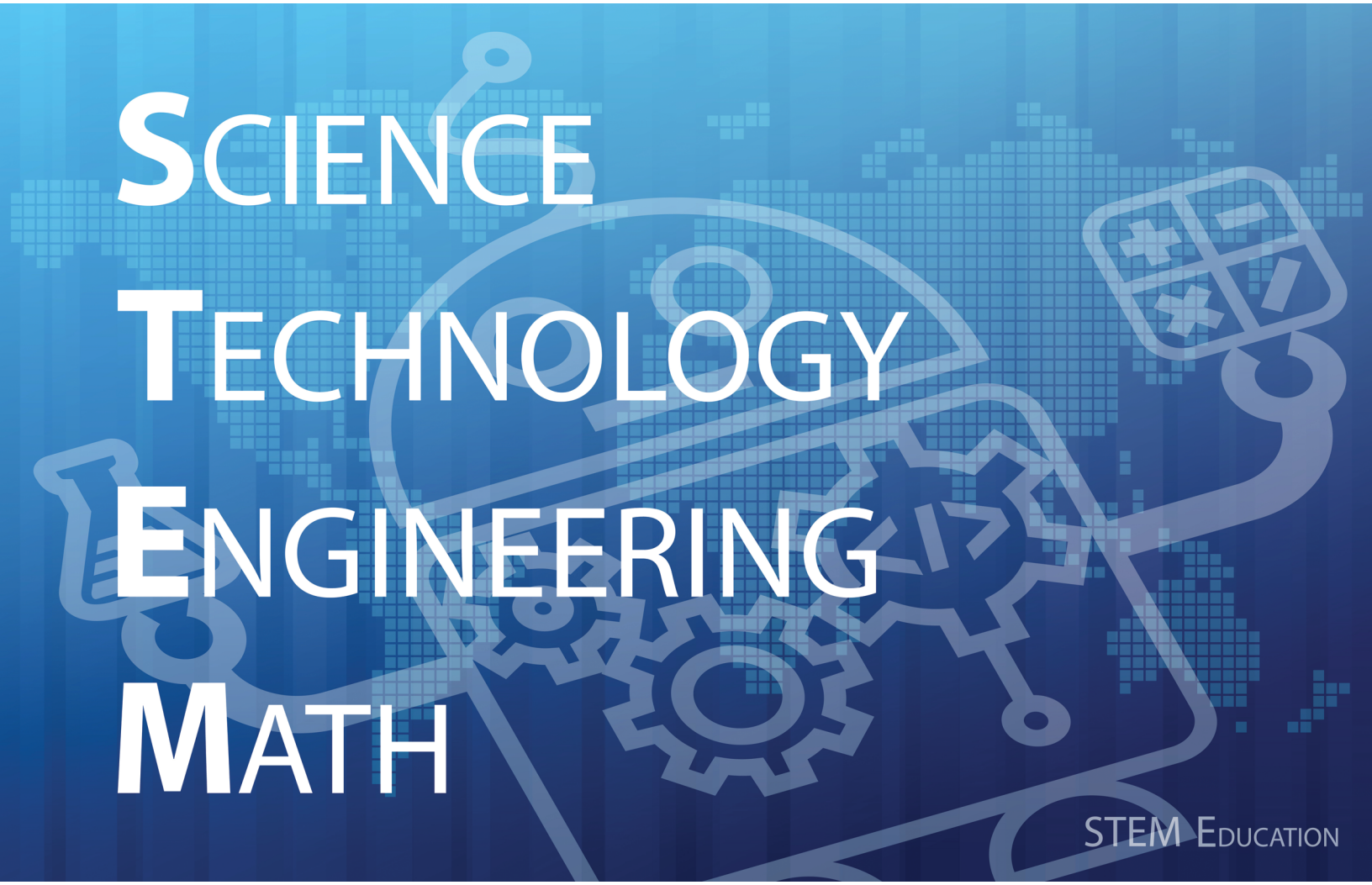

Profiles of High-Performing STEM Majors

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Abstract

Building upon the research findings in an earlier ACT Research Report (Westrick, 2016), this study used data from 119,131 students at 26 four-year institutions to make comparisons between STEM majors earning semester GPAs of 3.0 or higher and their STEM peers earning semester GPAs less than 3.0. The results indicate that the high-performing students entered college with higher mean ACT scores and HSGPAs than did their peers, though their measured interests were quite similar. For STEM majors who earned semester GPAs of 3.0 or higher consecutively in semesters five through eight, their mean ACT STEM scores exceeded the ACT STEM benchmark of 26. High school students considering a STEM major in college may benefit from knowing the level of precollege academic achievement required to perform at a high level in a STEM program in college.

Background

This study was a follow-up of the ACT Research Report 2016-5, *Profiles of Persisting Fourth-Year STEM Majors* (Westrick, 2016). That study examined the standardized mean differences (δ, Cohen, 1988) between students' precollege academic achievement levels, measured by ACT test scores and high school grade point average (HSGPA), and their interests, as measured by their ACT Interest Inventory scores for STEM and non-STEM majors. Specifically, students were placed into one of three student major categories (SMC) based on their declared majors using the two-digit Classification of Instructional Program (CIP) codes (National Center for Education Statistics, 2002): STEM-Biological (CIP 26), STEM-Quantitative (CIPs 11, 14, 27, and 40), and non-STEM (all other CIP codes). The results indicated that STEM majors enter college with higher levels of precollege academic achievement than did non-STEM majors, and both STEM-Biological and STEM-Quantitative majors had interest profiles that distinguished them from non-STEM majors. Future research using this data set will focus on STEM migration, with comparisons made between students persisting in STEM majors and students who enter or leave STEM fields between the second and eighth semesters. However, the aim of the current study was to build upon the results of the first study by examining differences between those persisting in STEM majors who were performing well in their studies and lower-performing peers. In keeping with previous ACT research (Allen, 2013; Allen & Sconing, 2005; Radunzel & Noble, 2012), a postsecondary semester grade point average (SGPA) of 3.0 or higher, a B or better average, was defined as high performing.

The first objective of the current study was to calculate the standardized mean differences between the ACT test scores, HSGPAs, and ACT Interest Inventory scores of "high performing" students persisting in STEM majors and the students who, though they were persisting in STEM majors, were not performing as well as their peers. Identical analyses were conducted for non-STEM majors. As admission test scores and HSGPA are positively correlated with grades earned through four years of study (Mattern & Patterson, 2011; Westrick, 2012), an expected outcome was the mean ACT scores and HSGPAs of STEM majors earning SGPAs greater than or equal to 3.0 would be higher than the means associated with students earning SGPAs less than 3.0. Biserial correlations can be calculated to show the strength of the relationship between a continuous variable (e.g., ACT scores) and a dichotomized variable SGPA of 3.0 or higher – SGPA less than 3.0. However, a biserial correlation can be converted to a standardized mean difference or *d*-value (Schmidt & Hunter, 2015). Standardized mean differences between two groups are calculated using the means for each group and the pooled standard deviations for the two groups, making group differences on different measures comparable. The advantage of using standardized mean differences is the ease of which they can be converted back to the original metric, something the general reader better understands. Interest Inventory profiles were also examined in this study. Given that the ACT Interest Inventory profiles of STEM majors showed little change over time in the first study (Westrick, 2016), differences in the measured interests of persisting STEM majors dichotomized by their SGPAs were expected to be small.

A second objective of the current study was to provide profiles of highly successful STEM majors, where success was defined as earning a SGPA of 3.0 or higher. The first study (Westrick, 2016) presented the profiles of persisting fourth-year STEM majors regardless of their GPAs. The profiles for STEM-Biological and STEM-Quantitative majors were determined using data from all students who had been continuously enrolled for eight semesters and were

in a STEM major in the eighth semester. In contrast, the profiles of high-performing STEM majors in the current study were based on a select group of persisting STEM students. The profiles for the two STEM categories were based on the students who earned an SGPA of 3.0 or higher in semesters five, six, seven, and eight, the time when students should have been specializing and the majority of their courses were related to their major. Students had to meet this standard in each of the four semesters. Furthermore, these students had to be in the same STEM category – STEM-Biological or STEM-Quantitative – over those four consecutive semesters. The objective was to base the profiles on students who consistently performed well in a STEM category over these four semesters. For reference, the profiles of all persisting STEM majors from the first study are presented with the high-performing STEM majors in current study.

Methods

Data

Data for this study were the same as those used in the previous one (Westrick, 2016). Data came from 26 four-year institutions that had 120,612 students who enrolled as first-time students, of which 119,131 completed the first semester and 66,980 remained continuously enrolled through the eighth semester. As in the earlier study, in each semester students were classified according to their declared major into one of three SMCs – STEM-Biological, STEM-Quantitative, and non-STEM—though in the current study, each SMC is dichotomized based upon the students SGPAs (i.e., less than 3.0, greater than or equal to 3.0).

Measures

The measures in the current study were ACT test scores, HSGPA, ACT Interest Inventory scores, and SGPA. The ACT test is a battery of four tests – English (ACTE), Mathematics (ACTM), Reading (ACTR), and Science (ACTS) – with a Composite (ACTC) score that is the average score of the four tests. All scores are reported on a scale from 1 to 36. ACT has recently introduced a STEM score, which is the average of the mathematics and science scores (Mattern, Radunzel, & Westrick, 2015; Radunzel, Mattern, Crouse, & Westrick, 2015). The measure of HSGPA in this study was based on students' self-reported high school grades in four core subject areas: English, mathematics, social science, and natural science. HSGPA was reported on a scale from 0 to 4. The ACT Interest Inventory is a wideband measure intended for use in career exploration. Data was collected when the students registered for the ACT test in high school. The inventory provides scores on six basic types of vocational interests paralleling six career types in Holland's (1997) theory of careers. The six vocational interests, with Holland's types in parentheses, are: Science & Technology (Investigative), Arts (Artistic), Social Service (Social), Administration & Sales (Enterprising), Business Operations (Conventional), and Technical (Realistic). ACT Interest Inventory scale scores range from 20 to 80. Research has shown that two dimensions (Data/Ideas and People/Things) underlie job analysis ratings and measured interests of Holland-type career groups (ACT, 2009). ACT Interest Inventory scores can be converted to Data/Ideas (DI) and People/Things (PT) scores.[1] As in the previous study, DI and PT scores were examined in the current study. The

[1] DI = 0(Realistic) – 1.73(Investigative) – 1.73(Artistic) + 0(Social) + 1.73(Enterprising) + 1.73(Conventional) and PT = 2(Realistic) + 1(Investigative) – 1(Artistic) – (Social) – 1(Enterprising) + 1(Conventional). Source: *The ACT Interest Inventory Technical Manual* (ACT, 2009).

only new measure in this study was SGPA, which was reported on a 0 to 4 scale by each institution.

Analyses

As in the previous study, standardized mean differences (δ) between the comparison groups regarding their ACT test scores, HSGPA, and ACT Interest Inventory scores were calculated at the institution level, and then meta-analytic techniques were used to provide the overall results across institutions (Schmidt & Hunter, 2015). Standardized mean differences greater than or equal to |0.20| with 80% credibility intervals that did not contain zero were considered to be of practical significance and are presented in bold text within the tables. As noted earlier, standardized mean differences can be converted to correlations and vice versa, and they provide validity evidence much as correlations do (Schmidt & Hunter, 2015). However, standardized mean differences allow comparisons between the means for different groups. For example, if the pooled standard deviation on a measure is 5 and the standardized mean difference between two groups is 0.60, multiplying the effect size (0.60) by the pooled standard deviation (5) indicates that the difference between the mean scores for the two groups is 3.

For the semester-by-semester comparisons, high-performing students were defined as students who earned a SGPA of 3.0 or higher. These students were identified in each semester, and students may have changed from one classification to the other (higher-performing or lower-performing) from one semester to the next. As in the first study, students were allowed to change majors throughout the time they were enrolled. Students who were in one SMC in the first semester may have been in another SMC in a later semester.

As discussed earlier, the profiles for the two STEM categories are based on the students who earned an SGPA of 3.0 or higher consecutively in semesters five, six, seven, and eight, the time when the majority of their courses would be related to their major. Students had to meet this standard in each of the four semesters, and they had to be in the same STEM category – STEM-Biological or STEM-Quantitative – over those four consecutive semesters.

Results

Descriptive Statistics

The overall descriptive statistics for the higher-performing and lower-performing students are presented in Tables 1 to 3 (ACT scores and HSGPA) and 4 to 6 (Interest Inventory scores). In each semester, STEM and non-STEM majors who earned SGPAs of 3.0 or higher had higher mean ACT scores and HSGPAs when compared with the students within their SMC who earned SGPAs less than 3.0. As the number of students retained decreased between the first and eighth semester, the means generally rose for both the higher performing and lower performing persisting students. As was seen in the first study, the mean scores and standard deviations for the Interest Inventory scores and the Data/Ideas and People/Things work task dimensions changed only slightly over eight semesters, with some means increasing and others decreasing, and with the standard deviations also showing little change.

Table 1. Descriptive Statistics for STEM-Biological Majors' ACT Scores and HSGPAs

SMC	Semester GPA	Sem.	*N*	ACTC	ACTE	ACTM	ACTR	ACTS	HSGPA
STEM-Biological	<3.0	1	4,247	22.3 (3.8)	22.2 (4.6)	21.7 (4.2)	22.7 (5.3)	22.1 (3.7)	3.47 (0.44)
		2	3,615	22.6 (3.9)	22.5 (4.6)	22.1 (4.3)	23.0 (5.3)	22.3 (3.9)	3.50 (0.43)
		3	2,925	22.9 (3.9)	22.8 (4.6)	22.5 (4.4)	23.4 (5.4)	22.6 (3.9)	3.55 (0.41)
		4	2,487	23.2 (3.9)	23.1 (4.7)	22.8 (4.4)	23.6 (5.4)	22.9 (3.9)	3.58 (0.40)
		5	2,174	23.5 (3.9)	23.4 (4.7)	23.1 (4.4)	23.8 (5.4)	23.1 (3.9)	3.60 (0.40)
		6	1,893	23.6 (3.9)	23.5 (4.7)	23.3 (4.4)	23.9 (5.4)	23.2 (4.0)	3.62 (0.39)
		7	1,719	23.9 (4.0)	23.7 (4.8)	23.7 (4.4)	24.1 (5.5)	23.4 (4.0)	3.65 (0.37)
		8	1,581	23.9 (3.9)	23.8 (4.7)	23.9 (4.4)	24.0 (5.4)	23.4 (3.9)	3.66 (0.37)
STEM-Biological	≥3.0	1	4,970	25.3 (3.9)	25.5 (4.7)	25.0 (4.4)	25.7 (5.3)	24.4 (4.0)	3.77 (0.31)
		2	4,838	25.5 (3.9)	25.7 (4.7)	25.2 (4.4)	25.8 (5.3)	24.6 (4.0)	3.79 (0.29)
		3	4,453	25.7 (3.8)	26.0 (4.6)	25.5 (4.3)	26.1 (5.2)	24.8 (4.0)	3.80 (0.28)
		4	4,377	25.8 (3.8)	26.1 (4.6)	25.6 (4.3)	26.1 (5.2)	24.8 (4.0)	3.80 (0.28)
		5	3,921	25.9 (3.7)	26.2 (4.6)	25.9 (4.2)	26.2 (5.2)	24.9 (4.0)	3.81 (0.27)
		6	3,857	26.0 (3.7)	26.2 (4.6)	25.9 (4.1)	26.3 (5.1)	25.0 (3.9)	3.82 (0.27)
		7	3,588	26.0 (3.7)	26.3 (4.6)	26.0 (4.1)	26.4 (5.1)	25.1 (3.9)	3.82 (0.26)
		8	3,579	26.1 (3.7)	26.2 (4.6)	26.0 (4.1)	26.4 (5.1)	25.1 (3.9)	3.82 (0.26)

Note. SMC = student major category; Sem. = semester; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

Table 2. Descriptive Statistics for STEM-Quantitative Majors' ACT Scores and HSGPAs

SMC	Semester GPA	Sem.	*N*	ACTC	ACTE	ACTM	ACTR	ACTS	HSGPA
STEM-Quantitative	<3.0	1	7,368	23.7 (4.0)	22.8 (4.7)	24.3 (4.4)	23.4 (5.5)	23.7 (4.1)	3.47 (0.46)
		2	6,832	24.0 (4.1)	23.0 (4.8)	24.8 (4.6)	23.6 (5.5)	24.0 (4.2)	3.50 (0.44)
		3	5,794	24.3 (4.0)	23.4 (4.8)	25.2 (4.5)	23.8 (5.5)	24.2 (4.2)	3.56 (0.41)
		4	4,690	24.4 (4.0)	23.6 (4.8)	25.4 (4.4)	24.0 (5.5)	24.3 (4.2)	3.57 (0.41)
		5	3,981	24.5 (4.0)	23.6 (4.8)	25.6 (4.4)	24.0 (5.4)	24.4 (4.2)	3.59 (0.40)
		6	3,364	24.6 (4.0)	23.7 (4.8)	25.7 (4.4)	24.1 (5.5)	24.5 (4.2)	3.60 (0.40)
		7	2,820	24.7 (4.0)	23.8 (4.8)	25.7 (4.4)	24.2 (5.5)	24.5 (4.2)	3.61 (0.39)
		8	2,438	24.7 (4.1)	23.8 (4.8)	25.9 (4.4)	24.1 (5.5)	24.6 (4.3)	3.61 (0.39)
STEM-Quantitative	≥3.0	1	8,148	26.5 (4.1)	26.0 (4.9)	27.5 (4.5)	26.2 (5.5)	26.0 (4.4)	3.77 (0.31)
		2	6,743	26.7 (4.1)	26.2 (4.8)	27.7 (4.3)	26.4 (5.4)	26.2 (4.4)	3.79 (0.30)
		3	5,262	27.2 (3.9)	26.6 (4.7)	28.2 (4.1)	26.8 (5.3)	26.5 (4.4)	3.81 (0.28)
		4	5,293	27.0 (4.0)	26.4 (4.8)	28.2 (4.2)	26.6 (5.4)	26.4 (4.4)	3.80 (0.29)
		5	4,819	27.3 (3.9)	26.6 (4.7)	28.4 (4.0)	26.9 (5.3)	26.6 (4.3)	3.81 (0.28)
		6	4,833	27.2 (3.9)	26.5 (4.7)	28.3 (4.1)	26.7 (5.3)	26.6 (4.3)	3.82 (0.27)
		7	4,773	27.1 (3.9)	26.5 (4.7)	28.4 (4.0)	26.7 (5.4)	26.6 (4.3)	3.81 (0.27)
		8	4,885	27.1 (3.9)	26.4 (4.7)	28.3 (4.0)	26.6 (5.3)	26.5 (4.3)	3.81 (0.27)

Note. SMC = student major category; Sem. = semester; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

Table 3. Descriptive Statistics for Non-STEM Majors' ACT Scores and HSGPAs

SMC	Semester GPA	Sem.	*N*	ACTC	ACTE	ACTM	ACTR	ACTS	HSGPA
Non-STEM	<3.0	1	47,301	21.0 (3.7)	20.9 (4.7)	20.2 (4.0)	21.5 (5.2)	20.9 (3.7)	3.25 (0.51)
		2	42,754	21.2 (3.8)	21.1 (4.7)	20.4 (4.1)	21.7 (5.3)	21.0 (3.7)	3.28 (0.51)
		3	34,541	21.5 (3.7)	21.4 (4.7)	20.8 (4.2)	21.9 (5.2)	21.3 (3.7)	3.34 (0.49)
		4	29,146	21.6 (3.8)	21.6 (4.7)	20.8 (4.2)	22.0 (5.2)	21.3 (3.7)	3.35 (0.48)
		5	24,381	21.8 (3.8)	21.7 (4.7)	21.1 (4.3)	22.2 (5.3)	21.5 (3.8)	3.37 (0.48)
		6	21,319	21.9 (3.8)	21.8 (4.7)	21.2 (4.3)	22.3 (5.3)	21.6 (3.8)	3.37 (0.48)
		7	18,339	21.9 (3.8)	21.9 (4.7)	21.3 (4.3)	22.3 (5.3)	21.6 (3.8)	3.38 (0.48)
		8	16,411	22.0 (3.9)	22.0 (4.7)	21.4 (4.4)	22.4 (5.3)	21.7 (3.8)	3.39 (0.48)
Non-STEM	≥3.0	1	47,097	23.8 (4.0)	24.2 (4.9)	23.1 (4.5)	24.5 (5.5)	23.0 (3.9)	3.63 (0.40)
		2	43,695	24.0 (3.9)	24.4 (4.8)	23.3 (4.4)	24.7 (5.4)	23.1 (3.8)	3.64 (0.39)
		3	38,372	24.2 (3.9)	24.6 (4.8)	23.5 (4.4)	24.9 (5.4)	23.3 (3.8)	3.65 (0.38)
		4	39,220	24.1 (3.9)	24.5 (4.8)	23.4 (4.4)	24.8 (5.3)	23.2 (3.8)	3.65 (0.38)
		5	37,490	24.1 (3.9)	24.5 (4.8)	23.4 (4.4)	24.7 (5.4)	23.2 (3.8)	3.65 (0.38)
		6	37,655	24.0 (3.9)	24.3 (4.8)	23.3 (4.4)	24.6 (5.4)	23.1 (3.8)	3.64 (0.38)
		7	37,821	23.9 (3.9)	24.3 (4.8)	23.2 (4.4)	24.5 (5.4)	23.1 (3.8)	3.64 (0.39)
		8	38,086	23.8 (3.9)	24.2 (4.8)	23.1 (4.4)	24.4 (5.4)	23.0 (3.8)	3.63 (0.39)

Note. SMC = student major category; Sem. = semester; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

Table 4. Descriptive Statistics for STEM-Biological Majors' ACT Interest Inventory Scores and Calculated Work Task Dimension Scores

SMC	Sem. GPA	Sem.	*N*	Sci. & Tech.	Arts	Social Serv.	Adm. & Sales	Bus. Ops.	Technical	P-T	D-I
STEM-Bio.	<3.0	1	4,247	58.9 (9.0)	50.7 (9.3)	52.2 (10.8)	50.0 (9.8)	49.3 (8.5)	50.9 (9.8)	4.9 (30.0)	-17.9 (31.4)
		2	3,615	59.1 (9.0)	50.8 (9.2)	52.0 (10.7)	49.6 (9.7)	49.3 (8.4)	51.0 (9.8)	6.0 (29.9)	-19.1 (31.2)
		3	2,925	59.4 (9.2)	51.1 (9.4)	52.2 (10.9)	49.9 (9.9)	49.5 (8.7)	51.5 (10.1)	6.4 (31.3)	-19.2 (31.9)
		4	2,487	59.7 (9.0)	51.1 (9.4)	52.0 (10.9)	49.8 (9.7)	49.5 (8.6)	51.7 (9.9)	7.6 (30.7)	-19.8 (32.1)
		5	2,174	59.8 (9.0)	51.3 (9.4)	52.1 (10.8)	49.7 (9.7)	49.6 (8.5)	51.7 (10.1)	7.4 (31.1)	-20.4 (31.3)
		6	1,893	59.6 (8.8)	51.2 (9.5)	52.2 (10.8)	49.5 (9.9)	49.6 (8.7)	51.7 (10.2)	7.4 (31.0)	-20.1 (31.2)
		7	1,719	59.7 (8.8)	50.8 (9.4)	52.0 (10.8)	49.4 (9.8)	49.6 (8.7)	51.5 (10.3)	8.1 (31.5)	-19.8 (30.9)
		8	1,581	59.6 (8.6)	50.8 (9.4)	51.7 (10.7)	49.4 (9.7)	49.5 (8.6)	51.5 (10.2)	8.5 (31.4)	-19.7 (31.1)
STEM-Bio.	≥3.0	1	4,970	60.1 (8.9)	51.2 (9.3)	53.1 (10.6)	50.4 (9.7)	49.6 (8.7)	51.0 (9.8)	3.8 (30.8)	-19.6 (32.5)
		2	4,838	60.1 (8.9)	51.2 (9.5)	53.0 (10.8)	50.4 (9.7)	49.6 (8.8)	51.2 (9.9)	4.4 (30.8)	-19.7 (32.6)
		3	4,453	59.9 (8.8)	51.3 (9.3)	52.8 (10.6)	50.1 (9.4)	49.4 (8.5)	51.2 (9.8)	4.8 (31.0)	-20.3 (32.5)
		4	4,377	59.9 (8.9)	51.4 (9.4)	52.8 (10.6)	50.2 (9.5)	49.6 (8.6)	51.2 (9.8)	4.8 (30.6)	-19.9 (32.4)
		5	3,921	60.2 (8.9)	51.3 (9.4)	52.8 (10.8)	50.2 (9.6)	49.6 (8.7)	51.4 (9.8)	5.5 (30.5)	-20.3 (32.4)
		6	3,857	60.4 (8.9)	51.4 (9.3)	52.7 (10.6)	50.3 (9.4)	49.7 (8.6)	51.5 (9.8)	6.1 (30.5)	-20.4 (32.2)
		7	3,588	60.4 (8.8)	51.5 (9.3)	52.5 (10.5)	50.2 (9.4)	49.6 (8.5)	51.5 (9.8)	6.3 (30.4)	-20.9 (32.2)
		8	3,579	60.4 (8.8)	51.5 (9.3)	52.6 (10.5)	50.1 (9.3)	49.7 (8.6)	51.5 (9.9)	6.3 (30.4)	-21.0 (31.9)

Note. SMC = student major category; Sem. = semester; Sci. & Tech. = Science & Technology; Social Serv. = Social Service; Adm. & Sales = Administration and Sales; Bus. Ops. = Business Operations; P-T = People-Things; D-I = Data-Ideas.

Table 5. Descriptive Statistics for STEM-Quantitative Majors' ACT Interest Inventory Scores and Calculated Work Task Dimension Scores

SMC	Sem. GPA	Sem.	*N*	Sci. & Tech.	Arts	Social Serv.	Adm. & Sales	Bus. Ops.	Technical	P-T	D-I
STEM-Quant	<3.0	1	7,368	55.8 (8.7)	51.2 (8.9)	49.8 (10.8)	50.7 (9.4)	51.8 (8.4)	55.1 (9.5)	16.5 (29.7)	-7.6 (30.2)
		2	6,832	56.1 (8.8)	51.1 (8.8)	49.7 (10.9)	50.7 (9.4)	52.0 (8.4)	55.1 (9.4)	17.1 (29.8)	-7.7 (30.5)
		3	5,794	56.4 (8.7)	51.0 (8.8)	49.8 (10.8)	50.5 (9.2)	52.0 (8.4)	55.1 (9.5)	17.6 (29.8)	-8.4 (30.5)
		4	4,690	56.4 (8.8)	51.1 (8.7)	49.7 (10.7)	50.5 (9.3)	52.0 (8.5)	55.2 (9.4)	17.9 (29.7)	-8.6 (31.0)
		5	3,981	56.5 (8.6)	51.1 (8.7)	49.8 (10.6)	50.7 (9.3)	52.2 (8.6)	55.3 (9.3)	18.0 (29.7)	-8.2 (31.0)
		6	3,364	56.5 (8.6)	51.1 (8.7)	49.6 (10.7)	50.5 (9.2)	51.9 (8.4)	55.2 (9.3)	18.1 (30.1)	-9.0 (30.9)
		7	2,820	56.7 (8.3)	51.3 (8.7)	49.9 (10.7)	50.7 (9.3)	52.2 (8.5)	55.6 (9.4)	18.3 (30.1)	-8.9 (30.7)
		8	2,438	56.6 (8.4)	51.3 (8.7)	49.7 (10.5)	50.5 (9.2)	52.1 (8.5)	55.2 (9.4)	17.8 (29.6)	-9.2 (30.6)
STEM-Quant	≥3.0	1	8,148	57.4 (8.7)	51.1 (8.9)	49.7 (10.7)	50.6 (9.4)	52.2 (8.6)	54.3 (9.4)	17.1 (31.0)	-10.1 (32.3)
		2	6,743	57.4 (8.8)	51.1 (8.9)	49.6 (10.5)	50.3 (9.4)	52.2 (8.6)	54.5 (9.5)	17.8 (30.8)	-10.5 (32.3)
		3	5,262	57.4 (8.7)	51.1 (8.8)	49.5 (10.5)	50.4 (9.5)	52.3 (8.7)	54.5 (9.4)	18.3 (30.8)	-10.1 (32.5)
		4	5,293	57.4 (8.6)	51.0 (8.8)	49.4 (10.4)	50.2 (9.3)	52.4 (8.6)	54.6 (9.4)	18.8 (31.0)	-10.1 (32.0)
		5	4,819	57.4 (8.6)	51.0 (8.9)	49.3 (10.3)	50.1 (9.3)	52.2 (8.6)	54.7 (9.4)	19.2 (30.8)	-10.5 (32.2)
		6	4,833	57.4 (8.6)	51.0 (8.9)	49.3 (10.2)	50.2 (9.3)	52.4 (8.6)	54.8 (9.5)	19.5 (30.4)	-10.0 (32.0)
		7	4,773	57.4 (8.7)	51.0 (8.9)	49.2 (10.2)	50.2 (9.3)	52.4 (8.6)	54.6 (9.5)	19.6 (30.5)	-10.1 (32.1)
		8	4,885	57.4 (8.6)	51.0 (8.8)	49.3 (10.4)	50.3 (9.3)	52.4 (8.6)	54.9 (9.5)	19.7 (30.7)	-9.9 (31.9)

Note. SMC = student major category; Sem. = semester; Sci. & Tech. = Science & Technology; Social Serv. = Social Service; Adm. & Sales = Administration and Sales; Bus. Ops. = Business Operations; P-T = People-Things; D-I = Data-Ideas.

Table 6. Descriptive Statistics for Non-STEM Majors' ACT Interest Inventory Scores and Calculated Work Task Dimension Scores

SMC	Sem. GPA	Sem.	*N*	Sci. & Tech.	Arts	Social Serv.	Adm. & Sales	Bus. Ops.	Technical	P-T	D-I
Non-STEM	<3.0	1	47,301	51.6 (8.8)	51.6 (9.4)	51.6 (10.8)	52.2 (9.9)	50.0 (8.7)	50.6 (9.7)	-4.3 (31.7)	-1.8 (33.0)
		2	42,754	51.7 (8.9)	51.7 (9.5)	51.7 (10.8)	52.2 (9.9)	50.0 (8.7)	50.7 (9.6)	-4.2 (31.8)	-2.0 (33.3)
		3	34,541	51.8 (8.9)	51.7 (9.4)	51.9 (10.7)	52.4 (9.9)	50.2 (8.7)	50.6 (9.5)	-4.6 (31.7)	-1.5 (33.2)
		4	29,146	51.8 (8.9)	51.7 (9.4)	51.8 (10.8)	52.4 (9.9)	50.1 (8.7)	50.6 (9.6)	-4.7 (31.8)	-1.8 (33.2)
		5	24,381	52.0 (8.9)	51.7 (9.3)	51.9 (10.8)	52.6 (9.8)	50.3 (8.7)	50.7 (9.6)	-4.3 (32.0)	-1.4 (33.4)
		6	21,319	52.2 (9.0)	51.9 (9.4)	51.9 (10.8)	52.7 (9.9)	50.3 (8.7)	50.8 (9.5)	-4.3 (31.9)	-1.9 (33.7)
		7	18,339	52.2 (9.0)	51.7 (9.3)	51.9 (10.8)	52.8 (9.9)	50.5 (8.7)	50.9 (9.6)	-3.9 (32.1)	-1.2 (33.4)
		8	16,411	52.3 (9.0)	51.9 (9.3)	51.9 (10.8)	52.8 (9.9)	50.5 (8.8)	51.0 (9.6)	-3.7 (32.4)	-1.5 (33.7)
Non-STEM	≥3.0	1	47,097	52.2 (9.0)	52.6 (9.7)	52.3 (10.7)	52.6 (10.0)	50.1 (9.0)	50.0 (9.3)	-7.3 (32.7)	-3.5 (35.5)
		2	43,695	52.2 (8.9)	52.6 (9.7)	52.4 (10.7)	52.7 (10.0)	50.1 (8.9)	50.0 (9.3)	-7.7 (32.6)	-3.4 (35.2)
		3	38,372	52.3 (8.9)	52.7 (9.7)	52.4 (10.7)	52.7 (10.0)	50.1 (8.9)	50.0 (9.3)	-7.8 (32.6)	-3.7 (35.4)
		4	39,220	52.3 (8.9)	52.6 (9.7)	52.5 (10.6)	52.8 (10.0)	50.1 (8.9)	50.1 (9.3)	-7.6 (32.6)	-3.4 (35.3)
		5	37,490	52.2 (8.9)	52.5 (9.6)	52.5 (10.6)	52.8 (10.0)	50.1 (8.9)	50.1 (9.3)	-7.8 (32.5)	-3.2 (35.1)
		6	37,655	52.2 (8.9)	52.4 (9.6)	52.5 (10.7)	52.8 (10.0)	50.2 (8.9)	50.1 (9.4)	-7.6 (32.5)	-2.7 (35.0)
		7	37,821	52.1 (8.9)	52.4 (9.6)	52.5 (10.7)	52.8 (9.9)	50.1 (8.9)	50.1 (9.3)	-7.6 (32.5)	-2.8 (34.9)
		8	38,086	52.1 (8.9)	52.3 (9.6)	52.5 (10.7)	52.8 (9.9)	50.1 (8.8)	50.1 (9.3)	-7.6 (32.3)	-2.6 (34.7)

Note. SMC = student major category; Sem. = semester; Sci. & Tech. = Science & Technology; Social Serv. = Social Service; Adm. & Sales = Administration and Sales; Bus. Ops. = Business Operations; P-T = People-Things; D-I = Data-Ideas.

Standardized Mean Differences in Precollege Academic Achievement Levels

Meta-analytic results for the comparisons made between higher-performing students and lower-performing persisting students within each SMC within each institution indicated that the mean ACT scores and HSGPAs of the higher-performing students were higher than those of the lower-performing students. Table 7 contains the meta-analytic results for the comparisons made between the higher-performing STEM-Biological majors and the lower-performing STEM-Biological majors. The higher-performing students had higher mean ACT scores and HSGPAs than those for the lower-performing students over all eight semesters. The general pattern for all six measures was that the effect sizes (δ) decreased over time. Between the first and eighth semesters, effect sizes for ACT Composite scores declined from 0.79 to 0.59, and those for HSGPA declined from 0.91 to 0.61. For the ACT subject area tests, effect sizes in the first semester ranged from 0.60 (ACTR) to 0.84 (ACTM) and between 0.49 (ACTS) and 0.57 (ACTE) in the eighth semester.

Table 7. Estimated Mean Effect Sizes for Comparisons between STEM-Biological Majors' ACT Scores and HSGPAs

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA	SGPA	ACTC	1	26	9,217	**0.79**	0.08	**[0.69, 0.89]**
≥3.0	<3.0		2	26	8,453	**0.74**	0.13	**[0.57, 0.91]**
			3	26	7,378	**0.75**	0.08	**[0.65, 0.85]**
			4	26	6,864	**0.68**	0.04	**[0.63, 0.72]**
			5	26	6,095	**0.65**	0.10	**[0.53, 0.78]**
			6	26	5,750	**0.62**	0.00	**[0.62, 0.62]**
			7	26	5,307	**0.60**	0.15	**[0.41, 0.80]**
			8	26	5,160	**0.59**	0.06	**[0.51, 0.67]**
SGPA	SGPA	ACTE	1	26	9,217	**0.75**	0.10	**[0.63, 0.87]**
≥3.0	<3.0		2	26	8,453	**0.72**	0.17	**[0.50, 0.94]**
			3	26	7,378	**0.73**	0.11	**[0.58, 0.87]**
			4	26	6,864	**0.67**	0.00	**[0.67, 0.67]**
			5	26	6,095	**0.63**	0.08	**[0.54, 0.73]**
			6	26	5,750	**0.60**	0.00	**[0.60, 0.60]**
			7	26	5,307	**0.59**	0.12	**[0.43, 0.75]**
			8	26	5,160	**0.57**	0.00	**[0.57, 0.57]**
SGPA	SGPA	ACTM	1	26	9,217	**0.84**	0.09	**[0.72, 0.95]**
≥3.0	<3.0		2	26	8,453	**0.77**	0.08	**[0.66, 0.87]**
			3	26	7,378	**0.77**	0.09	**[0.66, 0.88]**
			4	26	6,864	**0.68**	0.06	**[0.60, 0.76]**
			5	26	6,095	**0.68**	0.11	**[0.55, 0.82]**
			6	26	5,750	**0.64**	0.08	**[0.54, 0.73]**
			7	26	5,307	**0.59**	0.17	**[0.38, 0.80]**
			8	26	5,160	**0.54**	0.08	**[0.43, 0.65]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics.

Table 7. Estimated Mean Effect Sizes for Comparisons between STEM-Biological Majors' ACT Scores and HSGPAs (*continued*)

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA	SGPA	ACTR	1	26	9,217	**0.60**	0.09	**[0.48, 0.71]**
≥3.0	<3.0		2	26	8,453	**0.55**	0.12	**[0.39, 0.71]**
			3	26	7,378	**0.57**	0.00	**[0.57, 0.57]**
			4	26	6,864	**0.52**	0.05	**[0.45, 0.59]**
			5	26	6,095	**0.50**	0.06	**[0.43, 0.57]**
			6	26	5,750	**0.48**	0.00	**[0.48, 0.48]**
			7	26	5,307	**0.48**	0.09	**[0.37, 0.59]**
			8	26	5,160	**0.50**	0.00	**[0.50, 0.50]**
SGPA	SGPA	ACTS	1	26	9,217	**0.67**	0.00	**[0.67, 0.67]**
≥3.0	<3.0		2	26	8,453	**0.69**	0.11	**[0.50, 0.79]**
			3	26	7,378	**0.62**	0.05	**[0.56, 0.68]**
			4	26	6,864	**0.58**	0.00	**[0.58, 0.58]**
			5	26	6,095	**0.53**	0.11	**[0.38, 0.68]**
			6	26	5,750	**0.52**	0.00	**[0.52, 0.52]**
			7	26	5,307	**0.50**	0.18	**[0.27, 0.72]**
			8	26	5,160	**0.49**	0.12	**[0.34, 0.65]**
SGPA	SGPA	HSGPA	1	26	9,217	**0.91**	0.18	**[0.69, 1.14]**
≥3.0	<3.0		2	26	8,453	**0.90**	0.12	**[0.75, 1.06]**
			3	26	7,378	**0.84**	0.18	**[0.61, 1.08]**
			4	26	6,864	**0.78**	0.17	**[0.56, 0.99]**
			5	26	6,095	**0.74**	0.19	**[0.49, 0.98]**
			6	26	5,750	**0.67**	0.20	**[0.42, 0.92]**
			7	26	5,307	**0.63**	0.22	**[0.36, 0.91]**
			8	26	5,160	**0.61**	0.26	**[0.27, 0.95]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

In most cases, the results for the STEM-Quantitative (Table 8) and non-STEM majors (Table 9) displayed the same general trends as those for the STEM-Biological majors. Between the first and eighth semesters, effect sizes for comparisons made between the students' mean ACT Composites scores declined from 0.71 to 0.61 for the STEM-Quantitative majors and from 0.71 to 0.46 for the non-STEM majors. For the HSGPA comparisons, the effect sizes declined from 0.90 to 0.61 for the STEM-Quantitative majors and from 0.87 to 0.69 for the non-STEM majors. For the ACT subject area tests, effect sizes in the first semester ranged from 0.53 (ACTR) to 0.76 (ACTM) for the STEM-Quantitative majors and between 0.56 (ACTR) and 0.71 (ACTE) for the non-STEM majors. In the eighth semester, the effect sizes ranged from 0.50 (ACTR) and 0.61 (ACTM) for the STEM-Quantitative majors and between 0.38 (ACTS) and 0.48 (ACTE) for the non-STEM majors. The one exception to the general trend of declining effect sizes was for the mean ACT Reading comparisons for the STEM-Quantitative majors (Table 8), where the largest effect size was found in the second semester (0.60), and the difference between the effect sizes in the first and eighth semesters was only 0.03.

Table 8. Estimated Mean Effect Sizes for Comparisons between STEM-Quantitative Majors' ACT Scores and HSGPAs

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	ACTC	1	26	15,516	**0.71**	0.11	**[0.56, 0.85]**
			2	26	13,575	**0.69**	0.12	**[0.53, 0.85]**
			3	26	11,056	**0.76**	0.13	**[0.60, 0.93]**
			4	26	9,983	**0.66**	0.14	**[0.49, 0.84]**
			5	26	8,800	**0.72**	0.12	**[0.57, 0.88]**
			6	26	8,197	**0.65**	0.09	**[0.54, 0.77]**
			7	26	7,593	**0.63**	0.09	**[0.51, 0.75]**
			8	26	7,323	**0.61**	0.11	**[0.48, 0.75]**
SGPA ≥3.0	SGPA <3.0	ACTE	1	26	15,516	**0.69**	0.09	**[0.58, 0.81]**
			2	26	13,575	**0.69**	0.13	**[0.52, 0.85]**
			3	26	11,056	**0.76**	0.12	**[0.60, 0.92]**
			4	26	9,983	**0.66**	0.14	**[0.47, 0.84]**
			5	26	8,800	**0.70**	0.10	**[0.58, 0.83]**
			6	26	8,197	**0.65**	0.04	**[0.60, 0.71]**
			7	26	7,593	**0.62**	0.08	**[0.51, 0.72]**
			8	26	7,323	**0.59**	0.06	**[0.51, 0.67]**
SGPA ≥3.0	SGPA <3.0	ACTM	1	26	15,516	**0.76**	0.10	**[0.63, 0.89]**
			2	26	13,575	**0.72**	0.11	**[0.57, 0.86]**
			3	26	11,056	**0.79**	0.11	**[0.65, 0.93]**
			4	26	9,983	**0.70**	0.11	**[0.56, 0.84]**
			5	26	8,800	**0.75**	0.14	**[0.56, 0.93]**
			6	26	8,197	**0.65**	0.12	**[0.50, 0.81]**
			7	26	7,593	**0.67**	0.17	**[0.46, 0.88]**
			8	26	7,323	**0.61**	0.12	**[0.45, 0.77]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics.

Table 8. Estimated Mean Effect Sizes for Comparisons between STEM-Quantitative Majors' ACT Scores and HSGPAs (*continued*)

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	ACTR	1	26	15,516	**0.53**	0.11	**[0.38, 0.67]**
			2	26	13,575	**0.54**	0.10	**[0.41, 0.67]**
			3	26	11,056	**0.60**	0.11	**[0.45, 0.74]**
			4	26	9,983	**0.52**	0.12	**[0.36, 0.68]**
			5	26	8,800	**0.58**	0.11	**[0.45, 0.71]**
			6	26	8,197	**0.52**	0.05	**[0.46, 0.58]**
			7	26	7,593	**0.49**	0.00	**[0.49, 0.49]**
			8	26	7,323	**0.50**	0.08	**[0.40, 0.61]**
SGPA ≥3.0	SGPA <3.0	ACTS	1	26	15,516	**0.58**	0.11	**[0.44, 0.73]**
			2	26	13,575	**0.56**	0.12	**[0.40, 0.71]**
			3	26	11,056	**0.60**	0.12	**[0.46, 0.75]**
			4	26	9,983	**0.54**	0.13	**[0.37, 0.71]**
			5	26	8,800	**0.59**	0.11	**[0.45, 0.74]**
			6	26	8,197	**0.54**	0.11	**[0.39, 0.68]**
			7	26	7,593	**0.53**	0.07	**[0.44, 0.63]**
			8	26	7,323	**0.51**	0.12	**[0.36, 0.66]**
SGPA ≥3.0	SGPA <3.0	HSGPA	1	26	15,516	**0.87**	0.16	**[0.66, 1.08]**
			2	26	13,575	**0.85**	0.18	**[0.61, 1.08]**
			3	26	11,056	**0.78**	0.19	**[0.54, 1.02]**
			4	26	9,983	**0.72**	0.10	**[0.59, 0.85]**
			5	26	8,800	**0.73**	0.13	**[0.55, 0.90]**
			6	26	8,197	**0.70**	0.13	**[0.54, 0.86]**
			7	26	7,593	**0.68**	0.19	**[0.43, 0.92]**
			8	26	7,323	**0.69**	0.12	**[0.53, 0.84]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

Table 9. Estimated Mean Effect Sizes for Comparisons between Non-STEM Majors' ACT Scores and HSGPAs

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	ACTC	1	26	94,398	**0.71**	0.11	**[0.56, 0.86]**
			2	26	86,449	**0.71**	0.12	**[0.56, 0.87]**
			3	26	72,913	**0.72**	0.09	**[0.61, 0.83]**
			4	26	68,366	**0.66**	0.08	**[0.56, 0.77]**
			5	26	61,871	**0.59**	0.10	**[0.47, 0.72]**
			6	26	58,974	**0.54**	0.09	**[0.42, 0.65]**
			7	26	56,160	**0.52**	0.09	**[0.40, 0.63]**
			8	26	54,497	**0.46**	0.07	**[0.37, 0.55]**
SGPA ≥3.0	SGPA <3.0	ACTE	1	26	94,398	**0.71**	0.11	**[0.56, 0.85]**
			2	26	86,449	**0.70**	0.11	**[0.56, 0.85]**
			3	26	72,913	**0.72**	0.08	**[0.62, 0.82]**
			4	26	68,366	**0.65**	0.09	**[0.54, 0.76]**
			5	26	61,871	**0.60**	0.10	**[0.48, 0.73]**
			6	26	58,974	**0.55**	0.09	**[0.43, 0.66]**
			7	26	56,160	**0.54**	0.08	**[0.43, 0.64]**
			8	26	54,497	**0.48**	0.06	**[0.41, 0.55]**
SGPA ≥3.0	SGPA <3.0	ACTM	1	26	94,398	**0.69**	0.10	**[0.56, 0.81]**
			2	26	86,449	**0.68**	0.12	**[0.53, 0.83]**
			3	26	72,913	**0.66**	0.07	**[0.56, 0.75]**
			4	26	68,366	**0.61**	0.07	**[0.52, 0.70]**
			5	26	61,871	**0.53**	0.08	**[0.43, 0.64]**
			6	26	58,974	**0.48**	0.08	**[0.38, 0.59]**
			7	26	56,160	**0.44**	0.08	**[0.33, 0.54]**
			8	26	54,497	**0.40**	0.06	**[0.32, 0.47]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTC = ACT Composite; ACTE = ACT English; ACTM = ACT Mathematics.

Table 9. Estimated Mean Effect Sizes for Comparisons between Non-STEM Majors' ACT Scores and HSGPAs (*continued*)

Group 1	Group 2	Variable	Semester	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	ACTR	1	26	94,398	**0.56**	0.11	**[0.42, 0.70]**
			2	26	86,449	**0.58**	0.12	**[0.43, 0.73]**
			3	26	72,913	**0.60**	0.09	**[0.49, 0.72]**
			4	26	68,366	**0.55**	0.08	**[0.44, 0.65]**
			5	26	61,871	**0.50**	0.09	**[0.38, 0.62]**
			6	26	58,974	**0.45**	0.08	**[0.34, 0.55]**
			7	26	56,160	**0.45**	0.08	**[0.36, 0.55]**
			8	26	54,497	**0.40**	0.07	**[0.31, 0.48]**
SGPA ≥3.0	SGPA <3.0	ACTS	1	26	94,398	**0.60**	0.12	**[0.45, 0.76]**
			2	26	86,449	**0.61**	0.13	**[0.44, 0.78]**
			3	26	72,913	**0.61**	0.09	**[0.49, 0.73]**
			4	26	68,366	**0.57**	0.09	**[0.45, 0.69]**
			5	26	61,871	**0.49**	0.11	**[0.36, 0.63]**
			6	26	58,974	**0.45**	0.09	**[0.34, 0.57]**
			7	26	56,160	**0.43**	0.09	**[0.31, 0.55]**
			8	26	54,497	**0.38**	0.07	**[0.28, 0.47]**
SGPA ≥3.0	SGPA <3.0	HSGPA	1	26	94,398	**0.90**	0.14	**[0.72, 1.08]**
			2	26	86,449	**0.88**	0.16	**[0.68, 1.08]**
			3	26	72,913	**0.83**	0.15	**[0.63, 1.03]**
			4	26	68,366	**0.78**	0.13	**[0.61, 0.95]**
			5	26	61,871	**0.74**	0.14	**[0.56, 0.91]**
			6	26	58,974	**0.68**	0.13	**[0.52, 0.85]**
			7	26	56,160	**0.66**	0.12	**[0.51, 0.81]**
			8	26	54,497	**0.61**	0.12	**[0.46, 0.77]**

Note. Bold indicates that the estimated mean effect size (δ) exceeds |0.20| and the credibility interval (CrI) does not contain zero. Sem. = semester; *k* = number of institutional studies; *SD*δ = standard deviation of estimated mean effect size; SGPA = semester grade point average; ACTR = ACT Reading; ACTS = ACT Science; HSGPA = high school grade point average.

Standardized Mean Differences in Measured Interests

Tables 10 (STEM-Biological), 11 (STEM-Quantitative), and 12 (non-STEM) contain the meta-analytic results for the Interest Inventory scale score and the DI/PT comparisons made between the higher-performing students and the lower-performing students within each of the SMCs. For all of the SMCs, none of the effect sizes was of practical significance. That is, none of the effect sizes exceeded 0.20 in magnitude. In only a few instances did the effect sizes exceed |0.10|, with the largest effect size being 0.15 for the first semester Science and Technology scale score comparisons made for STEM-Quantitative majors (Table 11).

Table 10. Estimated Mean Effect Sizes Comparisons between STEM-Biological Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SDδ*	80% CrI
SGPA ≥3.0	SGPA <3.0	Science & Technology	1	26	9,217	0.10	0.08	[-0.00, 0.20]
			2	26	8,453	0.08	0.05	[0.01, 0.15]
			3	26	7,378	0.05	0.00	[0.05, 0.05]
			4	26	6,864	0.00	0.06	[-0.07, 0.07]
			5	26	6,095	0.02	0.06	[-0.06, 0.10]
			6	26	5,750	0.07	0.00	[0.07, 0.07]
			7	26	5,307	0.07	0.05	[-0.00, 0.13]
			8	26	5,160	0.10	0.00	[0.10, 0.10]
SGPA ≥3.0	SGPA <3.0	Arts	1	26	9,217	0.05	0.00	[0.05, 0.05]
			2	26	8,453	0.04	0.00	[0.04, 0.04]
			3	26	7,378	0.03	0.00	[0.03, 0.03]
			4	26	6,864	0.02	0.02	[-0.01, 0.05]
			5	26	6,095	-0.02	0.00	[-0.02, -0.02]
			6	26	5,750	0.00	0.05	[-0.07, 0.07]
			7	26	5,307	0.07	0.00	[0.07, 0.07]
			8	26	5,160	0.07	0.13	[-0.10, 0.24]
SGPA ≥3.0	SGPA <3.0	Social Service	1	26	9,217	0.08	0.00	[0.08, 0.08]
			2	26	8,453	0.09	0.00	[0.09, 0.09]
			3	26	7,378	0.06	0.09	[-0.06, 0.17]
			4	26	6,864	0.06	0.05	[-0.01, 0.13]
			5	26	6,095	0.05	0.00	[0.05, 0.05]
			6	26	5,750	0.03	0.07	[-0.06, 0.12]
			7	26	5,307	0.05	0.13	[-0.12, 0.22]
			8	26	5,160	0.09	0.16	[-0.12, 0.30]
SGPA ≥3.0	SGPA <3.0	Administration & Sales	1	26	9,217	0.03	0.00	[0.03, 0.03]
			2	26	8,453	0.06	0.00	[0.06, 0.06]
			3	26	7,378	0.00	0.00	[0.00, 0.00]
			4	26	6,864	0.03	0.05	[-0.03, 0.09]
			5	26	6,095	0.04	0.10	[-0.08, 0.17]
			6	26	5,750	0.07	0.15	[-0.12, 0.26]
			7	26	5,307	0.08	0.07	[-0.01, 0.17]
			8	26	5,160	0.06	0.12	[-0.09, 0.22]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

Table 10. Estimated Mean Effect Sizes Comparisons between STEM-Biological Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores (*continued*)

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	Business Operations	1	26	9,217	0.03	0.02	[0.01, 0.06]
			2	26	8,453	0.03	0.04	[-0.02, 0.09]
			3	26	7,378	-0.01	0.00	[-0.01, -0.01]
			4	26	6,864	0.00	0.00	[0.00, 0.00]
			5	26	6,095	0.00	0.00	[0.00, 0.00]
			6	26	5,750	0.00	0.00	[0.00, 0.00]
			7	26	5,307	0.00	0.00	[0.00, 0.00]
			8	26	5,160	0.02	0.00	[0.02, 0.02]
SGPA ≥3.0	SGPA <3.0	Technical	1	26	9,217	0.01	0.00	[0.01, 0.01]
			2	26	8,453	0.01	0.00	[0.01, 0.01]
			3	26	7,378	-0.03	0.00	[-0.03, -0.03]
			4	26	6,864	-0.06	0.00	[-0.06, -0.06]
			5	26	6,095	-0.05	0.00	[-0.05, -0.05]
			6	26	5,750	-0.03	0.00	[-0.03, -0.03]
			7	26	5,307	0.00	0.09	[-0.12, 0.11]
			8	26	5,160	0.00	0.00	[0.00, 0.00]
SGPA ≥3.0	SGPA <3.0	People-Things	1	26	9,217	-0.03	0.00	[-0.03, -0.03]
			2	26	8,453	-0.05	0.00	[-0.05, -0.05]
			3	26	7,378	-0.05	0.08	[-0.16, 0.05]
			4	26	6,864	-0.09	0.04	[-0.15, -0.04]
			5	26	6,095	-0.07	0.00	[-0.07, -0.07]
			6	26	5,750	-0.04	0.04	[-0.09, 0.02]
			7	26	5,307	-0.06	0.07	[-0.15, 0.03]
			8	26	5,160	-0.07	0.19	[-0.31, 0.18]
SGPA ≥3.0	SGPA <3.0	Data-Ideas	1	26	9,217	-0.04	0.03	[-0.08, 0.00]
			2	26	8,453	-0.01	0.00	[-0.01, -0.01]
			3	26	7,378	-0.04	0.00	[-0.04, -0.04]
			4	26	6,864	0.01	0.00	[0.01, 0.01]
			5	26	6,095	0.02	0.00	[0.02, 0.02]
			6	26	5,750	0.00	0.07	[-0.08, 0.08]
			7	26	5,307	-0.03	0.00	[-0.03, -0.03]
			8	26	5,160	-0.04	0.00	[-0.04, -0.04]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

Table 11. Estimated Mean Effect Sizes Comparisons between STEM-Quantitative Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	Science & Technology	1	26	15,516	0.15	0.05	[0.09, 0.22]
			2	26	13,575	0.12	0.06	[0.04, 0.19]
			3	26	11,056	0.11	0.00	[0.11, 0.11]
			4	26	9,983	0.10	0.00	[0.10, 0.10]
			5	26	8,800	0.09	0.09	[-0.03, 0.21]
			6	26	8,197	0.08	0.00	[0.08, 0.08]
			7	26	7,593	0.06	0.00	[0.06, 0.06]
			8	26	7,323	0.07	0.00	[0.07, 0.07]
SGPA ≥3.0	SGPA <3.0	Arts	1	26	15,516	-0.03	0.00	[-0.03, -0.03]
			2	26	13,575	-0.02	0.05	[-0.09, 0.04]
			3	26	11,056	0.00	0.04	[-0.04, 0.05]
			4	26	9,983	-0.00	0.05	[-0.06, 0.05]
			5	26	8,800	-0.01	0.00	[-0.01, -0.01]
			6	26	8,197	-0.01	0.00	[-0.01, -0.01]
			7	26	7,593	-0.05	0.00	[-0.05, -0.05]
			8	26	7,323	-0.05	0.00	[-0.05, -0.05]
SGPA ≥3.0	SGPA <3.0	Social Service	1	26	15,516	-0.03	0.08	[-0.13, 0.08]
			2	26	13,575	-0.04	0.06	[-0.11, 0.04]
			3	26	11,056	-0.03	0.00	[-0.03, -0.03]
			4	26	9,983	-0.03	0.00	[-0.03, -0.03]
			5	26	8,800	-0.05	0.05	[-0.11, 0.02]
			6	26	8,197	-0.03	0.05	[-0.10, 0.04]
			7	26	7,593	-0.08	0.08	[-0.19, 0.02]
			8	26	7,323	-0.05	0.00	[-0.05, -0.05]
SGPA ≥3.0	SGPA <3.0	Administra-tion & Sales	1	26	15,516	-0.03	0.07	[-0.12, 0.07]
			2	26	13,575	-0.06	0.06	[-0.13, 0.02]
			3	26	11,056	-0.01	0.00	[-0.01, -0.01]
			4	26	9,983	-0.03	0.00	[-0.03, -0.03]
			5	26	8,800	-0.06	0.00	[-0.06, -0.06]
			6	26	8,197	-0.02	0.00	[-0.02, -0.02]
			7	26	7,593	-0.05	0.00	[-0.05, -0.05]
			8	26	7,323	-0.02	0.00	[-0.02, -0.02]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

Table 11. Estimated Mean Effect Sizes Comparisons between STEM-Quantitative Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores (*continued*)

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	Business Operations	1	26	15,516	0.03	0.07	[-0.07, 0.12]
			2	26	13,575	0.00	0.04	[-0.05, 0.06]
			3	26	11,056	0.02	0.00	[0.02, 0.02]
			4	26	9,983	0.04	0.00	[0.04, 0.04]
			5	26	8,800	0.00	0.00	[0.00, 0.00]
			6	26	8,197	0.06	0.01	[0.04, 0.08]
			7	26	7,593	0.02	0.00	[0.02, 0.02]
			8	26	7,323	0.03	0.00	[0.03, 0.03]
SGPA ≥3.0	SGPA <3.0	Technical	1	26	15,516	-0.09	0.06	[-0.17, -0.02]
			2	26	13,575	-0.08	0.00	[-0.08, -0.08]
			3	26	11,056	-0.08	0.00	[-0.08, -0.08]
			4	26	9,983	-0.08	0.00	[-0.08, -0.08]
			5	26	8,800	-0.07	0.00	[-0.07, -0.07]
			6	26	8,197	-0.04	0.05	[-0.11, 0.03]
			7	26	7,593	-0.12	0.07	[-0.20, -0.03]
			8	26	7,323	-0.04	0.00	[-0.04, -0.04]
SGPA ≥3.0	SGPA <3.0	People-Things	1	26	15,516	0.03	0.08	[-0.07, 0.13]
			2	26	13,575	0.03	0.04	[-0.02, 0.08]
			3	26	11,056	0.02	0.04	[-0.04, 0.07]
			4	26	9,983	0.02	0.00	[0.02, 0.02]
			5	26	8,800	0.03	0.07	[-0.05, 0.12]
			6	26	8,197	0.04	0.00	[0.04, 0.04]
			7	26	7,593	0.03	0.04	[-0.02, 0.09]
			8	26	7,323	0.06	0.00	[0.06, 0.06]
SGPA ≥3.0	SGPA <3.0	Data-Ideas	1	26	15,516	-0.06	0.04	[-0.11, 0.00]
			2	26	13,575	-0.07	0.06	[-0.15, 0.01]
			3	26	11,056	-0.04	0.00	[-0.04, -0.04]
			4	26	9,983	-0.04	0.01	[-0.05, -0.02]
			5	26	8,800	-0.06	0.00	[-0.06, -0.06]
			6	26	8,197	-0.01	0.04	[-0.07, 0.04]
			7	26	7,593	-0.03	0.05	[-0.09, 0.04]
			8	26	7,323	-0.01	0.03	[-0.05, 0.03]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

Table 12. Estimated Mean Effect Sizes Comparisons between Non-STEM Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	Science & Technology	1	26	94,398	0.04	0.04	[-0.00, 0.09]
			2	26	86,449	0.04	0.06	[-0.04, 0.11]
			3	26	72,913	0.04	0.06	[-0.03, 0.11]
			4	26	68,366	0.04	0.05	[-0.03, 0.11]
			5	26	61,871	0.00	0.05	[-0.06, 0.07]
			6	26	58,974	-0.01	0.06	[-0.09, 0.07]
			7	26	56,160	-0.03	0.05	[-0.09, 0.03]
			8	26	54,497	-0.04	0.04	[-0.09, 0.01]
SGPA ≥3.0	SGPA <3.0	Arts	1	26	94,398	0.09	0.03	[0.04, 0.13]
			2	26	86,449	0.07	0.02	[0.04, 0.10]
			3	26	72,913	0.10	0.03	[0.05, 0.14]
			4	26	68,366	0.08	0.04	[0.02, 0.13]
			5	26	61,871	0.07	0.03	[0.03, 0.11]
			6	26	58,974	0.04	0.03	[0.01, 0.08]
			7	26	56,160	0.06	0.00	[0.06, 0.06]
			8	26	54,497	0.03	0.00	[0.03, 0.03]
SGPA ≥3.0	SGPA <3.0	Social Service	1	26	94,398	0.05	0.03	[0.01, 0.09]
			2	26	86,449	0.05	0.02	[0.02, 0.08]
			3	26	72,913	0.05	0.00	[0.05, 0.05]
			4	26	68,366	0.06	0.00	[0.06, 0.06]
			5	26	61,871	0.05	0.01	[0.04, 0.06]
			6	26	58,974	0.05	0.00	[0.05, 0.05]
			7	26	56,160	0.05	0.00	[0.05, 0.05]
			8	26	54,497	0.05	0.02	[0.03, 0.07]
SGPA ≥3.0	SGPA <3.0	Administration & Sales	1	26	94,398	0.02	0.04	[-0.04, 0.07]
			2	26	86,449	0.03	0.05	[-0.04, 0.09]
			3	26	72,913	0.02	0.05	[-0.05, 0.08]
			4	26	68,366	0.02	0.05	[-0.05, 0.08]
			5	26	61,871	0.00	0.05	[-0.06, 0.06]
			6	26	58,974	0.00	0.06	[-0.07, 0.08]
			7	26	56,160	-0.02	0.04	[-0.07, 0.04]
			8	26	54,497	-0.01	0.04	[-0.07, 0.05]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

Table 12. Estimated Mean Effect Sizes Comparisons between Non-STEM Majors' Interest Inventory Scores and Calculated Work Task Dimension Scores (*continued*)

Group 1	Group 2	Variable	Sem.	*k*	*N*	δ	*SD*δ	80% CrI
SGPA ≥3.0	SGPA <3.0	Business Operations	1	26	94,398	0.02	0.05	[-0.05, 0.09]
			2	26	86,449	0.00	0.06	[-0.07, 0.08]
			3	26	72,913	-0.01	0.05	[-0.08, 0.05]
			4	26	68,366	0.00	0.04	[-0.06, 0.05]
			5	26	61,871	-0.03	0.04	[-0.08, 0.01]
			6	26	58,974	-0.02	0.05	[-0.08, 0.05]
			7	26	56,160	-0.05	0.06	[-0.12, 0.03]
			8	26	54,497	-0.05	0.04	[-0.10, 0.00]
SGPA ≥3.0	SGPA <3.0	Technical	1	26	94,398	-0.06	0.03	[-0.10, -0.02]
			2	26	86,449	-0.08	0.02	[-0.11, -0.04]
			3	26	72,913	-0.07	0.03	[-0.11, -0.03]
			4	26	68,366	-0.06	0.02	[-0.08, -0.03]
			5	26	61,871	-0.08	0.02	[-0.10, -0.05]
			6	26	58,974	-0.08	0.03	[-0.12, -0.04]
			7	26	56,160	-0.10	0.03	[-0.14, -0.05]
			8	26	54,497	-0.11	0.04	[-0.17, -0.05]
SGPA ≥3.0	SGPA <3.0	People-Things	1	26	94,398	-0.08	0.02	[-0.10, -0.05]
			2	26	86,449	-0.09	0.02	[-0.12, -0.06]
			3	26	72,913	-0.09	0.03	[-0.13, -0.05]
			4	26	68,366	-0.08	0.03	[-0.12, -0.04]
			5	26	61,871	-0.10	0.05	[-0.17, -0.04]
			6	26	58,974	-0.10	0.04	[-0.15, -0.05]
			7	26	56,160	-0.12	0.02	[-0.15, -0.09]
			8	26	54,497	-0.12	0.05	[-0.18, -0.06]
SGPA ≥3.0	SGPA <3.0	Data-Ideas	1	26	94,398	-0.04	0.06	[-0.11, 0.03]
			2	26	86,449	-0.03	0.06	[-0.12, 0.05]
			3	26	72,913	-0.06	0.05	[-0.13, 0.01]
			4	26	68,366	-0.04	0.05	[-0.10, 0.02]
			5	26	61,871	-0.04	0.05	[-0.11, 0.02]
			6	26	58,974	-0.02	0.08	[-0.12, 0.09]
			7	26	56,160	-0.04	0.08	[-0.14, 0.06]
			8	26	54,497	-0.02	0.05	[-0.08, 0.04]

Note. Sem. = semester; *k* = number of institutional studies; δ = estimated mean effect size; *SD*δ = standard deviation of estimated mean effect size; CrI = credibility interval; SGPA = semester grade point average.

To illustrate the similarities between the higher-performing and lower-performing students, Figure 1 contains the DI/PT plots for the STEM majors disaggregated by their first and eighth semester GPAs. For both the STEM groups, the plots for the lower-performing students (GPA < 3.0) were relatively close to plots for their higher-performing counterparts (GPA > 3.0). The plots for the non-STEM majors showed similar differences between the higher-performing and lower-performing students.

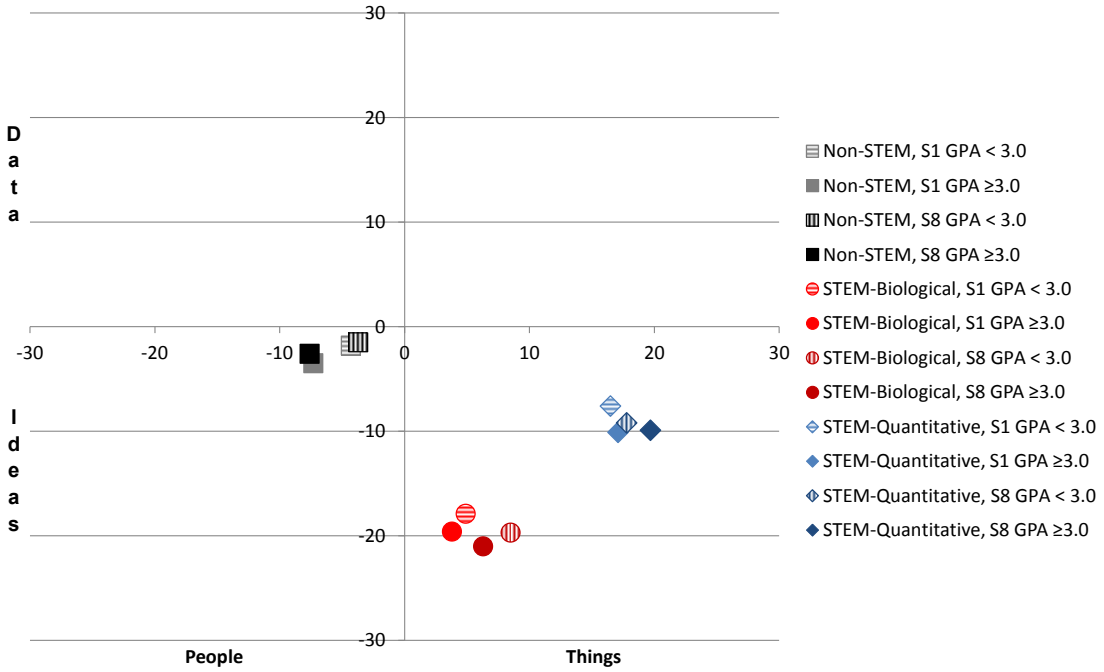

Figure 1. Data/Ideas and People/Things plots for STEM major, disaggregated by semester 1 GPA and semester 8 GPA

Unlike the comparisons made in precollege academic achievement levels (Tables 7 through 9), the effect sizes for the measured interests comparisons did not generally become smaller over time. Sometimes the differences were larger, and sometimes they were smaller, but in most cases the effect sizes were within a very narrow range over eight semesters, the widest range being 0.10 (Table 10, Science & Technology).

Profiles of High-Performing STEM Majors

For the creation of the profiles, the high-performing STEM majors had to be continuously enrolled at the same institution from the first semester through the eighth semester, the same as in the first study. However, an additional requirement in this study was that the high-performing STEM majors had to have earned a SGPA of 3.0 or higher in semesters five through eight while remaining in the same STEM category. In these four semesters, most students would have completed their general education requirements and would have then enrolled in required and elective courses for their major. Students earning SGPAs of 3.0 or higher in their third and fourth years of study would be consistently performing well within their major. For reference purposes, the profiles for the STEM majors who persisted through the eighth semester – regardless of their GPAs – in the first study (Westrick, 2016) are presented after the profiles of the high-performing STEM majors identified in this study. It is important to note that the comparisons made in this section differ from the comparisons made semester to semester in the preceding section.

Table 13 contains the means and interquartile ranges (IQRs) for the ACT Composite, English, mathematics, reading, and science scores for the high-performing STEM majors in the current study. Rounded test scores for the high-performing STEM-Biological majors were 27, 27, 27, 27, and 26, respectively, with an average HSGPA of 3.85. These ACT scores were one or two

points higher than the scores for all STEM-Biological majors enrolled in the eighth semester in the first study, reproduced in Table 14. The average Interest Inventory Science and Technology, Arts, Social Service, Business Operations, Administration and Sales, and Technical scores for the high-performing stem majors were 61, 51, 53, 50, 50, and 51, respectively, and their mean P/T and D/I work task dimension scores were 6 and -22, respectively. These figures were nearly identical to those found in the first study. For the high-performing STEM Quantitative majors, their mean ACT Composite, English, mathematics, reading, and science scores were 28, 27, 29, 27, and 27, respectively, one or two points higher than those from the first study. Their mean HSGPA was 3.87. The mean Interest Inventory Science and Technology, Arts, Social Service, Business Operations, Administration and Sales, and Technical scores for high-performing STEM-Quantitative majors were 58, 51, 49, 52, 50, and 55, respectively, and their mean People/Things and Data/Ideas work task dimension scores were 20 and -11, respectively. As with the STEM-Biological majors, the mean measured-interest scores for the high-performing STEM-Quantitative majors were quite similar to those for the persisting STEM-Quantitative majors in the first study. The medians and IQRs for the institutional means are presented in Table 15. As seen in the results from the first study presented in Table 16, the ranges of institutional means are narrower than the ranges of individual scores. This indicated that there was greater variation within institutions than across institutions.

Table 13. Profiles of High-performing STEM Majors, Student Means and Interquartile Ranges for STEM Majors with Semester GPAs of 3.0 or Higher in Semesters 5 through 8

	STEM-Biological (N=2,381)			STEM-Quantitative (N=2,942)		
Measure	**25th percentile**	**Mean**	**75th percentile**	**25th percentile**	**Mean**	**75th percentile**
ACT						
Composite	24	27	29	25	28	31
English	24	27	30	24	27	31
Mathematics	24	27	29	27	29	32
Reading	24	27	30	24	27	31
Science	23	26	28	24	27	30
HSGPA	3.79	3.85	4.00	3.81	3.87	4.00
Interest Inventory						
Science & Technology	55	61	66	53	58	62
Arts	45	51	58	45	51	57
Social Service	46	53	58	43	49	56
Administration & Sales	44	50	55	46	52	58
Business Operations	45	50	57	43	50	55
Technical	44	51	58	48	55	61
People-Things	-14	6	27	0	20	40
Data-Ideas	-43	-22	0	-33	-11	10

Table 14. Profiles of All Persisting STEM Majors, Student Means and Interquartile Ranges for Precollege Academic Achievement and Interest Measures

	STEM-Biological (N=5,160)			STEM-Quantitative (N=7,323)		
Measure	**25th percentile**	**Mean**	**75th percentile**	**25th percentile**	**Mean**	**75th percentile**
ACT						
Composite	23	25	28	23	26	29
English	22	25	29	22	26	29
Mathematics	23	25	28	25	27	30
Reading	22	26	29	22	26	30
Science	22	25	27	23	26	29
HSGPA	3.64	3.76	4.00	3.60	3.74	4.00
Interest Inventory						
Science & Technology	54	60	65	52	57	62
Arts	45	51	58	45	51	57
Social Service	46	52	58	43	50	56
Administration & Sales	44	50	55	46	52	58
Business Operations	43	50	55	45	50	57
Technical	44	51	58	48	55	61
People-Things	-13	7	28	0	19	39
Data-Ideas	-42	-21	0	-31	-10	10

Reproduced from ACT Research Report 2016-5, *Profiles of Persisting Fourth-Year STEM Majors*.

Table 15. Profiles of High-Performing STEM Majors with Semester GPAs of 3.0 or Higher in Semesters 5 through 8, Medians and Interquartile Ranges for Institutional Means

	STEM-Biological			STEM-Quantitative		
Measure	**25th percentile**	**Median**	**75th percentile**	**25th percentile**	**Median**	**75th percentile**
ACT						
Composite	25	26	27	25	26	28
English	25	26	27	24	26	27
Mathematics	24	25	27	26	27	29
Reading	25	26	27	25	26	28
Science	24	25	26	25	26	27
HSGPA	3.77	3.86	3.89	3.77	3.84	3.88
Interest Inventory						
Science & Technology	59	61	61	54	56	59
Arts	50	52	53	50	51	52
Social Service	50	52	53	47	48	50
Administration & Sales	48	50	50	52	53	54
Business Operations	48	49	51	47	49	50
Technical	50	51	52	53	54	55
People-Things	5	8	15	16	22	29
Data-Ideas	-29	-23	-19	-14	-10	-3

Table 16. Median and Interquartile Ranges of Institutional Means for Precollege Academic Achievement and Interest Measures

	STEM-Biological			STEM-Quantitative		
Measure	**25th percentile**	**Median**	**75th percentile**	**25th percentile**	**Median**	**75th percentile**
ACT						
Composite	23	24	26	24	24	26
English	23	25	26	23	24	26
Mathematics	23	24	26	24	26	27
Reading	24	25	26	23	24	26
Science	23	24	25	23	25	26
HSGPA	3.62	3.74	3.79	3.58	3.67	3.78
Interest Inventory						
Science & Technology	58	60	61	50	51	52
Arts	51	51	52	47	48	50
Social Service	50	51	53	52	52	53
Administration & Sales	49	49	50	48	49	51
Business Operations	47	49	50	53	54	55
Technical	51	52	53	16	20	25
People-Things	6	9	13	-12	-9	-4
Data-Ideas	-29	-22	-17	50	51	52

Reproduced from ACT Research Report 2016-5, *Profiles of Persisting Fourth-Year STEM Majors*.

As mentioned earlier, the new ACT STEM Readiness Benchmark (Radunzel et al., 2015) is 26. Follow-up analyses with the data for the current study found the mean ACT STEM score for the combined STEM-Biological and STEM-Quantitative students in the first semester of this study was 26. Looking beyond the first semester to the third and fourth years of college, the mean ACT STEM scores for the high-performing STEM-Biological and STEM-Quantitative majors in the current study were even higher, 27 and 28, respectively.

Discussion

The first objective of this study sought to determine if there were differences of practical significance between high-performing and lower-performing students regarding their precollege academic achievement levels and their measured interests within each SMC. Validity studies have shown that students with higher ACT scores and HSGPAs tend to earn higher grades in college (ACT, 2014), and the results of this study deliver the same general message. The meta-analytic results strongly suggest that within each SMC, the higher-performing students differed from their lower-performing peers regarding their levels of precollege academic achievement, and these differences were not trivial. Most effect sizes (δ) were in the moderate range, greater than or equal to 0.50 but less than 0.80. The general pattern for ACT scores and HSGPA were for the effect sizes to decrease between the first semester and the eighth semester. Higher attrition rates for less-prepared students from each SMC probably explain some of the change over time. As seen in Table 1, the mean ACT scores and HSGPAs for students in both SGPA categories rose and the number of students decreased in each

semester. Furthermore, the migration of students from the two STEM SMCs to the non-STEM group probably contributes in some degree to this trend.[2]

The results of this study underscore the importance of the level of precollege preparation needed for students to succeed academically within undergraduate STEM programs. Incoming college students who just met the ACT College Readiness Benchmarks and performed well in high school may believe that they are prepared for STEM studies in college, but they may find themselves in college with students who are much better prepared for STEM studies. The relatively new ACT STEM College Readiness Benchmark, a mean ACT mathematics and science score of 26 (Mattern et al., 2015; Radunzel et al, 2015), was created to help students gauge their readiness for STEM studies in college, and the results of this study provide support for the STEM Benchmark.

Another important result of this study is that there were no differences of practical significance between the high-performing and lower-performing students regarding their measured interests. If there were differences of practical significance between their measured interests, one could argue that the high-performing students were performing better because their interests were better aligned with their chosen major. The results of the current study, however, suggest that within each SMC the students in both groups were very much alike in their measured interests.

Limitations and Future Research

The limitations of this study are much the same as those of the first study (Westrick, 2016). The foremost limitation of this study is its descriptive nature, as the profiles are simply the means and IQRs for the students' precollege measures. Other research studies have modeled STEM enrollment and/or persistence (Le, Robbins, & Westrick, 2014; Mattern et al., 2015). This report does not contain that type of information, but it does compliment the results of those studies by presenting additional evidence of the importance of the levels of precollege academic achievement associated with high academic performance through the fourth year of college. The current meta-analyses demonstrate that the differences between higher-performing and lower-performing students within each STEM SMC are of practical significance across institutions. A second limitation of the report was the number and types of institutions included. It would be ideal for future researchers to conduct similar analyses using data from institutions than cover a broader range of institutional admission selectivity levels. This study used a convenience sample, but the results are in agreement with other research, notably that the mean STEM score of the high-performing STEM majors in the first semester matched the ACT STEM readiness benchmark derived using a nationally representative sample (Mattern et al., 2015).

Finally, this study and the first study did not address student migration into and out of STEM fields over time. Future research using this data set will focus on STEM migration, with comparisons made between persisting STEM majors and 1) non-STEM majors who migrated

[2] Students' migration into and out of the STEM SMCs is the subject of the next study in this series. STEM students are a self-selected group, and earlier studies have suggested that they enter college with higher mean ACT scores and HSGPAs than those of non-STEM students (Westrick, 2016), and they face more stringent grading standards in their programs of study (Westrick, 2015). To some extent, these factors also contribute to student attrition and migration, and to the decline in the standardized mean differences between the higher-performing and lower-performing students in the current study.

into STEM fields; 2) STEM majors who migrated out to non-STEM fields; and 3) STEM majors who departed the institution where they first enrolled, regardless of whether they dropped out, stopped out, or transferred to another institution.

Conclusion

This study has provided snapshots of high-performing STEM majors over four years of study. Using a sample of nearly 120,000 students from 26 four-year institutions, the higher-performing STEM majors had higher mean ACT scores and HSGPAs than those for lower-performing STEM majors. Moreover, their average scores were well above the ACT College Readiness Benchmarks and better aligned with the ACT STEM College Readiness Benchmark. Within each SMC, the differences between the mean ACT scores and HSGPAs of the students earning SGPAs of 3.0 or higher and those for students earning SGPAs less than 3.0 were of practical significance over all eight semesters. Though the two groups within each SMC differed in their mean precollege academic achievement levels, they were similar to each other regarding their measured interests. These results suggest that differences in undergraduate performance within the STEM SMCs has more to do with the students' precollege academic achievement levels than it does with measured interests.

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