



# Strategies for Improving Quasi-Experimental Studies:

Exploratory Factor  
Analysis and Propensity  
Score Matching

**National Indian Youth Leadership Project**

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# Overview



**We'll be sharing two strategies to improve our ability to accurately capture program effects:**

- 1. Factor Analysis, followed by...**
- 2. Propensity Score matching**

**Through demonstration, discussion, and activity**

# The Web of Life Project Elements



**OAH Tier 2 TPP Grantee**

**6<sup>th</sup> graders in two distinct Native communities (Pueblo, Navajo/mixed)**

**Based on NIYLP's  
Project Venture**



# The Web of Life Project Elements



**Positive youth development approach  
(just say yes!)**

**Adventure-based,  
experiential**

**Social-emotional  
learning**



# Web of Life (cont.)



**Delivery components**

**Service-learning  
projects**

**Culturally guided**





## Structure (year-long)

- Weekly in and after school sessions
- Day long weekend sessions





## Structure (year-long)

- Multi day events, camping, etc.
- Horse Inspired Growth & Healing



# Implementation & Evaluation Progress



**In FY12, WOL was still in extended pilot development phase**

**In FY13, we are fully implementing and evaluating the finalized full curriculum**

# Evaluation Team Goals



**Accurately describe program effects**

**Identify opportunities for program improvement**



## **Quasi-experimental design:**

**4 Different middle school sites**

**2 Treatment**

**2 Comparison**

# Web of Life Survey Instrument



**Pre-post with treatment and control**

**About 30 minutes to administer**

**Read aloud during classroom time**

**Native survey administrators**

**Active consent**

# Web of Life Survey Measures



**Sexual Behavior & Intentions**

**Substance Abuse**

***Internal Assets***

**Mental Health (anxiety & depression)**

**Ethnic Identity**

**External Assets**

**Demographics**

Our data exploration journey begins...



**We began by thinking about baseline equivalence issues and soon realized that...**

**We needed to examine factor equivalence/measurement fit and sensitivity before comparing groups**

# Evaluation Challenges



**Measurement Fit / Sensitivity in  
Population**

**Treatment / Comparison Group  
Differences**

**Implementation Differences / Dose / Etc.**

# Measurement Fit



**Sensitivity of surveys / measurement tools may vary in different populations**

**Search Institute Developmental Assets Profile was validated with very few Native American youth / different tribes**

**Poor fit can mask or distort results**

# Internal Assets Jig-Saw Puzzle



**How do YOU see the factors?**



# Search Institute Constructs



## 32 Internal Asset Questions

### Combined to Form 4 Constructs:

**Commitment to Learning – 7 questions**  
( $\alpha.78$ )

**Positive Values – 10 questions** ( $\alpha.80$ )

**Social Competence – 8 questions** ( $\alpha.73$ )

**Positive Identity – 6 questions** ( $\alpha.77$ )

# Exploratory Factor Analysis



**Used to IDENTIFY CLUSTERS of inter-correlated variables (factors)**

**ART that combines statistics, theory and practical experience**

# Our Factor Analysis Process



**Included all 32 Search Institute Internal Asset questions**

**Ran multiple ways looking for BEST fit**

**Sat TOGETHER to interpret our statistical output and integrate it with theory and our experience**

Pattern Matrix

Internal Alpha Promax

		Factor								
		1	2	3	4	5	6	7	8	9
1	I stand up for what I believe in.	.137	-.082	-.063	.058	-.018	.034	.011	.121	.588
2	I feel in control of my life and future.	-.101	.183	.067	.498	.148	.060	-.086	-.091	.365
3	I feel good about myself.	-.072	.208	-.035	.184	-.085	.487	-.044	.087	.060
4	I avoid things that are dangerous or unhealthy.	-.033	.029	.636	.038	-.124	.186	.119	.073	.006
5	I enjoy reading or being read to.	.110	-.129	.213	-.046	.185	.279	-.109	.357	.067
6	I build friendships with other people.	-.080	-.099	.005	.008	-.146	.660	.227	.080	.013
7	I care about school.	.185	.037	.053	-.011	.525	.068	-.022	-.082	.010
8	I do my homework.	-.191	.004	-.039	.090	.773	-.261	.126	.112	.007
9	I stay away from tobacco, alcohol, and other drugs.	-.017	.096	.771	-.055	.031	-.081	-.141	-.046	-.053
10	I enjoy learning.	.153	-.067	-.062	-.004	.535	.318	-.052	.063	-.061
11	I express my feelings in proper ways.	-.029	.248	.032	-.099	.114	.011	.175	.562	.093
12	I feel good about my future.	.068	-.003	-.081	.556	.067	.018	.111	-.049	.029
14	I deal with frustration in positive ways.	.082	.094	.228	-.083	-.010	.054	.373	.267	-.052
15	I overcome challenges in positive ways.	-.009	-.112	.089	.170	.072	.088	.525	.127	.121
16	I think it is important to help other people.	.798	-.133	.027	.173	-.121	.228	-.082	-.014	-.063
18	I plan ahead and make good choices.	.332	.007	.079	.117	.131	.127	.202	-.104	.020
19	I resist bad influences.	.067	-.070	.537	.026	.009	-.139	.375	-.113	-.019
20	I resolve conflicts without anyone getting hurt.	.177	-.089	.075	.433	-.055	.033	.106	.206	-.065
22	I take responsibility for what I do.	.066	.738	.167	-.005	-.038	.016	-.190	.206	-.148
23	I tell the truth even when it is not easy.	.201	.599	-.020	-.029	-.024	-.164	-.084	.064	.038
24	I accept people who are different from me.	.184	.389	.031	-.159	-.159	.174	.120	-.146	.218
26	I am actively engaged in learning new things.	.109	.002	-.150	-.170	.234	.249	.470	.064	.002
27	I am developing a sense of purpose in my life.	-.036	-.041	.010	.414	-.056	.075	.630	.025	-.080
28	I am encouraged to try things that might be good for me.	.079	.270	.120	.309	.052	-.010	.116	-.029	.050
30	I am helping to make my community a better place.	.364	.346	-.148	.154	-.016	-.115	.017	.124	-.001
32	I am developing good health habits.	-.324	.548	.001	.035	.118	.144	.134	.117	-.048
33	I am encouraged to help others.	.633	.157	-.006	-.018	-.048	-.076	.008	-.003	.080

Extraction Method: Alpha Factoring.  
 Rotation Method: Promax with Kaiser Normalization.

**Factor analysis output and interpretation to identify underlying constructs (1 of 3)**

	Factor								
	1	2	3	4	5	6	7	8	9
35 I am trying to help solve social problems.	.562	-.108	-.005	.081	.046	-.318	.038	.170	.184
31 I am developing respect for other people.	.348	.449	.007	.150	.072	-.194	.000	-.018	-.146
38 I am eager to do well in school and other activities.	.195	.215	-.061	.124	.122	.107	.218	-.180	-.209
39 I am sensitive to the needs and feelings for others.	.591	.203	.007	-.177	-.020	.020	.066	.048	.098
4 I am serving others in my community.	.068	.185	-.276	.171	-.097	.201	.056	.429	.038

Extraction Method: Alpha Factoring.  
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 13 iterations.

*Compassion/Caring* *Caring/Service*  
Doer, Problem Solver, Helper, Caring/Service

Total Variance Explained

Factor	Rotation Sums of Squared Loadings <sup>a</sup>
	Total
1	6.475
2	6.245
3	2.884
4	4.877
5	5.038
6	4.581
7	4.663
8	2.020
9	.975

Extraction Method: Alpha Factoring

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

- 1. 16 I think important help other people
- 31 I plan ahead & make good choices
- 33 I am helping to make community better
- 35 I am encouraged to help others
- 39 I am trying to help solve social prob's -
- I am sensitive to needs & feelings of others
- 22 I take responsibility for what I do
- 23 I tell the truth, even when not easy
- 24 I accept people who are different from me
- 32 I am helping to make community better
- 37 I am developing good health habits
- 37 I am developing respect for other people
- 38? *Personal Integrity*
- 39
- 4 I avoid things that are dangerous or unhealthy
- 9 I stay away from A to D
- 19 I resist bad influences
- 2 I feel in control of my life & future
- 4 I feel good about my future
- 20 I resolve conflicts about anyone getting hurt
- 28 (I am encouraged to try things that might be good for me.)
- 7 I care about school
- 8 I do my homework
- 10 I plan ahead and make good choices
- I enjoy learning

*Compassion*  
*Healthy Choices*  
*Optimism about future confidence*  
*Valuing Learning*

*Confidence*  
*Self Efficacy*

*Competence*

Factor analysis output and interpretation to identify underlying constructs (2 of 3)

3 Feel good about myself (social)  
 6 I build friendships w/ other people } Try in #7

7 Competence  
 14 I deal w/ frustration in positive ways  
 15 I overcome challenges in positive ways  
 26 I am actively engaged in learning new things - (6?)  
 21 I am developing a sense of purpose in my life  
 18 I plan ahead + make good choices

Capable/  
 Competence

5 I enjoy reading or being read to \* Try in #5  
 11 I express my feelings in proper ways Try in #7  
 41 I am serving others in my community Try in #1

9 I stand up for what I believe in. Try in #2  
 Confidence / Character

38 CL  
 PV  
 SC  
 PT

Food Corps -  
 Gallup  
 ① school gardens  
 ② lunch  
 ③ nutrition

Compassion/Caring  
 Confidence  
 Competence  
 Character

X- PV doesn't impact

# What We Settled On



## **Service/Compassion/Caring**

**– 5 questions ( $\alpha.75$ )**

## **Character/Integrity**

**– 5 questions ( $\alpha.74$ )**

## **Healthy Choices**

**– 4 questions ( $\alpha.72$ )**

# What We Settled On (Cont.)



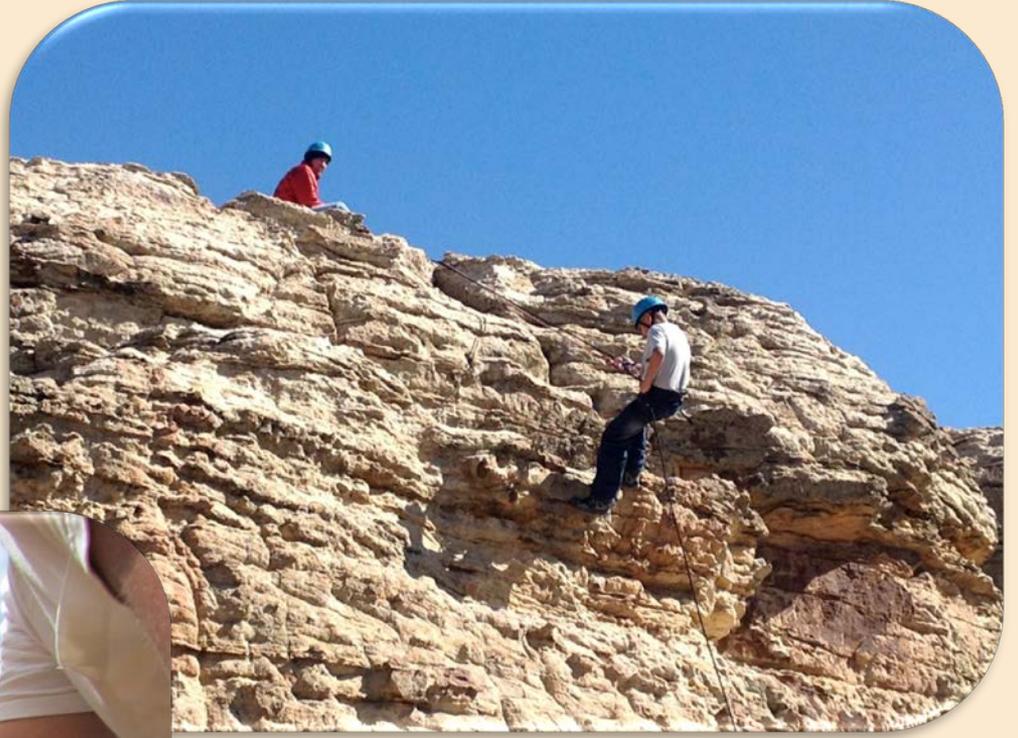
## Optimism/Future Confidence

– 5 questions ( $\alpha.75$ )

## Learning Competence

– 7 questions ( $\alpha.82$ )

**6 Questions NOT included**



# Propensity Score Matching



**Statistical tool for improving the evaluation of treatment effects in quasi-experimental (non-randomized) studies**

**Goal is to reduce bias resulting from treatment and comparison group differences at baseline**

# Propensity Score Method



**Generate a propensity score for each individual**

**Evaluate pre/post match group differences**



# Results of the Propensity Matching

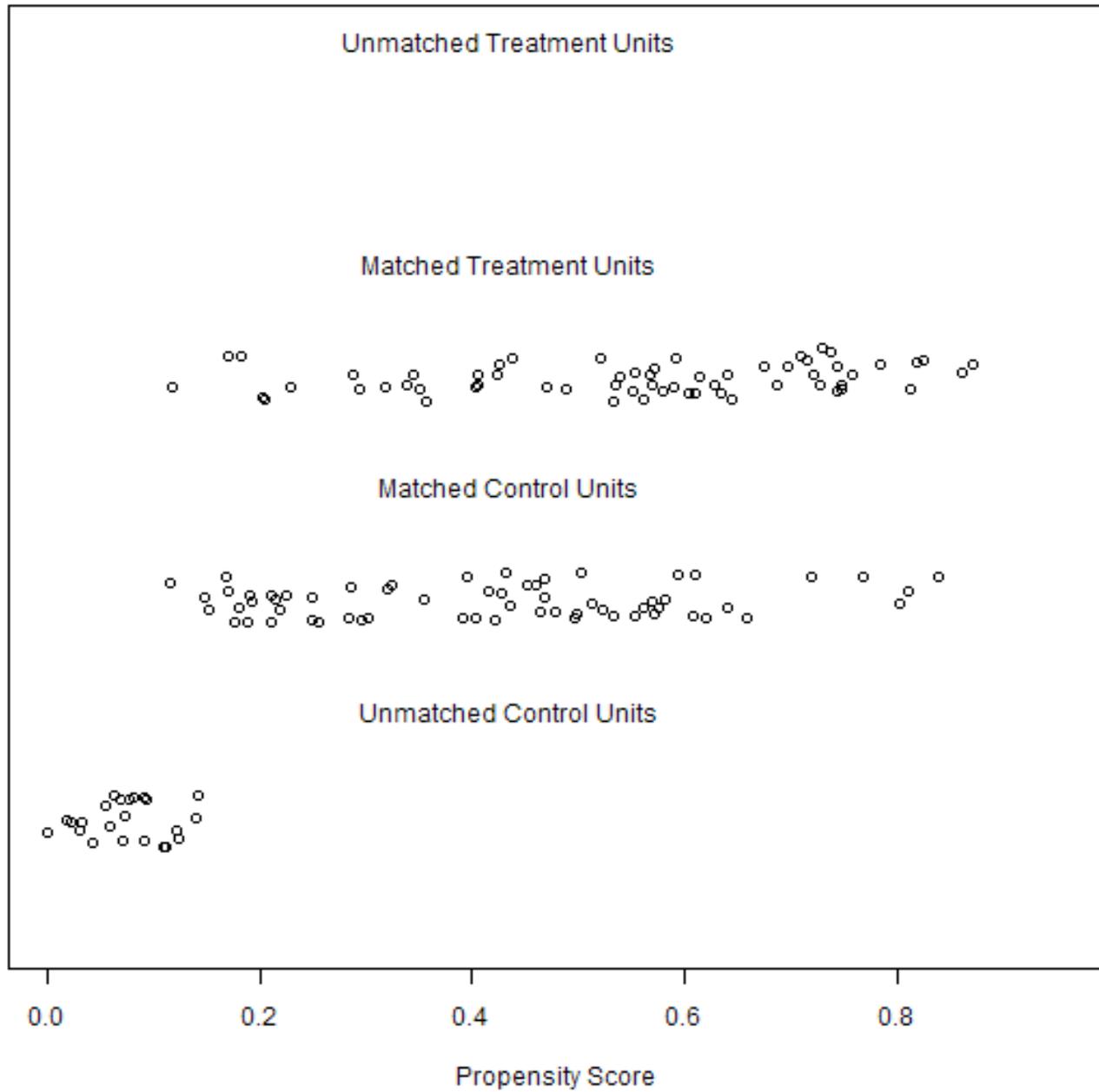


**All 62 Treatment cases were matched with a Comparison case, making for 124 cases**

**23 Comparison cases were unmatched**

**Matching improved balance on 11 of 13 covariates**

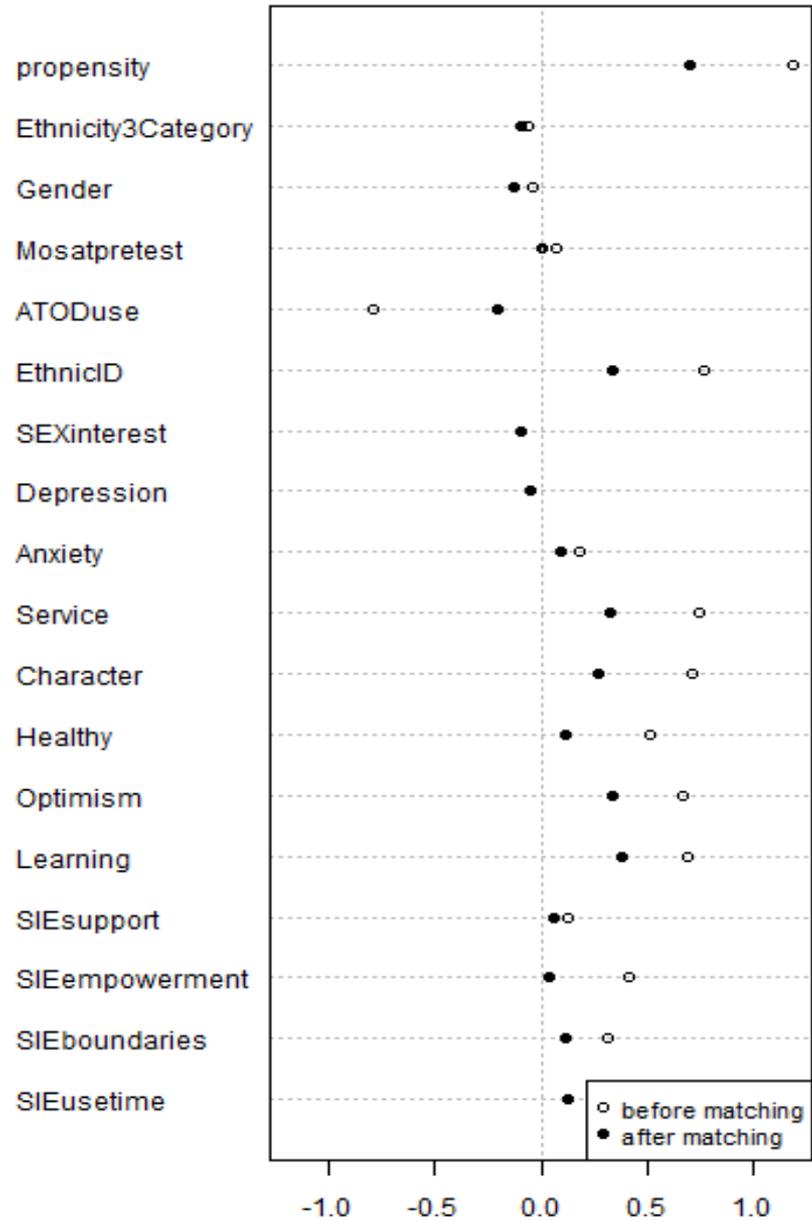
## Distribution of Propensity Scores



Dotplot of standardized mean differences (Cohen's  $d$ ) for TX and COMP for all covariates before and after matching.

Demographics

Internal Assets





# Treatment and Comparison Group Differences



**Repeated Measures ANOVA with Effect Sizes** to look at Treatment and Comparison group differences at Post Test

First we looked at all 124 Cases

Then at the top half of cases in dose

Lastly we looked at Treatment site

# Partial Eta Squared for Covariates (1 of 2)



Covariate	All 124 Cases TX=62	Top Half Dosage TX=36	Site L TX=16
ATOD Use	<b>.018</b>	<b>.011</b>	<b>.013</b>
Sexual Interest	.004	.001	<b>.025</b>
Ethnic Identity	.005	<b>(.016)</b>	.001
Anxiety	.004	.009	.003
Depression	.002	.002	<b>(.011)</b>

# Partial Eta Squared for Covariates (2 of 2)



Covariate	All 124 Cases TX=62	Top Half Dosage TX=36	Site L TX=16
Service	.001	.000	<b>.010</b>
Character	.008	<b>.016</b>	<b>.033</b>
Healthy Choices	<b>.020</b>	<b>.016</b>	<b>.009</b>
Optimism	.002	.000	.003
Learning	.001	.007	<b>.010</b>



# Key Points



**Differences between program sites can be as great as differences between Treatment and Comparison groups**

**Evaluation findings are more useful and provide greater insight when interpreted together with program staff**

# Key Points



**Propensity Score Matching can improve your ability to detect program effects**

**Consider DOSAGE and IMPLEMENTATION when trying to detect program effects and support program improvement**

# Thank You



**Questions?**

**Suggestions?**

# Resources



1. The National Indian Youth Leadership Project, McClellan Hall [www.niylp.org](http://www.niylp.org)
2. Search Institute [www.search-institute.org](http://www.search-institute.org)
3. Preacher, K.J. & MacCallum, R.C. (2003). Repairing Tom Swift's Electric Factor Analysis Machine. In *Understanding Statistics*, 2(1), 13-43.
4. Guo, S. & Fraser M.W. (2010). *Propensity Score Analysis: Statistical Methods and Applications*.
5. Propensity score matching in SPSS. Thoemmes, F. <http://arxiv.org/pdf/1201.6385.pdf>

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