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LSAY LCA Project Report

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1. Recoding of all the indicator variables into binary categories

Math as a Subject Matter Items (From Cohort 2, Year 1, Fall 1987)

AB39A = I enjoy math

AB39H = Math is useful in everyday problems

AB39I = Math helps a person think logically

AB39K = It is important to know math to get a good job

AB39L = I will use math in many ways as an adult

Science as a Subject Matter Items (From Cohort 2, Year 1, Fall 1987)

AB39M = I enjoy science

AB39T = Science is useful in everyday problems

AB39U = Science helps a person think logically

AB39W = It is important to know science to get a good job

AB39X = I will use science in many ways as an adult

1 (strongly disagree) 🡪 0

2 (disagree) 🡪 0

3 (not sure) 🡪 0

4 (agree) 🡪 1

5 (strongly agree) 🡪 1

1. Add one more covariate GENDER1

1 (female) 🡪 1

2 (male) 🡪 0

1. Final LCA model:

Sample size = 2861

Number of indicator variables = 10 (AB39A2, AB39H2, AB39I2, AB39K2, AB39L2, AB39M2, AB39T2, AB39U2, AB39W2, AB39X2)

Number of covariate variables = 4 (AMTHIRT, ASCIIRT, RACETH1, GENDER1)

Number of distal outcome variables = 5 (STEM, STEMSup, ENGINEER, CMTHIRT, CSCIIRT)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AB39A2 | AB39H2 | AB39I2 | AB39K2 | AB39L2 | AB39M2 | AB39T2 | AB39U2 | AB39W2 | AB39X2 |

AMTHIRT

ASCIIRT

RACETH1

GENDER1

STEM

STEMSup

ENGINEER

CMTHIRT

CSCIIRT

c

1. Results of LCA with covariates

* Categorical latent variable
* Continuous covariates (AMTHIRT, ASCIIRT) and categorical covariates (RACETH1, GENDER1) with indirect effects on Ys through C which can be thought of as predictors of class membership
* This modeling allows us to understand how different classes relate to students’ background information such as academic achievement and demographics

1. Class enumeration

Investigating the unconditional model, 5-class solution and 6-class solution were chosen as candidates for the final model.

1. Overall picture of 5-class solution

* Sample size = 2861
* Log-likelihood = -15254.022
* Number of parameters = 70
* BIC = 31065.168
* ABIC = 30842.753
* Entropy = 0.702
* VLMR = 0.0479
* BLRT = 0

ALTERNATIVE PARAMETERIZATIONS FOR THE CATEGORICAL LATENT VARIABLE REGRESSION  
Parameterization using Reference Class 1

Estimate S.E. Est./S.E. P-Value

C#2 ON

AMTHIRT -0.043 0.012 -3.422 0.001  
 ASCIIRT -0.023 0.012 -1.893 0.058  
 RACETH1 -0.056 0.233 -0.238 0.812  
 GENDER1 0.240 0.163 1.468 0.142

C#3 ON

AMTHIRT -0.016 0.013 -1.201 0.230  
 ASCIIRT 0.005 0.014 0.347 0.729  
 RACETH1 -0.146 0.244 -0.598 0.550  
 GENDER1 0.309 0.176 1.761 0.078

C#4 ON

AMTHIRT -0.005 0.010 -0.474 0.635  
 ASCIIRT -0.029 0.010 -2.987 0.003  
 RACETH1 -0.532 0.183 -2.914 0.004  
 GENDER1 0.888 0.146 6.090 0.000

C#5 ON

AMTHIRT -0.032 0.011 -2.944 0.003  
 ASCIIRT -0.035 0.010 -3.510 0.000  
 RACETH1 -0.466 0.179 -2.600 0.009  
 GENDER1 0.438 0.139 3.144 0.002

Intercepts

C#2 3.069 0.573 5.360 0.000  
 C#3 0.147 0.810 0.182 0.856  
 C#4 1.542 0.523 2.948 0.003  
 C#5 3.243 0.627 5.172 0.000

EQUALITY TESTS OF MEANS ACROSS CLASSES USING POSTERIOR PROBABILITY-BASED MULTIPLE IMPUTATIONS WITH 4 DEGREE(S) OF FREEDOM FOR THE OVERALL TEST AND 1 DEGREE OF FREEDOM FOR THE PAIRWISE TESTS

STEM

Mean S.E. Mean S.E.

Class 1 0.130 0.018 Class 2 0.081 0.018  
 Class 3 0.101 0.021 Class 4 0.065 0.013  
 Class 5 0.036 0.011

Chi-Square P-Value Chi-Square P-Value

Overall test 9.111 0.058 Class 1 vs. 2 3.598 0.058  
 Class 1 vs. 3 1.050 0.305 Class 1 vs. 4 8.478 0.004  
 Class 1 vs. 5 19.880 0.000 Class 2 vs. 3 0.477 0.490  
 Class 2 vs. 4 0.474 0.491 Class 2 vs. 5 4.501 0.034  
 Class 3 vs. 4 1.910 0.167 Class 3 vs. 5 7.049 0.008  
 Class 4 vs. 5 2.689 0.101

STEMSUP

Mean S.E. Mean S.E.

Class 1 0.202 0.021 Class 2 0.150 0.024  
 Class 3 0.171 0.026 Class 4 0.138 0.018  
 Class 5 0.112 0.018

Chi-Square P-Value Chi-Square P-Value

Overall test 5.162 0.271 Class 1 vs. 2 2.488 0.115  
 Class 1 vs. 3 0.765 0.382 Class 1 vs. 4 5.037 0.025  
 Class 1 vs. 5 10.231 0.001 Class 2 vs. 3 0.334 0.563  
 Class 2 vs. 4 0.133 0.716 Class 2 vs. 5 1.561 0.211  
 Class 3 vs. 4 0.987 0.320 Class 3 vs. 5 3.228 0.072  
 Class 4 vs. 5 1.004 0.316

ENGINEER

Mean S.E. Mean S.E.

Class 1 0.043 0.011 Class 2 0.025 0.010  
 Class 3 0.032 0.012 Class 4 0.018 0.007  
 Class 5 0.004 0.004

Chi-Square P-Value Chi-Square P-Value

Overall test 6.231 0.183 Class 1 vs. 2 1.368 0.242  
 Class 1 vs. 3 0.446 0.504 Class 1 vs. 4 3.802 0.051  
 Class 1 vs. 5 11.542 0.001 Class 2 vs. 3 0.190 0.663  
 Class 2 vs. 4 0.296 0.587 Class 2 vs. 5 3.423 0.064  
 Class 3 vs. 4 0.981 0.322 Class 3 vs. 5 4.790 0.029  
 Class 4 vs. 5 2.757 0.097

CMTHIRT

Mean S.E. Mean S.E.

Class 1 56.848 0.544 Class 2 50.815 0.594  
 Class 3 55.282 0.693 Class 4 54.986 0.449  
 Class 5 51.250 0.523

Chi-Square P-Value Chi-Square P-Value

Overall test 99.260 0.000 Class 1 vs. 2 52.126 0.000  
 Class 1 vs. 3 2.995 0.084 Class 1 vs. 4 6.919 0.009  
 Class 1 vs. 5 54.179 0.000 Class 2 vs. 3 22.044 0.000  
 Class 2 vs. 4 30.256 0.000 Class 2 vs. 5 0.282 0.595  
 Class 3 vs. 4 0.118 0.731 Class 3 vs. 5 22.095 0.000  
 Class 4 vs. 5 27.662 0.000

CSCIIRT

Mean S.E. Mean S.E.

Class 1 56.730 0.542 Class 2 51.882 0.643  
 Class 3 56.237 0.667 Class 4 55.007 0.455  
 Class 5 51.564 0.550

Chi-Square P-Value Chi-Square P-Value

Overall test 72.323 0.000 Class 1 vs. 2 31.300 0.000  
 Class 1 vs. 3 0.319 0.572 Class 1 vs. 4 5.764 0.016  
 Class 1 vs. 5 44.959 0.000 Class 2 vs. 3 20.106 0.000  
 Class 2 vs. 4 14.841 0.000 Class 2 vs. 5 0.130 0.719  
 Class 3 vs. 4 2.170 0.141 Class 3 vs. 5 29.629 0.000  
 Class 4 vs. 5 21.804 0.000

1. Overall picture of 6-class solution

* Sample size = 2861
* Log-likelihood = -15175.353
* Number of parameters = 85
* BIC = 31027.215
* ABIC = 30757.140
* Entropy = 0.721
* VLMR = 0.7007
* BLRT = 0

ALTERNATIVE PARAMETERIZATIONS FOR THE CATEGORICAL LATENT VARIABLE REGRESSION  
Parameterization using Reference Class 1

Estimate S.E. Est./S.E. P-Value

C#2 ON

AMTHIRT -0.024 0.014 -1.729 0.084  
 ASCIIRT -0.028 0.013 -2.141 0.032  
 RACETH1 -0.023 0.200 -0.112 0.911  
 GENDER1 0.362 0.204 1.777 0.076

C#3 ON

AMTHIRT -0.007 0.014 -0.513 0.608  
 ASCIIRT 0.015 0.014 1.050 0.294  
 RACETH1 -0.148 0.309 -0.480 0.631  
 GENDER1 0.244 0.384 0.636 0.525

C#4 ON

AMTHIRT -0.058 0.039 -1.497 0.134  
 ASCIIRT -0.029 0.019 -1.465 0.143  
 RACETH1 -0.382 0.330 -1.159 0.247  
 GENDER1 0.115 0.209 0.552 0.581

C#5 ON

AMTHIRT -0.006 0.009 -0.632 0.528  
 ASCIIRT -0.027 0.010 -2.853 0.004  
 RACETH1 -0.525 0.172 -3.042 0.002  
 GENDER1 0.863 0.158 5.466 0.000

C#6 ON

AMTHIRT -0.022 0.013 -1.699 0.089  
 ASCIIRT -0.036 0.013 -2.784 0.005  
 RACETH1 -0.510 0.203 -2.505 0.012  
 GENDER1 0.551 0.199 2.768 0.006

Intercepts

C#2 2.283 0.674 3.387 0.001  
 C#3 -1.064 0.928 -1.146 0.252  
 C#4 3.696 2.582 1.432 0.152  
 C#5 1.594 0.490 3.251 0.001  
 C#6 2.236 0.640 3.494 0.000

EQUALITY TESTS OF MEANS ACROSS CLASSES USING POSTERIOR PROBABILITY-BASED MULTIPLE IMPUTATIONS WITH 5 DEGREE(S) OF FREEDOM FOR THE OVERALL TEST AND 1 DEGREE OF FREEDOM FOR THE PAIRWISE TESTS

STEM

Mean S.E. Mean S.E.

Class 1 0.132 0.018 Class 2 0.083 0.018  
 Class 3 0.114 0.024 Class 4 0.039 0.018  
 Class 5 0.063 0.013 Class 6 0.039 0.015

Chi-Square P-Value Chi-Square P-Value

Overall test 11.185 0.048 Class 1 vs. 2 3.396 0.065  
 Class 1 vs. 3 0.347 0.556 Class 1 vs. 4 13.212 0.000  
 Class 1 vs. 5 9.868 0.002 Class 1 vs. 6 15.583 0.000  
 Class 2 vs. 3 0.983 0.322 Class 2 vs. 4 2.926 0.087  
 Class 2 vs. 5 0.795 0.373 Class 2 vs. 6 3.583 0.058  
 Class 3 vs. 4 6.207 0.013 Class 3 vs. 5 3.478 0.062  
 Class 3 vs. 6 7.401 0.007 Class 4 vs. 5 1.072 0.301  
 Class 4 vs. 6 0.000 0.989 Class 5 vs. 6 1.381 0.240

STEMSUP

Mean S.E. Mean S.E.

Class 1 0.198 0.021 Class 2 0.155 0.024  
 Class 3 0.196 0.029 Class 4 0.092 0.026  
 Class 5 0.134 0.017 Class 6 0.127 0.025

Chi-Square P-Value Chi-Square P-Value

Overall test 9.900 0.078 Class 1 vs. 2 1.606 0.205  
 Class 1 vs. 3 0.003 0.955 Class 1 vs. 4 9.924 0.002  
 Class 1 vs. 5 5.544 0.019 Class 1 vs. 6 4.658 0.031  
 Class 2 vs. 3 1.092 0.296 Class 2 vs. 4 3.070 0.080  
 Class 2 vs. 5 0.476 0.490 Class 2 vs. 6 0.699 0.403  
 Class 3 vs. 4 7.072 0.008 Class 3 vs. 5 3.135 0.077  
 Class 3 vs. 6 3.236 0.072 Class 4 vs. 5 1.734 0.188  
 Class 4 vs. 6 0.847 0.357 Class 5 vs. 6 0.057 0.812

ENGINEER

Mean S.E. Mean S.E.

Class 1 0.046 0.011 Class 2 0.025 0.011  
 Class 3 0.031 0.013 Class 4 0.014 0.011  
 Class 5 0.017 0.007 Class 6 0.004 0.005

Chi-Square P-Value Chi-Square P-Value

Overall test 4.701 0.453 Class 1 vs. 2 1.755 0.185  
 Class 1 vs. 3 0.782 0.377 Class 1 vs. 4 4.022 0.045  
 Class 1 vs. 5 4.909 0.027 Class 1 vs. 6 11.996 0.001  
 Class 2 vs. 3 0.101 0.751 Class 2 vs. 4 0.511 0.475  
 Class 2 vs. 5 0.369 0.544 Class 2 vs. 6 3.284 0.070  
 Class 3 vs. 4 0.925 0.336 Class 3 vs. 5 0.813 0.367  
 Class 3 vs. 6 3.613 0.057 Class 4 vs. 5 0.067 0.796  
 Class 4 vs. 6 0.679 0.410 Class 5 vs. 6 2.388 0.122

CMTHIRT

Mean S.E. Mean S.E.

Class 1 56.522 0.549 Class 2 52.123 0.616  
 Class 3 56.968 0.783 Class 4 48.684 0.759  
 Class 5 54.710 0.445 Class 6 52.053 0.664

Chi-Square P-Value Chi-Square P-Value

Overall test 126.949 0.000 Class 1 vs. 2 27.257 0.000  
 Class 1 vs. 3 0.202 0.653 Class 1 vs. 4 69.266 0.000  
 Class 1 vs. 5 6.680 0.010 Class 1 vs. 6 26.595 0.000  
 Class 2 vs. 3 22.278 0.000 Class 2 vs. 4 11.362 0.001  
 Class 2 vs. 5 10.898 0.001 Class 2 vs. 6 0.006 0.938  
 Class 3 vs. 4 57.719 0.000 Class 3 vs. 5 5.816 0.016  
 Class 3 vs. 6 23.191 0.000 Class 4 vs. 5 44.948 0.000  
 Class 4 vs. 6 10.351 0.001 Class 5 vs. 6 10.494 0.001

CSCIIRT

Mean S.E. Mean S.E.

Class 1 56.498 0.550 Class 2 52.579 0.650  
 Class 3 57.738 0.759 Class 4 50.204 0.832  
 Class 5 54.834 0.450 Class 6 52.069 0.682

Chi-Square P-Value Chi-Square P-Value

Overall test 93.662 0.000 Class 1 vs. 2 20.222 0.000  
 Class 1 vs. 3 1.632 0.201 Class 1 vs. 4 39.503 0.000  
 Class 1 vs. 5 5.584 0.018 Class 1 vs. 6 25.413 0.000  
 Class 2 vs. 3 24.828 0.000 Class 2 vs. 4 4.732 0.030  
 Class 2 vs. 5 7.321 0.007 Class 2 vs. 6 0.298 0.585  
 Class 3 vs. 4 43.321 0.000 Class 3 vs. 5 10.316 0.001  
 Class 3 vs. 6 30.052 0.000 Class 4 vs. 5 23.159 0.000  
 Class 4 vs. 6 2.829 0.093 Class 5 vs. 6 10.735 0.001