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Understanding SAT[®] Score Relationships with Career and Technical Education (CTE) Program Outcomes

PAUL A. WESTRICK, JESSICA P. MARINI, AND EMILY J. SHAW



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Abstract

This SAT[®] validity study focuses on SAT relationships with student outcomes in career and technical education (CTE) programs at two-year postsecondary institutions. This study draws upon two samples, one with 14,357 students initially enrolled at 55 two-year institutions and another with 46,098 students initially enrolled at 580 institutions. Analyses demonstrate that SAT scores are useful for understanding students' academic performance in CTE programs, as well as their persistence to the second year and degree/certificate completion within three years. The findings show:

- SAT scores are strongly predictive of academic performance in CTE programs—students with higher SAT scores are more likely to have higher grades in these programs.
- SAT scores are predictive of student persistence to the second year—students with higher SAT scores are more likely to return for their second year of study.
- SAT scores are positively related to degree/certificate completion in CTE programs; as students' SAT scores increase, so do students' completion rates.
- The aforementioned results hold for students across all CTE programs, and also for the STEM¹focused and trade-focused CTE programs separately analyzed in this study.

Taken together, this study provides strong evidence that the SAT can be a useful tool for understanding and evaluating student readiness for CTE programs and students' subsequent success in these programs. In particular, we can see that many lower performing students on the SAT can still be successful in the CTE programs studied, and as expected, stronger SAT performance is associated with more positive outcomes for these students.

¹ STEM: Science, technology, engineering, and mathematics.

Introduction

Out of every 100 students entering the ninth grade, only 16 will complete high school and college and hold jobs that require the degrees they earned (Cass, 2018). Twelve of the 100 will graduate from college but work in jobs that do not require their degrees; another 29 will enroll in but not graduate from college; and the remaining 43 never attend college (Ibid.).

These sobering facts make it clear that most people in the United States work in jobs that do not require a college degree, and interest in CTE has increased in recent years (Hess & Martin, 2019). In the past, workers with only a high school education could find jobs that paid good wages, notably in manufacturing, but these opportunities have decreased over the years (Carnevale, Strohl, Ridley, & Gulish, 2018). A middle pathway, one that requires education and training beyond high school but less than a four-year degree, is seen as a way for more workers to find good-paying jobs, and these jobs are shifting from traditional blue-collar jobs toward skilled and technical occupations (Carnevale et al., 2018). According to a National Science Board and National Science Foundation report on science and engineering (S&E) indicators, approximately 17 million people make up the skilled technical workforce in the United States, with skilled technical workers defined as "workers in occupations that use significant levels of S&E expertise and technical knowledge and whose educational attainment is less than a bachelor's degree" (NSB & NSF, 2020, p.18). Compared to other workers without a bachelor's degree, skilled technical workers earn higher average wages and have lower unemployment rates (NSB & NSF, 2020).

The SAT has traditionally been associated with enrollment-related decisions and student outcomes at four-year postsecondary institutions. However, given the growing interest in CTE, we conducted this study to better understand the validity of the SAT as a predictor of student outcomes in CTE programs at two-year postsecondary institutions. Specifically, we examined SAT relationships with first-year GPA (FYGPA), persistence to the second year, and degree or certificate completion within three years in CTE programs. We were interested in understanding these relationships across all CTE programs but also those that are more focused in STEM and those focused on the trades to see if the relationships were similar across different types of CTE programs.

SAT Score Relationships with First Year Grade Point Average (FYGPA) Methodology

Sample

College Board broadly recruited two-year institutions to participate in this national SAT validity study. These institutions provided data on their first-time entering class of fall 2017 and/or fall 2018 through College Board's secure online Admitted Class Evaluation Service™ (ACES™) system. ² Ultimately, 55

² Twenty-one institutions had data for 2017, and 36 institutions had data for 2018.

institutions across eight states provided the complete student-level information needed for the analyses that follow in this section of the report.

Inclusion in the study sample required students to have SAT scores, institution-provided academic major information, and a valid FYGPA supplied by the institution. Inclusion also required that students be enrolled in what College Board's subject matter experts considered a CTE program of study. This resulted in a sample size of 14,357 students.

Two programmatic areas of interest were students enrolled in STEM-focused CTE programs (n=2,934) and those in trade-focused CTE programs (n=938). Analyses for these two programmatic areas mirrored those of the overall sample. Information on which CTE programs were categorized and STEM- or trade-focused is presented in the Appendix.

Measures

SAT Scores. SAT scores were obtained from College Board's database and matched to each student provided in the institution files. The SAT scores included in this study are:

SAT Total Score (400 to 1600 scale)—increments of 10, sample mean of 965 (SD=141) for the FYGPA analyses.

SAT Evidence-Based Reading and Writing (ERW) Section Score (200 to 800 scale) —increments of 10, sample mean of 491 (SD=74) for the FYGPA analyses.

SAT Math Section Score (200 to 800 scale)—increments of 10, sample mean of 474 (SD=81) for the FYGPA analyses.

College Grades. Each institution provided FYGPA values for their 2017 first-time, first-year students. The FYGPAs across the 55 institutions in this sample ranged from 0.00 to 4.30. FYGPA had a sample mean of 2.31 (SD=1.13).

Descriptive Statistics

Table 1 includes descriptive statistics for all measures of interest in the samples. Descriptive statistics are reported for all SAT scores studied—ERW section, Math section, and Total scores—as well as FYGPA. STEM students had the highest average SAT scores, and students in the trades had the lowest average SAT scores.

	Overall Sample			STEM Sample			Trades Sample		
Measure	n	М	SD	n	М	SD	n	М	SD
SAT ERW	14,357	491	74	2,934	513	80	938	467	73
SAT Math	14,357	474	81	2,934	513	88	938	470	72
SAT Total	14,357	965	141	2,934	1026	153	938	937	133
FYGPA	14,357	2.31	1.13	2,934	2.28	1.14	938	2.42	1.10

Table 1: Descriptive Statistics for Measures of Interest, First-Year GPA Analyses

Methods

For the college performance (FYGPA) analyses, we gathered two types of validity evidence for the SAT. First, we calculated the mean FYGPA for students within SAT Total score and SAT Math score bands to visualize relationships between test scores and earned FYGPAs. Our second method was to estimate students' chances of earning a FYGPA of 2.0 or higher given their SAT scores. For these analyses, we conducted logistic regression analyses for the overall sample, as well as for the students in STEM- and trade-related programs.

Results

Figure 1 graphically depicts the mean FYGPA by SAT Total score band across all CTE programs studied. As SAT scores increase, so do the average FYGPAs. This pattern was found in the overall sample and the two programmatic areas studied. For example, students in STEM programs with SAT Total scores between 800 and 990 had a mean FYGPA of 2.06. In contrast, STEM students with SAT Total scores between 1200 and 1390 had a mean FYGPA of 2.71, more than half a letter grade higher than that for the students previously mentioned.

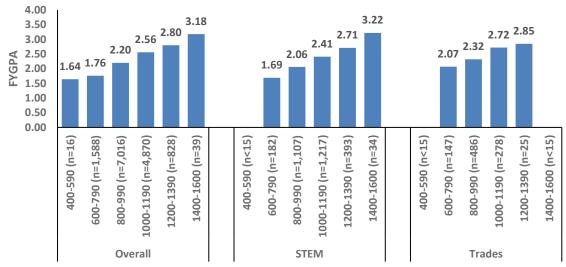


Figure 1: Mean FYGPA by SAT Total Score Bands

Note. Results based on fewer than 15 students are not reported (e.g., STEM, score band 400-590).

Figure 2 graphically communicates the validity of the SAT for predicting FYGPA using SAT Math section scores, complementing the information presented in Figure 1. The emphasis on Math section scores is most relevant for the students in STEM programs, and it is among the STEM students where the differences between mean FYGPAs across Math section score bands are largest, especially at the upper end of Math section score scale.

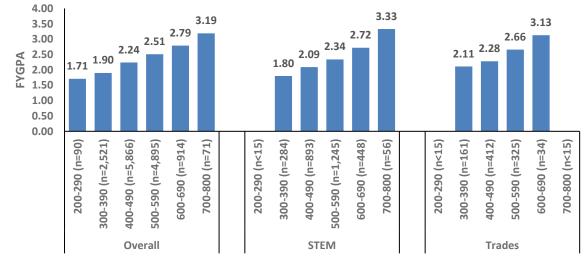
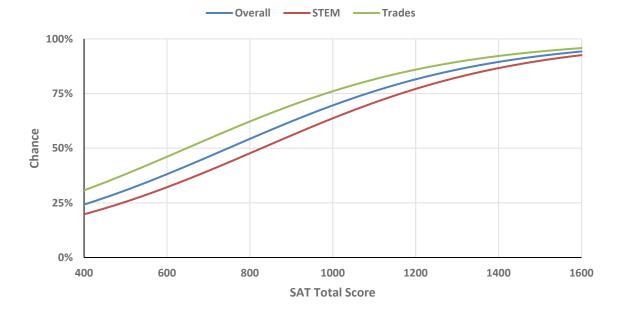


Figure 2: Mean FYGPA by SAT Math Section Score Bands

Note. Results based on fewer than 15 students are not reported (e.g., STEM, score band 200–290).

Figure 3 further demonstrates the value of using SAT scores to predict future academic success in CTE programs. This graph shows students' probabilities of earning a FYGPA of 2.00 or higher in CTE programs given their SAT Total score. For example, a student in a trade program with an SAT Total score of 800, has approximately a 62% chance of earning a FYGPA of 2.00 or higher, while a student in a trade program with an SAT Total score of 1200 has approximately an 86% chance of earning a FYGPA of 2.00 or higher. In contrast, students in STEM programs with SAT Total scores of 800 and 1200 have 48% and 77% chances of earning a 2.00 or higher FYGPA, respectively. The lower estimates for the latter group may reflect more stringent grading standards in STEM-related courses.

Figure 3: Probability of a 2.00 or Higher FYGPA Given SAT Total Score



Using the SAT in a model like the one illustrated above helps institutions predict a student's likelihood of succeeding in a CTE program. Institutions may use information like this to identify students who may struggle academically for targeted academic assistance and support to promote their successful completion, thus benefiting both the student and the institution.

SAT Score Relationships with Persistence to the Second Year and Degree/Certificate Completion within Three Years Methodology

Sample

Similar to the FYGPA analyses above, inclusion in the persistence to the second year and degree/certificate completion within three years analyses sample required students to have SAT scores available. These students were matched to postsecondary attendance records from the National Student Clearinghouse (NSC) based on their first institution of study, which had to be a two-year institution. A preliminary check of our NSC data for the 2017 cohort found that 62.1% of the students at two-year institutions were retained to the same institution the following year, which was nearly identical to what was reported in *Digest of Education Statistics 2019* (DeBrey, Snyder, Zhang, & Dillow, 2021).³ For inclusion in the current study, we further restricted the sample to the students whose first academic major was considered a CTE program (see the Appendix for the complete list of academic majors). The final sample consisted of 46,098 students who had initially enrolled at 580 two-year institutions across 48 states.⁴

Persistence to the second year required students to be enrolled at any institution in the Fall 2018 semester. Any degree or certificate earned within three years of initial enrollment counted as a degree/certificate earned.

Methods

For both the persistence and completion analyses, we calculated the percentage of CTE students persisting to any institution and the percentage of students completing a degree or certificate within three years of first enrolling at a two-year institution.

³ DeBrey et al. (2021, Table 326.30) reported that 62.3% of first-time undergraduate students enrolled full-time at two-year institutions were retained to the same institution from 2017 to 2018. Excluding for-profit institutions, we calculated that the retention rate was 62.1%.

⁴ In most College Board validity studies, inclusion typically requires that an institution has at least 15 students with SAT scores and outcome data. For the current study, this requirement was waived as most two-year institutions do not require admission test scores, allowing us to maximize our sample size.

Descriptive Statistics

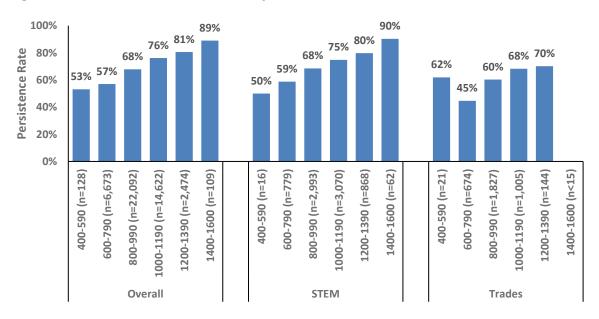
Table 2 provides a summary of SAT scores for students included in the persistence and completion analyses. The mean SAT scores for the samples studied in these analyses are somewhat lower than those found for the FYGPA analysis sample.

	Overall Sample			STEM Sample			Trades Sample		
Measure	n	М	SD	n	М	SD	n	М	SD
SAT ERW	46,098	480	80	7,788	499	85	3,677	462	79
SAT Math	46,098	471	80	7,788	503	87	3,677	466	78
SAT Total	46,098	951	147	7,788	1002	160	3,677	928	145

Table 2: Descriptive Statistics for Measures of Interest, Persistence and Completion Analyses

Results

Figure 4 shows the average second-year persistence rates by SAT Total score bands. The general trend was that as SAT scores increased, persistence rates also increased, showing the positive relationship between SAT scores and persistence to the second year across CTE programs. For example, students in the overall sample with SAT Total scores between 800 and 990 had a mean persistence rate of 68%. In contrast, students with SAT Total scores between 1200 and 1390 had a mean persistence rate of 81%. For the overall sample of students in CTE programs, the persistence rate was 70%. Students in STEM programs had an overall persistence rate of 71%, and students in trade programs had an overall persistence rate of 60%.





Note. Results are not reported for categories with less than 15 students (e.g., Trades, 1400–1600).

Figure 5 depicts third-year degree or certificate completion rates by SAT Total score bands. The general trend was that completion rates increased in tandem with SAT scores, but then the rates dipped for those students in the highest SAT score bands for each group. For the overall and the STEM samples, completion rates peaked for students in the 1200-1390 and 1400-1600 SAT Total score bands, at 34% and 32%, respectively. For students in trades programs, completion rates peaked at 44% in the 1000-1190 SAT Total score band, and then dipped slightly to 41% for students in the 1200-1390 SAT Total score band. Overall, completion rates were highest in the trades (37%), followed by students in STEM programs (23%), and then by the overall group (22%).

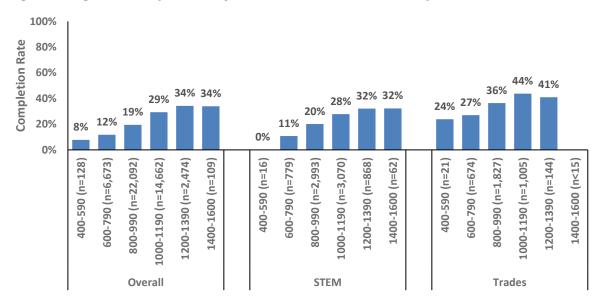


Figure 5: Degree or Certificate Completion Rate within Three Years by SAT Total Score Bands

Note. Results are not reported for categories with less than 15 students (e.g., Trades, 1400–1600).

Conclusion

This study represents a contemporary understanding of the validity of the SAT as a predictor of student outcomes in CTE programs at two-year postsecondary institutions, a change from studying SAT validity at four-year postsecondary institutions. Findings from the current study affirm the value and effectiveness of the SAT as a tool for institutions with CTE programs to use to inform decisions related to student readiness and success and to assist institutions in targeting instructional supports and interventions for students who may need them to be successful in their academic endeavors. Future research should replicate the current study with a broader sample of institutions.

This study finds that:

• SAT scores are predictive of performance—students with higher SAT scores are more likely to have higher grades in in CTE programs.

- SAT scores are predictive of student persistence to the second year—students with higher SAT scores are more likely to return for their second year of study.
- SAT scores are positively related to degree/certificate completion in CTE programs. However, students who initially enrolled with SAT scores well above the mean for CTE programs may be more inclined to pursue studies at a four-year institution than complete a degree or certificate in a CTE program.
- The aforementioned results hold for students across all CTE programs, and also for the STEMfocused and trade-focused CTE programs separately analyzed in this study.

In summation, this study provides strong initial evidence that the SAT can be a useful tool for understanding and evaluating student readiness for CTE programs and students' subsequent performance and success in these programs. In particular, we can see that many lower performing students on the SAT can still be successful in the CTE programs studied, and as expected, stronger SAT performance is associated with more positive outcomes for these students.

References

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Appendix: Academic majors by NCES Classification of Instructional Program (CIP) Code (CIP) and CIP Title Definition

- 01.00 Agriculture, General
- 01.01 Agricultural Business and Management
- 01.02 Agricultural Mechanization
- 01.03 Agricultural Production Operations
- 01.04 Agricultural and Food Products Processing
- 01.05 Agricultural and Domestic Animal Services
- 01.06 Applied Horticulture and Horticultural Business Services
- 01.08 Agricultural Public Services
- 01.09 Animal Sciences
- 01.10 Food Science and Technology
- 01.11 Plant Sciences
- 01.99 Agriculture, Agriculture Operations, and Related Sciences, Other
- 03.01 Natural Resources Conservation and Research
- 03.02 Natural Resources Management and Policy
- 03.03 Fishing and Fisheries Sciences and Management
- 03.05 Forestry
- 03.06 Wildlife and Wildlands Science and Management
- 03.99 Natural Resources and Conservation, Other
- 04.02 Architecture
- 04.03 City/Urban, Community and Regional Planning (STEM)
- 04.04 Environmental Design (STEM)
- 04.05 Interior Architecture (STEM)
- 04.06 Landscape Architecture (STEM)
- 04.09 Architectural Technology/Technician (STEM)
- 09.07 Radio, Television, and Digital Communication
- 09.09 Public Relations, Advertising, and Applied Communication
- 09.99 Communication, Journalism, and Related Programs, Other
- 10.01 Communications Technology/Technician
- 10.02 Audiovisual Communications Technologies/Technicians
- 10.03 Graphic Communications
- 10.99 Communications Technologies/Technicians and Support Services, Other
- 11.02 Computer Programming (STEM)
- 11.03 Data Processing (STEM)
- 11.04 Information Science/Studies (STEM)
- 11.05 Computer Systems Analysis (STEM)
- 11.06 Data Entry/Microcomputer Applications (STEM)
- 11.08 Computer Software and Media Applications (STEM)
- 11.09 Computer Systems Networking and Telecommunications (STEM)
- 11.10 Computer/Information Technology Administration and Management (STEM)
- 11.99 Computer and Information Sciences and Support Services, Other (STEM)
- 12.03 Funeral Service and Mortuary Science
- 12.04 Cosmetology and Related Personal Grooming Services

- 12.05 Culinary Arts and Related Services
- 13.15 Teaching Assistants/Aides
- 14.02 Aerospace, Aeronautical and Astronautical Engineering (STEM)
- 14.03 Agricultural/Biological Engineering and Bioengineering (STEM)
- 14.04 Architectural Engineering (STEM)
- 14.05 Biomedical/Medical Engineering (STEM)
- 14.07 Chemical Engineering (STEM)
- 14.08 Civil Engineering (STEM)
- 14.09 Computer Engineering, General (STEM)
- 14.10 Electrical, Electronics and Communications Engineering (STEM)
- 14.11 Engineering Mechanics (STEM)
- 14.12 Engineering Physics (STEM)
- 14.13 Engineering Science (STEM)
- 14.18 Materials Engineering (STEM)
- 14.19 Mechanical Engineering (STEM)
- 14.20 Metallurgical Engineering (STEM)
- 14.24 Ocean Engineering (STEM)
- 14.33 Construction Engineering (STEM)
- 14.35 Industrial Engineering (STEM)
- 14.36 Manufacturing Engineering (STEM)
- 14.38 Surveying Engineering (STEM)
- 14.39 Geological/Geophysical Engineering (STEM)
- 14.42 Mechatronics, Robotics, and Automation Engineering (STEM)
- 14.99 Engineering, Other (STEM)
- 15.00 Engineering Technology, General (STEM)
- 15.01 Architectural Engineering Technologies/Technicians (STEM)
- 15.02 Civil Engineering Technologies/Technicians (STEM)
- 15.03 Electrical Engineering Technologies/Technicians (STEM)
- 15.04 Electromechanical Instrumentation and Maintenance Technologies/Technicians (STEM)
- 15.05 Environmental Control Technologies/Technicians (STEM)
- 15.06 Industrial Production Technologies/Technicians (STEM)
- 15.07 Quality Control and Safety Technologies/Technicians (STEM)
- 15.08 Mechanical Engineering Related Technologies/Technicians (STEM)
- 15.09 Mining and Petroleum Technologies/Technicians (STEM)
- 15.10 Construction Engineering Technologies (STEM)
- 15.11 Engineering-Related Technologies (STEM)
- 15.12 Computer Engineering Technologies/Technicians (STEM)
- 15.13 Drafting/Design Engineering Technologies/Technicians (STEM)
- 15.14 Nuclear Engineering Technologies/Technicians (STEM)
- 15.15 Engineering-Related Fields (STEM)
- 15.16 Nanotechnology (STEM)
- 15.99 Engineering Technologies/Technicians, Other (STEM)
- 19.01 Family and Consumer Sciences/Human Sciences, General
- 19.04 Family and Consumer Economics and Related Studies
- 19.05 Foods, Nutrition, and Related Services
- 19.07 Human Development, Family Studies, and Related Services
- 19.09 Apparel and Textiles

- 22.00 Non-Professional General Legal Studies (Undergraduate)
- 22.03 Legal Support Services
- 23.11 Technical and Business Writing
- 25.03 Library Assistant
- 26.07 Zoology/Animal Biology
- 29.02 Intelligence, Command Control and Information Operations
- 29.04 Military Systems and Maintenance Technology
- 30.12 Historic Preservation and Conservation
- 30.16 Accounting and Computer Science
- 30.19 Nutrition Sciences
- 31.01 Parks, Recreation and Leisure Studies
- 31.03 Parks, Recreation and Leisure Facilities Management
- 31.05 Health and Physical Education/Fitness
- 31.06 Outdoor Education
- 31.99 Parks, Recreation, Leisure, and Fitness Studies, Other
- 41.00 Science Technologies/Technicians, General (STEM)
- 41.01 Biology Technician/Biotechnology Laboratory Technician (STEM)
- 41.02 Nuclear and Industrial Radiologic Technologies/Technicians (STEM)
- 41.03 Physical Science Technologies/Technicians (STEM)
- 41.99 Science Technologies/Technicians, Other (STEM)
- 43.01 Criminal Justice and Corrections
- 43.02 Fire Protection
- 43.99 Security and Protective Services, Other
- 44.02 Community Organization and Advocacy
- 46.00 Construction Trades, General (Trades)
- 46.01 Mason/Masonry (Trades)
- 46.02 Carpenters (Trades)
- 46.03 Electrical and Power Transmission Installers (Trades)
- 46.04 Building/Construction Finishing, Management, and Inspection (Trades)
- 46.05 Plumbing and Related Water Supply Services (Trades)
- 46.99 Construction Trades, Other (Trades)
- 47.00 Mechanics and Repairers, General (Trades)
- 47.01 Electrical/Electronics Maintenance and Repair Technology (Trades)
- 47.02 Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology/Technician (HAC, HACR, HVAC, HVACR) (Trades)
- 47.03 Heavy/Industrial Equipment Maintenance Technologies (Trades)
- 47.04 Precision Systems Maintenance and Repair Technologies (Trades)
- 47.06 Vehicle Maintenance and Repair Technologies (Trades)
- 47.99 Mechanic and Repair Technologies/Technicians, Other (Trades)
- 48.00 Precision Production Trades, General (Trades)
- 48.05 Precision Metal Working (Trades)
- 48.07 Woodworking (Trades)
- 48.99 Precision Production, Other (Trades)
- 49.01 Air Transportation
- 49.02 Ground Transportation
- 49.03 Marine Transportation
- 50.04 Design and Applied Arts

- 50.05 Drama/Theatre Arts and Stagecraft
- 50.06 Film/Video and Photographic Arts
- 51.00 Health Services/Allied Health/Health Sciences, General
- 51.02 Communication Disorders Sciences and Services
- 51.06 Dental Support Services and Allied Professions
- 51.07 Health and Medical Administrative Services
- 51.08 Allied Health and Medical Assisting Services
- 51.09 Allied Health Diagnostic, Intervention, and Treatment Professions
- 51.10 Clinical/Medical Laboratory Science and Allied Professions
- 51.15 Mental and Social Health Services and Allied Professions
- 51.16 Nursing
- 51.18 Ophthalmic and Optometric Support Services and Allied Professions
- 51.20 Pharmacy, Pharmaceutical Sciences, and Administration
- 51.26 Health Aides/Attendants/Orderlies
- 51.27 Medical Illustration and Informatics
- 51.31 Dietetics and Clinical Nutrition Services
- 51.34 Alternative and Complementary Medical Support Services
- 51.35 Somatic Bodywork and Related Therapeutic Services
- 51.38 Registered Nursing, Nursing Administration, Nursing Research and Clinical Nursing
- 51.39 Practical Nursing, Vocational Nursing and Nursing Assistants
- 51.99 Health Professions and Related Clinical Sciences, Other
- 52.04 Business Operations Support and Assistant Services
- 52.07 Entrepreneurial and Small Business Operations
- 52.09 Hospitality Administration/Management
- 52.15 Real Estate
- 52.18 General Sales, Merchandising and Related Marketing Operations
- 52.19 Specialized Sales, Merchandising and Marketing Operations
- 52.20 Construction Management
- 52.99 Business, Management, Marketing, and Related Support Services, Other

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