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VALIDITY OF THE ACADEMIC PROFILE

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An Investigation of the Construct Validity
of the Long Form of the *Academic Profile*

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Abstract

Analyses of the scores of more than 5,000 students majoring in arts and humanities, business, education, natural sciences, social sciences, mathematics and engineering indicated that scores on the *Academic Profile* increased as students advanced through the educational curriculum, with juniors and seniors generally scoring higher than freshmen, and with students who had completed all of the undergraduate core curriculum generally scoring higher than those who had not completed the core curriculum. These findings replicated the results of earlier studies.[1]

This study also found that the higher scores of juniors and seniors could be explained almost entirely by their completion of more of the core curriculum. This is important because it laid to rest a competing explanation that the higher levels of performance by juniors and seniors might simply reflect their maturation over a three- to four-year period. Previous *Academic Profile* analyses had been unable to resolve this issue, and thus had left open the possibility that the *Academic Profile's* assessment of academic skills might be confounded by examinee differences in intellectual maturation.

This study also found that while completion of advance courses beyond the core curriculum had relatively little impact on *Academic Profile* scores, students in different major fields tended to earn scores that were consistent with the skill requirements of their fields. For example, humanities major scored higher than any other group on the Reading and Writing scales, while mathematics and engineering majors scored highest on the Mathematics scale. The study also replicated earlier findings that good students (i.e., those with relatively high grade-point averages) generally score higher than average or poor students.

[1] Findings from previous studies are described in *The Academic Profile User's Guide, Part 1*.

Background

The *Academic Profile* was designed to contribute to the assessment of the outcomes of undergraduate general education programs. To achieve this purpose, the test assesses those academic skills and abilities (i.e., reading, writing, critical thinking, and mathematics) that are typically emphasized in the general undergraduate core curricula, avoiding insofar as possible any items requiring specific subject-matter knowledge beyond the general material included in most core curricula. As stated in *The Academic Profile User's Guide* (1990), the test "…does this by testing college-level reading, college-level writing, critical thinking, and mathematics within the contexts of the humanities, social sciences, and natural sciences[2]. Questions use stimulus material from the three academic areas to test the skills. However, the emphasis is on measuring the skill; test takers are not expected to bring specific knowledge about the content areas to the questions. Indeed, all the subject knowledge required to determine the answer is contained in the question if the skill exists."

Several years ago, a number of analyses were conducted to evaluate the extent to which the *Academic Profile* was actually measuring the skills and abilities that it was designed to measure. These construct-related validity[3] analyses, which are reported in *The Academic Profile User's Guide, Part I* (1990), produced generally favorable results. For example, they showed that scores on the *Academic Profile* increased as grade-point average, class level, and amount of core curriculum completed increased.

Although the initial results were encouraging, it was not clear to what extent the class level and core completion results simply reflected the effects of maturation. Although students who had completed most of the core curriculum scored higher than those who had completed less of the curriculum, those who had completed more of the core curriculum were also likely to be at higher class levels. After all, it would be virtually impossible in most circumstances for a freshman to have completed all of the core curriculum, and extremely unlikely that a senior would have completed none of the classes in the core curriculum. When an attempt was made to hold core completion constant by looking at differences between class levels with a single level of core completion ("Some"), test scores still increased as class level increased. Although this result seemed to indicate that completion of the core curriculum did not fully account for the superior performance of more advanced students, it should be noted that core completion was originally measured at only three levels: "None," Some," and "All." It is likely that freshmen who indicated that they had completed "Some" of the curriculum had completed fewer core courses than the seniors who indicated that they had completed "Some" of the curriculum. However, there was no way to investigate that possibility using the data that were available at that time.

[2] Mathematics skills are not tested within subject-matter contexts.

[3] Construct-related validity refers to the extent to which an instrument is actually measuring the constructs (i.e., skills or abilities) that it purports to measure. Construct validity typically is evaluated by examining how test scores vary in concert with other variables that are related to the constructs of interest. Ideally, test scores should increase as other indicators of the relevant constructs increase, but should not change substantially as a function of other extraneous variables.

Purpose of this Study

The purpose of this study was to reevaluate the construct-related validity of the *Academic Profile,* using more recent and more detailed information. The 1990-91 *Academic Profile* answer sheets asked examinees to use five categories to describe the percentage of the core curriculum completed, in contrast to the three categories that had been available at the time of the previous validity study. The 1990-91 answer sheets also requested information about the number of core courses and the number of electives completed in each of four content areas (humanities, social sciences, natural sciences, and mathematics).

As mentioned earlier, the *Academic Profile* was designed to measure those skills and abilities in reading, writing, critical thinking and mathematics that are expected to develop through completion of the core curriculum, as opposed to the more specific knowledge, skills, and abilities that are developed through advanced study in any specific content area. Thus, construct validity would be supported by the following findings:

(1) If the *Academic Profile* is measuring the skills and abilities that are acquired in the undergraduate core curriculum, then test scores should increase as the percentage of core curriculum completed increases.

(2) Because the *Academic Profile* is intended to measure skills and abilities taught in the core curriculum rather than those that develop through more advanced study, test scores should be more highly related to completion of relevant courses in the core curriculum than to completion of advanced electives.

(3) Because more advanced students will have completed more of the core curriculum, test scores should generally increase as class level increases. However, this increase should be explainable in terms of the greater percentage of the core curriculum completed by more advanced students.

(4) Insofar as students' course grades reflect their mastery of relevant course material, *Academic Profile* scores should increase as undergraduate grade-point average increases.

(5) Because of differences in their interests and abilities, students in different fields of study are unlikely to benefit equally from all courses in the core curriculum. Students in different majors would be expected to exhibit patterns of scores on the four skill measures (Reading, Writing, Critical Thinking, Mathematics) that are consistent with the relative importance of those skills in their individual fields of study. For example, mathematics majors would be expected to score higher than humanities majors on the mathematics subscale, whereas humanities majors would be expected to score higher on the Reading and Writing subscales.

(6) Finally, because the skill measures (Reading, Writing, Critical Thinking, and Mathematics) are meant to assess specific skills rather than general academic ability, correlations among the four skills should be low enough to suggest that

different constructs really are being measured. On the other hand, the three academic content areas (humanities, social science, natural science) were intended primarily to provide contexts within which the different skills could be measured, so correlations among content areas should be substantially higher than those among the skill measures.

Method

Sample

During 1990-91, 10,890 students who were enrolled in B.A./B.S. programs at 4-year colleges and universities in the United States were tested with the long form of the *Academic Profile.* For the analyses reported here, students who did not specify their class level, amount of core curriculum completed, undergraduate grade point average, and major field of study were excluded from the sample, as were entering freshmen and any students whose undergraduate major did not fit into any of the six general fields described below. The remaining sample consisted of 5,092 students. The numbers of examinees in each major field and class level are shown in Table 1.

Table 1. Sample Sizes

		Freshmen	Sophomores	Juniors	Seniors	Total
Business Majors	N	64	258	271	514	1,107
	% of Sample	1.3	5.1	5.3	10.1	21.7
Education Majors	N	31	177	170	274	652
	% of Sample	0.6	3.5	3.3	5.4	12.8
Humanities/Arts Majors	N	83	190	160	331	764
	% of Sample	1.6	3.7	3.1	6.5	15.0
Natural Science Majors	N	54	152	127	127	460
	% of Sample	1.1	3.0	2.5	2.5	9.0
Social Science Majors	N	67	249	229	354	899
	% of Sample	1.3	4.9	4.5	7.0	17.7
Math/Engineering Majors	N	65	257	560	328	1,210
	% of Sample	1.3	5.0	11.0	6.4	23.8
Total	N	364	1,283	1,517	1,928	5,092
	% of Sample	7.1	25.2	29.8	37.9	100.0

Design and Analyses

Multivariate analysis of variance[4] (MANOVA), was used to investigate the effects of the following self-reported variables[5] on the seven *Academic Profile* subscores for the 5,092 students in the sample:

(1) Undergraduate major field (6 categories): Business, Education, Humanities/Arts, Natural Sciences, Social Sciences, Math/Engineering.

(2) Undergraduate grade point average[6] (5 categories): 1.0-1.99, 2.0-2.49, 2.5-2.99, 3.0-3.49, 3.5-4.0

(3) Core Curriculum completed (5 categories): none, about 25%, about half, about 75%, and 100%.

(4) Class level (2 categories): lower division, upper division.
(4 categories): freshman[7], sophomore, junior, senior.

The MANOVA was run twice, once using 4 categories of class level (freshman, sophomore, junior, and senior), and once using 2 categories (lower division, upper division). There was no significant effect for class level in either analysis, and the other main effects and interactions were essentially the same in the two analyses, but the 4-category analysis did introduce a greater degree of multicollinearity in the data. Therefore, the MANOVA results discussed in this report are based upon the analysis using only two categories for class level.

For each significant MANOVA result, univariate F-ratios were examined in order to assess the effects of the independent variables on each of the *Academic Profile* subscales. These F-ratios indicate the effect of each independent variable, controlling for the effects of all other variables in the analysis. For example, the F-ratios for class level indicate what the effects of class level on *Academic Profile* scores would be if examinees at each class level were comparable in terms of grade point average, core curriculum completed, and undergraduate major field.

In addition to the MANOVA, Spearman Rank Correlations of test scores with core and elective courses completed were computed, as were Pearson product-moment correlations among *Academic Profile* scores on the three content areas (Humanities, Social Science, Natural Science) and four skills (Reading, Writing, Critical Thinking, Mathematics).

[4] Type III sums of squares were used for these analyses, computed through the SAS GLM procedure. For these analyses, all factors were assumed to be fixed.
[5] Values for these variables were obtained for examinee responses to the demographic questions on the *Academic Profile* answer sheet.
[6] Only one student in the sample reported a grade point average below 1.00; that student was excluded from the analyses.
[7] Entering freshmen were excluded from the analysis because they had no undergraduate grade point average.

Results

Overall, the results of these analyses support the validity of the *Academic Profile*. The MANOVA results indicated significant overall main effects for major field, undergraduate grade point average and core curriculum completed, but no significant effects for class level (for major field, grade point average and core completed, all $p < .001$; for class level, all $p > .10$). This pattern of results was found for the three content area subscores and the four skill subscores.

The remainder of this report will discuss these and other results in terms of the five predicted outcomes described earlier in this report.

(1) Test scores should increase as the percentage of core curriculum completed increases.

This was supported by the results. Performance on all seven *Academic Profile* subscales was significantly related to the percentage of the core curriculum that had been completed at the time of testing. A summary of *Academic Profile* performance by percentage of core curriculum completed is provided in Table 2. On all seven subscales, mean scores increase monotonically as the percentage of core curriculum completed increases. The *Academic Profile* was designed to assess those skills that should be developed in the course of a general education core curriculum, and this result suggests that the measured skills do, in fact, increase as students progress through the core curriculum. Thus, these results provide additional evidence for the validity of the *Academic Profile.*

It should be noted that the measure of core completion that was used in this analysis was quite imprecise, using only 5 levels (none, about 25 percent, about 50 percent, about 75 percent, 100 percent), relied upon the examinees' estimates, and ignored institutional differences in core requirements. With a more precise measure, the strength of the relationship between test scores and relevant core curriculum might be even stronger than these results indicate.

(2) Scores on the *Academic Profile* should be more highly related to completion of courses in the core curriculum than to completion of specific elective courses.

This was supported by the results. Because the *Academic Profile* was intended to assess the skills and abilities related to the core curriculum and <u>not</u> the more specific knowledge/skills /abilities that are taught in elective or advanced courses, test scores should show a substantially greater relationship to the completion of core courses than to the completion of other electives.

To address this issue, Spearman rank correlations were computed between scores on the *Academic Profile* and (a) the percentage of core courses completed (using the 5 levels previously described), (b) the completion of core courses in humanities, social sciences, natural sciences, and mathematics (completed all, some, none), and (c) number of electives completed in the humanities, social sciences, natural sciences, and mathematics (none, 1-2 courses, 3 or more courses).

Table 2. Test Scores[8] by Percentage of Core Curriculum Completed[9]

	Percentage of Core Curriculum Completed										
	None		About 25%		About 50%		About 75%		100%		
	(N=214)		(N=341)		(N=701)		(N=2097)		(N=1739)		
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F(4,4838[10])
Humanities	112.87 [a]	6.28	114.42 [a,b]	6.49	115.25 [b]	6.79	116.33 [c]	6.83	117.90 [d]	6.26	10.42*
Social Science	111.66 [a]	5.67	113.05 [a,b]	6.00	113.72 [b]	6.29	114.80 [c]	6.41	116.11 [d]	6.24	8.62*
Natural Science	113.49 [a]	5.86	115.16 [a,b]	6.43	116.24 [b,c]	6.45	116.96 [c]	6.47	118.26 [d]	5.92	11.34*
Reading	115.16 [a]	7.01	116.80 [a,b]	7.16	117.97 [b]	7.17	119.00 [c]	7.21	120.45 [d]	6.76	10.31*
Writing	113.65 [a]	5.47	115.10 [a,b]	5.73	115.65 [b]	5.88	116.64 [c]	5.92	117.95 [d]	5.47	11.33*
Critical Thinking	109.20 [a]	5.47	110.72 [a,b]	6.28	111.59 [b]	6.76	112.44 [c]	6.83	113.85 [d]	6.56	8.15*
Mathematics	111.79 [a]	6.53	114.42 [b]	6.91	114.85 [b]	7.67	115.17 [b]	7.42	116.05 [c]	6.81	8.37*

* $p < .001$

[8] On each subscale, minimum possible score is 100, maximum possible score is 130.
[9] Within each row, means with the same superscript are not significantly different from one another (Tukey-Kramer test, $p > .05$).
[10] F-ratio is for the main effect of core completed. Degrees of freedom for all F-ratios in this report reflect the presence of some empty cells in the higher-order interactions (three-way and four-way). There were no empty cells for any of the main effects or two-way interactions.

These correlation coefficients, presented in Table 3, show small but generally positive relationships between *Academic Profile* scores and completion of core courses in the humanities, social sciences, natural sciences and mathematics. With the exception of the correlations between the Mathematics subscale and core courses in the humanities and social sciences, all of the correlations with core curriculum are significant (i.e., significantly greater than zero).

In contrast, only one significant positive correlation was found between test scores and electives completed. This significant correlation between the *Academic Profile* Mathematics score and the number of mathematics electives completed (.09) was, however, considerably lower than the correlation between the Mathematics score and the amount of the mathematics core curriculum completed.

It is perhaps noteworthy that while there were no significant positive relationships between test scores and completion of humanities electives or social science electives, the number of electives completed in each of these areas showed a significant negative correlation with scores on the Mathematics subscale. There are a number of possible explanations for these results. One explanation could be that mathematics and engineering majors simply take fewer electives in the humanities and social sciences than do students in other major fields.

(3) As class level increases, scores on all subscales should increase; however, this increase should be explainable in terms of core curriculum completed.

This was supported by the results. As the values in Table 4 indicate, mean scores on all of the *Academic Profile* subscales show a general increase as class level increases. As mentioned earlier, this result was not statistically significant for any of the subscales. It should be noted, however, that the effect of class level would have been significant if the percentage of core curriculum completed had not been included in the analysis. Thus, the failure to obtain a significant result in the present analysis indicates that much of the score variance associated with class level can be explained in terms of the percentage of core curriculum completed by students at different class levels.

(4) As undergraduate grade point average increases, scores on all subscales should increase.

This, too, was supported by the results of the analyses. Performance on all of the *Academic Profile* subscales was significantly related to self-reported undergraduate grade point average. A summary of *Academic Profile* performance by grade point average is shown in Table 5. For students with grade point averages between 2.0 and 4.0, mean scores on all *Academic Profile* subscales increase monotonically as grade point average increases, with students in each grade-point-average interval scoring significantly higher than those in the interval below them.

Table 3
Spearman Rank Correlations of Test Scores with Core Curriculum and Electives Completed[11]

	Percent of Total Core Completed	Humanities Core	Humanities Electives	Social Science Core	Social Science Electives	Natural Science Core	Natural Science Electives	Mathematics Core	Mathematics Electives
Subscale	(N=5092)	(N=4646)	(N=4262)	(N=4621)	(N=4249)	(N=4635)	(N=4145)	(N=4621)	(N=4198)
Humanities	.19*	.08*	.00	.06*	.00	.12*	-.05	.13*	-.04
Social Science	.18*	.07*	.02	.08*	.03	.12*	-.02	.13*	-.02
Natural Science	.18*	.05*	-.01	.05*	-.02	.12*	-.01	.13*	-.02
Reading	.19*	.06*	.00	.06*	.01	.12*	-.04	.11*	-.05
Writing	.19*	.07*	.02	.06*	-.01	.12*	-.04	.12*	-.04
Critical Thinking	.17*	.06*	.00	.06*	-.01	.12*	-.01	.13*	.00
Mathematics	.11*	.00	-.11*	.00	-.10*	.12*	.01	.14*	.09*

* Boneferroni-adjusted $p < .05$

[11] Percent of total core completed was reported on a 5-point scale from 0 to 100%. Within the four content areas shown here, core completion was reported on a 3-point scale (no, partial, yes) and electives were reported on a 3-point scale (none, 1-2 courses, 3 or more courses).

Table 4
Test Scores[12] by Class Level[13]

	Freshmen		Sophomores		Juniors		Seniors		
	(N=364)		(N=1283)		(N=1517)		(N=1928)		
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F(3,4667)
Humanities	114.84	6.51	115.62	6.55	116.58	6.98	117.19	6.55	0.90
Social Science	113.29	6.15	113.89	6.14	115.11	6.59	115.58	6.30	1.97
Natural Science	115.14	6.69	116.34	6.27	117.51	6.50	117.49	6.14	1.96
Reading	116.93	7.62	118.22	7.06	119.35	7.30	119.75	6.92	1.87
Writing	115.21	5.68	116.18	5.65	116.79	6.01	117.32	5.78	1.44
Critical Thinking	111.13	6.15	111.44	6.47	113.05	7.07	113.17	6.64	1.00
Mathematics	114.83	6.61	114.14	6.88	116.30	7.89	115.20	6.92	1.45

[12] On each subscale, minimum possible score is 100, maximum possible score is 130.
[13] F-ratio is for the main effect of class (four categories). When two categories were used (upper-division, lower-division) all F-ratios were even smaller than those reported here. Degrees of freedom reflect the presence of some empty cells in the higher-order interactions (three-way and four-way). There were no empty cells for any of the main effects or two-way interactions.

Table 5. Test Scores[14] by GPA[15]

	Undergraduate Grade Point Average (Excludes Entering Freshmen)										
	1.0 – 1.99		2.0 – 2.49		2.5 – 2.99		3.0 -3.49		3.5 – 4.0		
	(N=97)		(N=1048)		(N=1665)		(N=1445)		(N=837)		
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F(4,4838[16])
Humanities	114.11 [a,b]	6.83	113.14 [a]	6.50	115.14 [b]	6.40	118.01 [c]	6.08	120.74 [d]	5.54	9.49 *
Social Science	112.44 [a,b]	6.07	111.95 [a]	5.94	113.52 [b]	5.88	116.22 [c]	5.95	119.05 [d]	5.84	11.06 *
Natural Science	114.32 [a,b]	6.77	114.13 [a]	6.19	115.80 [b]	6.11	118.39 [c]	5.72	121.13 [d]	5.30	13.26 *
Reading	116.01 [a,b]	7.49	115.68 [a]	7.14	117.77 [b]	6.81	120.64 [c]	6.52	123.38 [d]	5.93	11.08 *
Writing	114.71 [a,b]	6.12	113.87 [a]	5.74	115.57 [b]	5.56	118.03 [c]	5.13	120.56 [d]	4.88	12.21 *
Critical Thinking	110.16 [a,b]	6.44	109.66 [a]	6.08	111.11 [b]	6.25	113.93 [c]	6.44	116.94 [d]	6.22	9.84 *
Mathematics	113.05 [a,b]	7.42	112.66 [a]	7.20	113.84 [b]	6.84	116.56 [c]	6.73	119.21 [d]	6.69	7.13 *

* $p < .001$

[14] On each subscale, minimum possible score is 100, maximum possible score is 130.
[15] Within each row, means with the same superscript are not significantly different from one another (Tukey-Kramer test, $p > .05$).
[16] F-ratio is for the main effect of GPA. Degrees of freedom for all F-ratios in this report reflect the presence of some empty cells for higher-order (three-way and four-way) interactions. There were no empty cells for any main effects or two-way interactions.

The only departure from monotonicity occurs in the very lowest interval, those with self-reported grade point averages of 1.0–1.99. The mean scores for this lowest group are not significantly different from the mean scores of examinees with self-reported grade-point averages of 2.0-2.99. However, given the low frequency of responses (N=97), the results for this group should be interpreted with some caution. Apart from the performance of this small group, these results provide further support for the validity of the *Academic Profile*.

(5) Students should exhibit patterns of scores that are consistent with the relative importance of different skills to their fields of study.

This was supported by the results. The *Academic Profile* test performance of students in the six undergraduate major fields is summarized in Table 6a. For each subscale, the table shows the mean score and standard deviation for students in each of the six major fields. The last column in the table shows the F-ratio for each subscale. For each subscale, major field was significantly related to test performance.

It appears that the relative performance of different majors on the four basic skill subscales was generally consistent with the academic requirements of the majors. For instance, humanities/art majors scored significantly higher than any other group on the Reading and Writing subscales, while math/engineering majors scored significantly higher on the Mathematics subscale. On the Critical Thinking subscale, which should tap both verbal and analytical skills, humanities/art majors did not differ significantly from natural science or math/engineering majors.

Table 6b shows the same data broken down by class level (upper division vs. lower division). As Table 6b indicates, there were significant interactions between undergraduate major and class level for two of the content areas and two of the skill measures, but the sizes of the effects were quite small. For the Humanities and Natural Science content areas and for the Reading skill measure, the interactions appear to reflect the fact that the differences between upper-division and lower-division scores were somewhat greater for natural science majors than for students in other major fields. On the Mathematics skill measure, the differences between upper-division and lower-division scores were greater for students majoring in mathematics, natural science and business than for students in the humanities, social science, or education.

Table 6a. Test Scores[17] by Major Field[18]

	Undergraduate Major Field												
	Business		Education		Humanities/Art		Natural Science		Social Science		Math/ Engineering		
	(N=1107)		(N=652)		(N=764)		(N=460)		(N=899)		(N=1210)		
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F(5,4838[19])
Humanities	114.64 [a]	6.40	115.54 [a]	6.08	119.09 [c]	6.54	117.48 [b]	6.56	115.16 [a]	6.71	117.47 [b]	6.74	9.01 *
Social Science	113.28 [a]	6.00	113.58 [a]	5.67	117.14 [c]	6.49	115.54 [b]	6.50	113.60 [a]	6.17	116.18 [b]	6.39	8.39 *
Natural Science	115.46 [a]	6.08	115.53 [a]	5.65	118.41 [c]	6.18	118.67 [b]	6.19	115.39 [a]	6.37	119.03 [b]	6.24	8.11 *
Reading	117.25 [a]	7.02	118.00 [a]	6.66	121.43 [c]	6.84	120.22 [b]	7.21	117.67 [a]	7.10	120.32 [b]	7.06	7.63 *
Writing	115.43 [a]	5.65	115.89 [a]	5.38	118.65 [c]	5.82	117.54 [b]	5.58	115.42 [a]	6.07	117.80 [b]	5.59	7.32 *
Critical Thinking	110.71 [a]	6.16	110.76 [a]	5.65	114.54 [b]	6.78	113.89 [b]	6.90	111.06 [a]	6.41	114.55 [b]	6.95	9.24 *
Mathematics	113.61 [b]	6.67	112.42 [a]	5.82	114.79 [c]	6.46	116.91 [d]	6.91	112.28 [a]	6.42	120.08 [e]	6.97	18.68 *

* $p < .001$

[17] On each subscale, minimum possible score is 100, maximum possible score is 130.
[18] Within each row, means with the same superscript are not significantly different from one another (Tukey-Kramer test, $p > .05$).
[19] F-ratio is for the main effect of major field. Degrees of freedom for all F-ratios in this report reflect the presence of some empty cells in the higher-order interactions (three-way and four-way). There were no empty cells for any of the main effects or two-way interactions.

Table 6b. Test Scores[20] by Major Field and Class Level (Upper/Lower Division)[21]

	Undergraduate Major Field												
	Business		Education		Humanities/Art		Natural Science		Social Science		Math/Engineering		
Upper Division N	785		444		491		254		583		888		
Lower Division N	322		208		273		206		316		322		
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F(5,4838[22])
Humanities	115.16	6.51	115.81	6.06	119.48	6.53	118.63	6.44	115.63	6.91	117.97	6.65	2.31*
	113.39	5.96	114.96	6.11	118.38	6.50	116.07	6.45	114.28	6.23	116.10	6.79	
Social Science	113.75	6.17	114.01	5.36	117.69	6.38	116.64	6.53	114.16	6.45	116.62	6.36	1.23
	112.13	5.41	112.06	5.87	116.16	6.59	114.18	6.21	112.58	5.47	114.95	6.33	
Natural Science	115.98	6.07	115.72	5.55	118.74	6.07	119.72	5.92	115.80	6.45	119.54	6.05	2.27*
	114.21	5.93	115.13	5.85	117.83	6.34	117.36	6.28	114.63	6.15	117.64	6.55	
Reading	117.80	7.06	118.34	6.48	121.91	6.62	121.47	6.91	118.23	7.24	120.81	6.90	2.28*
	115.91	6.75	117.26	6.97	120.56	7.15	118.68	7.30	116.65	6.73	118.96	7.34	
Writing	115.80	5.77	116.14	5.39	119.03	5.87	118.35	5.42	115.73	6.28	118.15	5.53	1.83
	114.52	5.25	115.36	5.34	117.96	5.68	116.54	5.63	114.86	5.63	116.84	5.67	
Critical Thinking	111.28	6.27	111.06	5.61	114.93	6.76	115.14	7.18	111.64	6.71	115.16	6.89	2.09
	109.30	5.65	110.12	5.68	113.84	6.78	112.36	6.21	109.99	5.67	112.87	6.85	
Mathematics	114.09	6.83	112.58	5.79	114.85	6.43	117.68	7.08	112.42	6.62	120.69	6.87	2.31*
	112.43	6.13	112.08	5.87	114.68	6.53	115.97	6.60	112.02	6.05	118.40	6.99	

* $p < .05$

[20] On each subscale, minimum possible score is 100, maximum possible score is 130.

[21] For each subscale, the first row contains the means and standard deviations for upper division students (juniors/seniors) and the second row contains the means and standard deviations for lower division students (freshmen/sophomores).

[22] F-ratio is for the major field x class level interaction. Degrees of freedom for all F-ratios in this report reflect the presence of some empty cells for the higher-order (three-way and four-way) interactions. There were no missing cells for main effects or two-way interactions.

(6) Intercorrelations among the four skill scores should be low enough to suggest that the subscales are measuring somewhat distinct abilities.

This was supported by the results. As shown in Table 7, the corrected content-area correlations are all equal to 1.0, suggesting that the three areas are, in fact, measuring the same things (i.e., each is merely providing a context in which to assess the four skills). As predicted, the correlations among the four skills are somewhat lower, indicating that the skill subscales generally are measuring somewhat different abilities.

Table 7.
Pearson Product-Moment Correlations Among Content Areas and Skills[23]

Content Areas

	Humanities	Social Science	Natural Science
Humanities	—	1.0	1.0
Social Science	.82	—	1.0
Natural Science	.82	.82	—

Skills

	Reading	Writing	Critical Thinking	Mathematics
Reading	—	.95	1.0	.74
Writing	.77	—	.99	.82
Critical Thinking	.80	.75	—	.89
Mathematics	.61	.64	.69	—

The rather modest correlations of mathematics with reading and writing indicates that the mathematics subscale is measuring something quite distinct from these other abilities. The higher correlation between reading and writing is not surprising, but even these two related subscales appear to measure somewhat different abilities. The Critical Thinking subscale is more problematic; the extremely high correlation between Critical Thinking and Reading suggests that the skills assessed by the Critical Thinking subscale may be redundant with the skills assessed by the Reading subscale. This is consistent with the view that critical thinking is essentially a higher-order reading skill.

[23] Correlation coefficients above the diagonal have been corrected for attenuation related to unreliability of the scales. The adjustments were based upon the reliability estimates published in the *Academic Profile User's Guide* (1990).

Discussion

Overall, the results of the analyses support the validity of the *Academic Profile*. Students in different undergraduate majors exhibit patterns of scores on the skill measures that are consistent with the relative importance of those skills in their fields of study. The failure to find any substantial (or significant) differences within major fields on the three content-area scores suggests that these three areas are providing testing contexts, as intended, but do not appear to be exerting much differential influence on the examinees' ability to demonstrate their competence in the basic skill areas.

As expected, test scores tended to increase as examinees' grade-point averages and core completion levels increased, providing further evidence that the constructs measured by the *Academic Profile* are relevant to academic success and to the undergraduate core curriculum. Although upper-division students scored substantially higher than lower-division students on all subscales, these differences appear to reflect the fact that upper division students generally have completed more of the core curriculum. In fact, when the effects of core curriculum were taken into account, there were no significant differences between the test scores of upper- and lower-division students. The correlational findings also suggest (albeit tentatively) that the *Academic Profile* is assessing those skills and abilities that are developed in the course of a general undergraduate curriculum rather than more advanced knowledges, skills, and abilities that may be acquired through specific coursework beyond the core curriculum.

These findings, individually and in combination, indicate that the *Academic Profile* probably is measuring the constructs that it was designed to measure.