Strategies for Improving Quasi-Experimental Studies:
Exploratory Factor Analysis and Propensity Score Matching

National Indian Youth Leadership Project
Susan Carter • Jan Vanslyke
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

6th 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
Web of Life (cont.)

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
In FY12, WOL was still in extended pilot development phase

In FY13, we are fully implementing and evaluating the finalized full curriculum
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
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.
How do YOU see the factors?
32 Internal Asset Questions

Combined to Form 4 Constructs:

Commitment to Learning – 7 questions (α.78)

Positive Values – 10 questions (α.80)

Social Competence – 8 questions (α.73)

Positive Identity – 6 questions (α.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
## Factor analysis output and interpretation to identify underlying constructs (1 of 3)

### Pattern Matrix

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
<th>Factor 7</th>
<th>Factor 8</th>
<th>Factor 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>I stand up for what I believe in.</td>
<td>0.137</td>
<td>-0.082</td>
<td>-0.063</td>
<td>0.058</td>
<td>-0.018</td>
<td>0.034</td>
<td>-0.011</td>
<td>0.121</td>
<td>0.588</td>
</tr>
<tr>
<td>I feel in control of my life and future.</td>
<td>0.101</td>
<td>0.183</td>
<td>0.067</td>
<td>0.498</td>
<td>0.148</td>
<td>0.060</td>
<td>-0.086</td>
<td>-0.091</td>
<td>0.365</td>
</tr>
<tr>
<td>I feel good about myself.</td>
<td>0.072</td>
<td>0.208</td>
<td>-0.035</td>
<td>0.184</td>
<td>-0.085</td>
<td>0.487</td>
<td>-0.044</td>
<td>0.087</td>
<td>0.060</td>
</tr>
<tr>
<td>I avoid things that are dangerous or unhealthy.</td>
<td>0.033</td>
<td>0.029</td>
<td>0.636</td>
<td>0.038</td>
<td>-0.124</td>
<td>0.186</td>
<td>-0.119</td>
<td>0.073</td>
<td>0.006</td>
</tr>
<tr>
<td>I enjoy reading or being read to.</td>
<td>0.110</td>
<td>0.129</td>
<td>0.213</td>
<td>-0.046</td>
<td>0.185</td>
<td>0.279</td>
<td>-0.109</td>
<td>0.357</td>
<td>0.067</td>
</tr>
<tr>
<td>I build friendships with other people.</td>
<td>0.080</td>
<td>-0.099</td>
<td>0.005</td>
<td>0.008</td>
<td>-0.146</td>
<td>0.660</td>
<td>-0.227</td>
<td>0.080</td>
<td>0.013</td>
</tr>
<tr>
<td>I care about school.</td>
<td>0.185</td>
<td>0.037</td>
<td>0.053</td>
<td>-0.011</td>
<td>0.525</td>
<td>0.068</td>
<td>-0.022</td>
<td>-0.082</td>
<td>0.010</td>
</tr>
<tr>
<td>I do my homework.</td>
<td>0.191</td>
<td>0.004</td>
<td>0.039</td>
<td>0.090</td>
<td>0.773</td>
<td>-0.261</td>
<td>0.126</td>
<td>0.112</td>
<td>0.007</td>
</tr>
<tr>
<td>I stay away from tobacco, alcohol, and other drugs.</td>
<td>0.017</td>
<td>0.096</td>
<td>0.771</td>
<td>-0.055</td>
<td>0.031</td>
<td>-0.081</td>
<td>-0.141</td>
<td>-0.046</td>
<td>0.053</td>
</tr>
<tr>
<td>I enjoy learning.</td>
<td>0.153</td>
<td>-0.067</td>
<td>-0.062</td>
<td>-0.004</td>
<td>0.535</td>
<td>0.318</td>
<td>-0.052</td>
<td>0.063</td>
<td>-0.061</td>
</tr>
<tr>
<td>I express my feelings in proper ways.</td>
<td>0.029</td>
<td>0.248</td>
<td>0.032</td>
<td>-0.099</td>
<td>0.114</td>
<td>0.011</td>
<td>0.175</td>
<td>0.562</td>
<td>0.093</td>
</tr>
<tr>
<td>I feel good about my future.</td>
<td>0.068</td>
<td>0.003</td>
<td>-0.081</td>
<td>0.556</td>
<td>0.067</td>
<td>0.018</td>
<td>0.111</td>
<td>-0.049</td>
<td>0.029</td>
</tr>
<tr>
<td>I deal with frustration in positive ways.</td>
<td>0.082</td>
<td>0.094</td>
<td>0.228</td>
<td>-0.083</td>
<td>-0.010</td>
<td>0.054</td>
<td>0.373</td>
<td>0.267</td>
<td>-0.052</td>
</tr>
<tr>
<td>I overcome challenges in positive ways.</td>
<td>0.009</td>
<td>0.112</td>
<td>0.089</td>
<td>0.170</td>
<td>0.072</td>
<td>0.088</td>
<td>0.525</td>
<td>0.127</td>
<td>0.121</td>
</tr>
<tr>
<td>I think it is important to help other people.</td>
<td>0.798</td>
<td>-0.133</td>
<td>0.027</td>
<td>0.173</td>
<td>-0.121</td>
<td>0.228</td>
<td>-0.082</td>
<td>-0.014</td>
<td>-0.063</td>
</tr>
<tr>
<td>I plan ahead and make good choices.</td>
<td>0.332</td>
<td>0.007</td>
<td>0.079</td>
<td>0.117</td>
<td>0.131</td>
<td>0.127</td>
<td>0.202</td>
<td>-0.104</td>
<td>0.020</td>
</tr>
<tr>
<td>I resist bad influences.</td>
<td>0.067</td>
<td>-0.070</td>
<td>0.537</td>
<td>0.026</td>
<td>0.009</td>
<td>-0.139</td>
<td>0.375</td>
<td>-0.113</td>
<td>-0.019</td>
</tr>
<tr>
<td>I resolve conflicts without anyone getting hurt.</td>
<td>0.177</td>
<td>-0.089</td>
<td>0.075</td>
<td>0.433</td>
<td>-0.055</td>
<td>0.033</td>
<td>0.106</td>
<td>0.206</td>
<td>-0.065</td>
</tr>
<tr>
<td>I take responsibility for what I do.</td>
<td>0.066</td>
<td>0.738</td>
<td>0.167</td>
<td>-0.005</td>
<td>-0.038</td>
<td>0.016</td>
<td>-0.190</td>
<td>0.206</td>
<td>-0.148</td>
</tr>
<tr>
<td>I tell the truth even when it is not easy.</td>
<td>0.201</td>
<td>0.599</td>
<td>-0.020</td>
<td>-0.029</td>
<td>0.024</td>
<td>-0.164</td>
<td>-0.084</td>
<td>0.064</td>
<td>0.038</td>
</tr>
<tr>
<td>I accept people who are different from me.</td>
<td>0.184</td>
<td>0.389</td>
<td>0.031</td>
<td>0.159</td>
<td>0.159</td>
<td>0.174</td>
<td>0.120</td>
<td>-0.146</td>
<td>0.218</td>
</tr>
<tr>
<td>I am actively engaged in learning new things.</td>
<td>0.109</td>
<td>0.002</td>
<td>0.150</td>
<td>0.170</td>
<td>0.234</td>
<td>0.249</td>
<td>0.470</td>
<td>0.064</td>
<td>0.002</td>
</tr>
<tr>
<td>I am developing a sense of purpose in my life.</td>
<td>-0.036</td>
<td>-0.041</td>
<td>0.010</td>
<td>0.414</td>
<td>0.056</td>
<td>0.075</td>
<td>0.630</td>
<td>0.025</td>
<td>-0.080</td>
</tr>
<tr>
<td>I am encouraged to try things that might be good for me.</td>
<td>0.079</td>
<td>0.270</td>
<td>0.120</td>
<td>0.309</td>
<td>0.052</td>
<td>-0.010</td>
<td>0.116</td>
<td>-0.029</td>
<td>0.050</td>
</tr>
<tr>
<td>I am helping to make my community a better place.</td>
<td>3.64</td>
<td>0.824</td>
<td>-1.48</td>
<td>0.154</td>
<td>0.016</td>
<td>-0.115</td>
<td>0.017</td>
<td>0.124</td>
<td>-0.001</td>
</tr>
<tr>
<td>I am developing good health habits.</td>
<td>-0.324</td>
<td>0.548</td>
<td>0.001</td>
<td>0.035</td>
<td>0.118</td>
<td>0.144</td>
<td>0.134</td>
<td>0.117</td>
<td>-0.048</td>
</tr>
<tr>
<td>I am encouraged to help others.</td>
<td>0.633</td>
<td>0.157</td>
<td>-0.006</td>
<td>0.018</td>
<td>0.048</td>
<td>-0.076</td>
<td>0.008</td>
<td>-0.003</td>
<td>0.080</td>
</tr>
</tbody>
</table>

**Extraction Method:** Alpha Factoring  
**Rotation Method:** Promax with Kaiser Normalization
Factor analysis output and interpretation to identify underlying constructs (2 of 3)
Factor analysis output and interpretation to identify underlying constructs (3 of 3)
What We Settled On

Service/Compassion/Caring
- 5 questions (α.75)

Character/Integrity
- 5 questions (α.74)

Healthy Choices
- 4 questions (α.72)
Optimism/Future Confidence
- 5 questions (α.75)

Learning Competence
- 7 questions (α.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
Dotplot of standardized mean differences (Cohen’s $d$) for TX and COMP for all covariates before and after matching.
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
<table>
<thead>
<tr>
<th>Covariate</th>
<th>All 124 Cases TX=62</th>
<th>Top Half Dosage TX=36</th>
<th>Site L TX=16</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATOD Use</td>
<td>.018</td>
<td>.011</td>
<td>.013</td>
</tr>
<tr>
<td>Sexual Interest</td>
<td>.004</td>
<td>.001</td>
<td>.025</td>
</tr>
<tr>
<td>Ethnic Identity</td>
<td>.005</td>
<td>(.016)</td>
<td>.001</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.004</td>
<td>.009</td>
<td>.003</td>
</tr>
<tr>
<td>Depression</td>
<td>.002</td>
<td>.002</td>
<td>(.011)</td>
</tr>
<tr>
<td>Covariate</td>
<td>All 124 Cases TX=62</td>
<td>Top Half Dosage TX=36</td>
<td>Site L TX=16</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------</td>
<td>-----------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Service</td>
<td>.001</td>
<td>.000</td>
<td>.010</td>
</tr>
<tr>
<td>Character</td>
<td>.008</td>
<td>.016</td>
<td>.033</td>
</tr>
<tr>
<td>Healthy Choices</td>
<td>.020</td>
<td>.016</td>
<td>.009</td>
</tr>
<tr>
<td>Optimism</td>
<td>.002</td>
<td>.000</td>
<td>.003</td>
</tr>
<tr>
<td>Learning</td>
<td>.001</td>
<td>.007</td>
<td>.010</td>
</tr>
</tbody>
</table>
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?
1. The National Indian Youth Leadership Project, McClellan Hall  www.niylp.org
2. Search Institute  www.search-institute.org
Please Contact Us

Susan L. Carter (New Mexico)
susanleecarter@comcast.net

Jan Vanslyke (California)
jan@janvanslyke.com