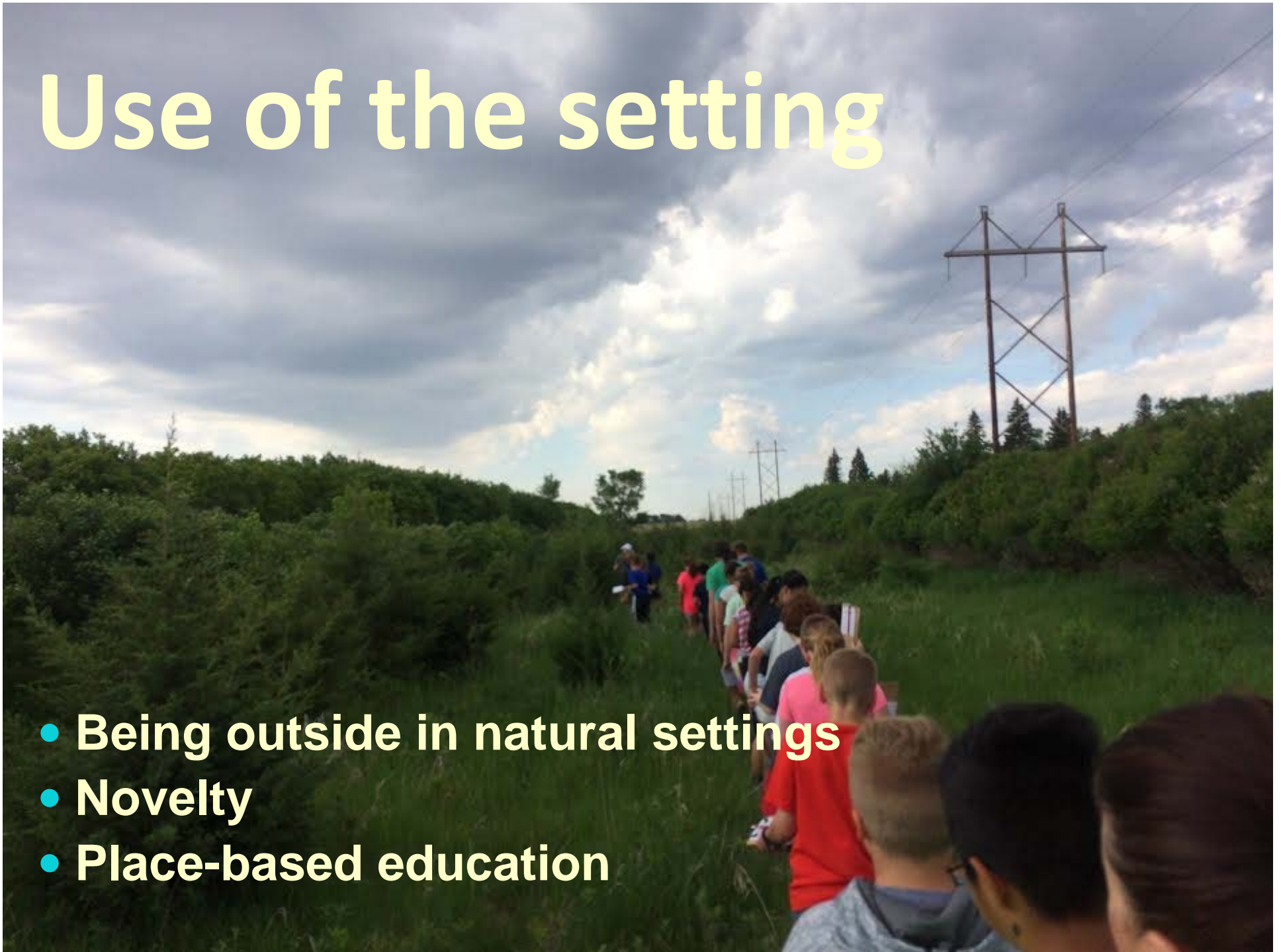
The group

Effects on EE21

- Staging (the state in which groups showed up)
- Preparation
- Smaller group sizes

Use of the setting

- Being outside in natural settings
- Novelty
- Place-based education



Instructor behaviors

- Emotional support
 - Passion, sincerity, affinity-seeking, positive communications
- Responsiveness
- Confidence & clarity
 - Apparent comfort and knowledge, instructional clarity, content clarity
- Opportunism



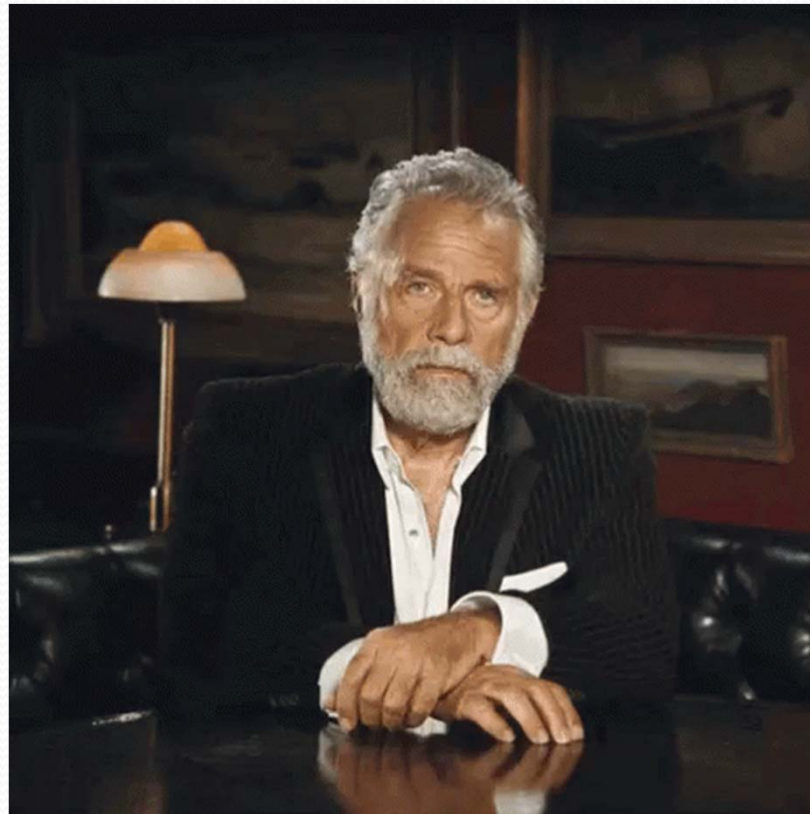
Quality communication

- Verbal engagement
- Question quality
- Effective class management
- Effective transitions
- Quality conclusions



What about lecture-focused programs?

No, my friend . . .



Aiming for behavior change?

- Systems focus
- Identification as “scientists”
- Advocacy
- Fact focus (neg.)



Strongest relationships

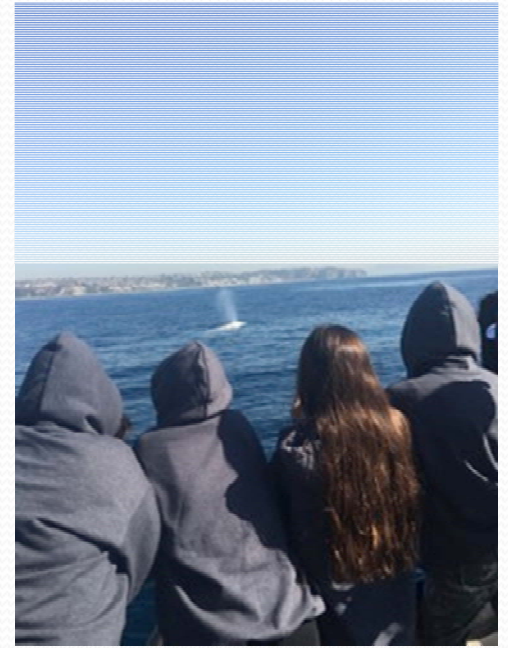
(Relative Importance Analysis)

EE21

- Transitions
- Group size (negative)
- Novelty
- Conclusion quality
- Natural settings

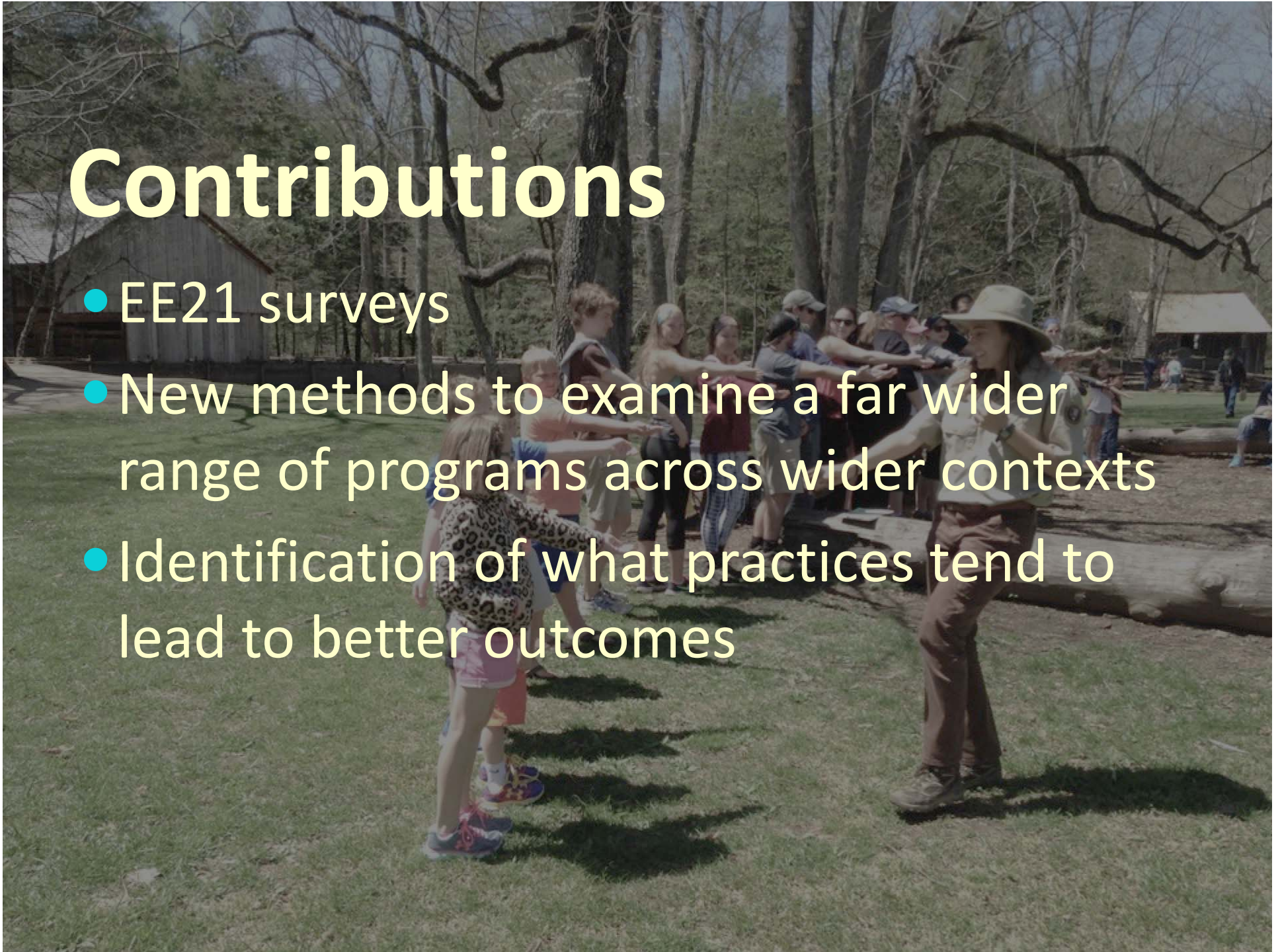
Behavioral intentions

- Advocacy



Contributions

- EE21 surveys
- New methods to examine a far wider range of programs across wider contexts
- Identification of what practices tend to lead to better outcomes



What's next

Expanding the sample

- Fall 2020 and Spring 2021
- Effective sets of practices in different contexts and diverse audiences

Establishing evidence-based EE21 learning networks

- Using EE21 to learn from each other, enhance programs, and evaluate the results



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North American Association
for Environmental Education



Association of Nature Center Administrators



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