

Spring 2014

Multiple Measures Notes – Accuplacer Self-Reported Comparisons

Math Assessment

The object of this study was to analyze measures to supplement a student's test score for initial course placement given valid predictive criteria from background questions collected on the Accuplacer placement test. To accomplish this, background responses were collected from test takers from November 2011 to the December 2013. An analysis of means between groups was conducted with the strongest, significant predictors combined in a regression analysis and analyzed. Two predictors, fewer years away from math instruction and number of years of math instruction were found to be likely predictors of higher math assessment scores on the Accuplacer math test modules after "Yes" to having had high school algebra.

Summary

The strongest predictors of math assessment score were 1) the length of time from the last math course; and 2) the number of years in which math was studied (which was the strongest predictor for the College Level Math test). Weak, but positive correlations were also found in Father's and Mother's Education Level (favoring the Mother's Educational Level which had a slightly higher mean) and for Gender (favoring females) which did not contribute significantly to the regression analysis.

There was no difference between ethnic groups for the CLM test, but small but significant differences were found between mean scores of ethnic groups in the Arithmetic and Elementary Algebra test modules – notably the group of "Choose not to answer" which had the highest mean scores in all three math modules. Ethnicity was not used in regression analysis due to too few Ns for many of the groups thus skewing a valid interpretation of the mean scores for the group.

Following a regression analysis of test takers who indicated they had some algebra, and then parsed by the three math modules, the following could be considered as an enhancement added to the placements upon completion of the Accuplacer math test modules.

Given that a test taker indicates "Yes" to the background question, "Have you completed algebra in high school?" and:

Arithmetic: If Years Since last Math Course is ≤ 2 and
Studied math > 1 year
add a factor of .123

Elementary Algebra: If Years Since last Math Course is ≤ 2 and
Studied math > 1 year
add a factor of .141

CLM: If Years Since last Math Course is ≤ 2 and
Studied math > 2 years
add a factor of .148.

Means across all groups, particularly Elementary Algebra, increased with indication of having taken High School Algebra (“Yes”):

High School Algebra		Arith	Elementary Algebra	College Level Math
No	Mean	35.63	34.26	47.40
	N	102	162	5
	Std. Deviation	17.672	21.952	23.437
Yes	Mean	39.38	54.88	52.63
	N	385	1734	110
	Std. Deviation	20.851	26.179	19.273
Total	Mean	38.60	53.12	52.40
	N	487	1896	115
	Std. Deviation	20.267	26.475	19.380

Correlation Coefficients

Math Modules Test Scores to Self-Reported Demographic Categories

To estimate the effect of self-reported multiple measures, and to arrive at possible weighted measures to add to assessment scores, the following analyses were run on all Accuplacer test scores from Fall 2011 to Fall 2013. The first analysis was run against scores on assessment tests and self-reported demographic categories to assess whether there were statistical effects found for certain groups. Then that information was fed into a regression analysis to determine the strength of the effects and to arrive at a conservative estimate to apply to test takers’ results to determine their level of course placement in English and Math.

Do the self-reported “years away from the last mathematics course” have an effect on mean math assessment scores?

Arithmetic – No

In the case of Arithmetic scores, the means were actually higher for the 7 or more years since last math class group.

Pearson’s Correlation: +.116 (Sig at .011 but in the opposite direction)

(Scores went up for the 7 years or more group whilst expected to go down)

Spearman’s: +.123** (Sig. at .007)

Regression Analysis: By adding the best predictors, “Years Since Last Math” and “Yes” to Algebra, the predictor is only increased by a factor of .034. (Sig. at .000).¹

¹ Correlation coefficient increases as the number of years since last math class decreases.
Correlation coefficient increases as the number of years studied in math increases.

Elementary Algebra—Yes (this module had the highest Ns per group)

Mean scores for the less than one year group: 65.86 (N: 661)

1 to 3 Year group: 51.43 (N: 682)

4 to 6 Year group: 45.22 (N: 172)

7 Years or More: 37.22 (N: 375)

Pearson's Correlation: $-.393^{**}$ (Sig at $.000$)

Regression Analysis: By adding the best predictors, "Years Since Last Math" and "Yes" to Algebra, the predictor can be increased by a factor of $.141$. (Sig. at $.000$).

College Level Math – Mixed correlations, significance questionable
(Ns became too small to be reliable after first group)

Less than One Year:	55.10 (N: 82)
1 to 3 Years:	42.05 (N: 22)
4 to 6 Years:	47.63 (N: 8)
7 Years or More:	65.25 (N: 4)
Pearson's Correlation:	-.089 (Not Sig. .341)
Spearman's	-.220 (Sig. at .018)

Regression Analysis: By adding the best predictors, "Years Since Last Math" and "Years Studied Math" for the "Yes" to Algebra group, the predictor can be increased by a factor of .141 with the strongest predictor for CLM being the number of years studied math. (Sig. at .000).

Did Number of Years Studied in math have an effect on assessment scores?

Arithmetic - No Correlations very weak and not significant

Pearson's:	-.001 (Not Sig. .989)
Spearman's	-.051 (Not Sig. .262)

Elementary Algebra – Yes, significant but with weak

Pearson's:	.219 (Sig. .000)
Spearman's ² :	.196 (Sig. .000)

College Level Math – Yes, moderately strong and significant

Pearson's:	.413 (Sig. at .000)
Spearman's:	.424 (Sig. at .000)

(See footnote, re: Spearman's and small Ns and the CLM group)

Does the parent's educational level correlate to higher math assessment scores?

Arithmetic – Perhaps, there is weak and mixed significance

Pearson's:	Father's: .010 (Not Sig .819)	Mother's: .088 (Sig at .049)
Spearman's:	Father's: .063 (Not Sig .163)	Mother's: .129 (Sig at .004)

Elementary Algebra – Yes, but weak

Pearson's:	Father's: .162 (Sig at .000)	Mother's: .174 (Sig at .000)
Spearman's:	Father's: .159 (Sig. at .000)	Mother's: .180 (Sig. at .000)

College Level Math – No

Pearson's:	Fathers: .023 (Not Sig.)	Mother's: .140 (Not Sig.)
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² Spearman's correlation coefficient is a nonparametric measure most used when small Ns are present. For this purpose, the Arithmetic and College Level Math Ns were appropriate to the Spearman's coefficient in lieu of the Pearson's R.

Note that the mother’s mean level of education is slightly higher than the mean father’s level of education. A level “3” would indicate “Some College” on a scale of 1 to 7 with 0=Choose not to answer, 1=Grade School to 7=Graduate Degree.

	Mean	Std. Deviation	N
Fathers Education	2.6632	1.63064	2102
Mothers Education	2.9035	1.50545	2103

Does gender have an effect on math assessment scores?

(1=Female, 2=Male)

Arithmetic – Yes, but extremely weak in favor of females

Pearson’s: -.094 (Sig. at .037)

Spearman’s: -.064 (Not Sig.)

Elementary Algebra – Yes, but extremely weak in favor of females

Pearson’s: -.061 (Sig. at .008)

Spearman’s: -.056 (Sig. at .014)

College Level Math – No, not significant in favor of females

Pearson’s: -.132 (Not Sig.)

Spearman’s: -.133 (Not Sig.)

Does ethnicity (self-reported) have an effect on math assessment scores?

In many cases, the N became so small after parsing into ethnicity categories and then by test module as to become unusable -- particularly for the Arithmetic and College Level Math modules. (See Chart below).

The highest mean scores for all three modules was found in the “Choose Not to Answer” group. Running a test of significance across ethnic groups to test scores in the three math modules indicates there is a statistical difference between groups for the Arithmetic and Elementary Algebra modules, but the null hypothesis is retained (“null” hypothesis of no difference between groups) for the College Level Math module:

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Arith is the same across categories of Self Description.	Independent-Samples Kruskal-Wallis Test	.002	Reject the null hypothesis.
2	The distribution of Elementary Algebra is the same across categories of Self Description.	Independent-Samples Kruskal-Wallis Test	.020	Reject the null hypothesis.
3	The distribution of College Level Math is the same across categories of Self Description.	Independent-Samples Kruskal-Wallis Test	.878	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

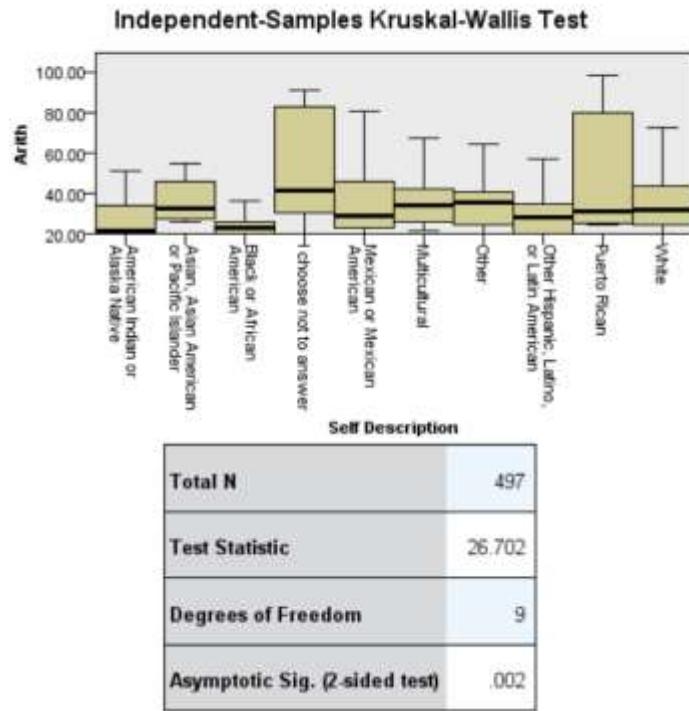
Case Summaries

Self Description		Arith	Elementary Algebra	College Level Math
American Indian or Alaska Native	N	14	57	1
	Mean	28.36	51.74	50.00
	Std. Error of Mean	2.832	3.078	.
	Std. Deviation	10.595	23.241	.
Asian, Asian American or Pacific Islander	N	6	43	4
	Mean	36.33	63.00	47.50
	Std. Error of Mean	4.470	4.266	9.954
	Std. Deviation	10.948	27.976	19.908
Black or African American	N	13	35	
	Mean	25.69	44.40	
	Std. Error of Mean	2.373	3.490	
	Std. Deviation	8.557	20.647	
I choose not to answer	N	12	52	4
	Mean	52.58	59.46	64.75
	Std. Error of Mean	7.932	4.011	10.395
	Std. Deviation	27.477	28.922	20.791
Mexican or Mexican American	N	25	131	5
	Mean	35.92	52.23	51.20
	Std. Error of Mean	3.581	2.208	4.893

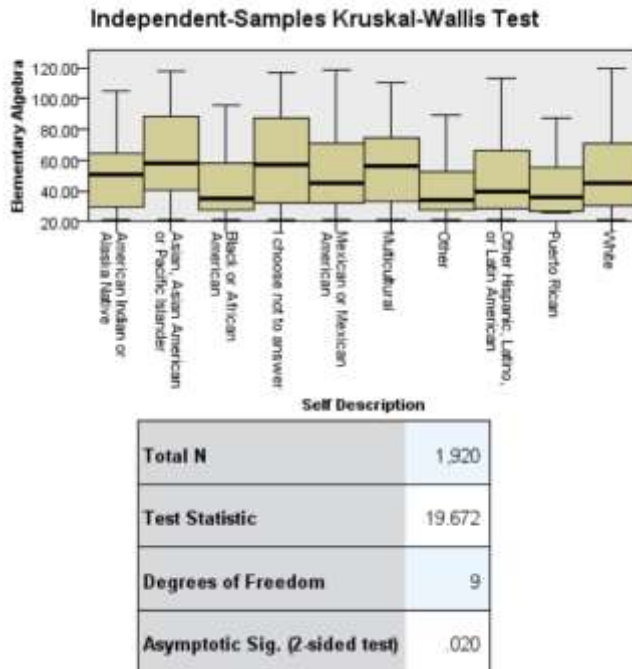
Case Summaries

	Std. Deviation	17.907	25.275	10.941
Multicultural	N	14	76	4
	Mean	37.07	57.09	46.75
	Std. Error of Mean	3.848	2.934	8.179
	Std. Deviation	14.398	25.577	16.358
Other	N	9	25	
	Mean	38.67	44.32	
	Std. Error of Mean	7.506	4.533	
	Std. Deviation	22.517	22.666	
Other Hispanic, Latino, or Latin American	N	24	79	6
	Mean	29.21	50.03	50.00
	Std. Error of Mean	2.138	2.958	7.878
	Std. Deviation	10.476	26.293	19.298
Puerto Rican	N	5	9	
	Mean	48.40	43.33	
	Std. Error of Mean	14.137	6.716	
	Std. Deviation	31.612	20.149	
White	N	375	1413	93
	Mean	39.78	53.03	52.68
	Std. Error of Mean	1.078	.712	2.061
	Std. Deviation	20.871	26.746	19.879
Total	N	497	1920	117
	Mean	38.64	53.05	52.49
	Std. Error of Mean	.911	.604	1.777
	Std. Deviation	20.303	26.483	19.224

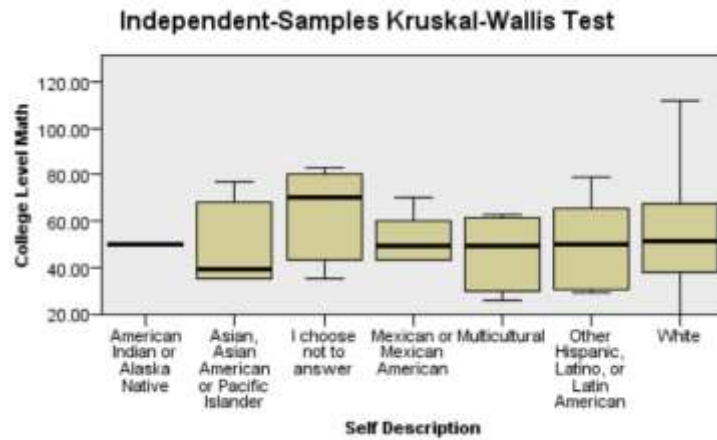
Arithmetic:



Elementary Algebra:



College Level Math:



Total N	117
Test Statistic	2.416
Degrees of Freedom	6
Asymptotic Sig. (2-sided test)	.878

When all factors were included in a regression analysis modeling predictor, the following was found: