Defining STEM Occupations

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Background

The definition of “STEM jobs” has varied according to the needs or focus of particular stakeholders. So at the time this project began in 2010, there was no clear consensus on what occupations should be included. Because prior lists had either been tailored for specific projects or were works in progress, no comprehensive list with a clear set of criteria existed.

What is STEM? STEM is an acronym that stands for Science, Technology, Engineering and Math. It has a nice ring to it, but what exactly is a “STEM occupation?” It’s not as clear cut as one might think. So S stands for Science and that seems straight forward. E is for Engineering and that’s not so hard. M is for Mathematics and we all know what that is. But what about the T? T stands for Technology and that’s pretty vague and awfully broad. It is generally understood that “technology” is used to represent computer technology (i.e., computer science specifically as well as the use of computer technologies such as scientific and analytical software).

However, when you begin to classify occupations as STEM or not STEM, you discover pretty quickly that even science, engineering and math aren’t necessarily as straight forward as you might have thought. What *level* of mathematics does an occupation have to employ to be considered a STEM occupation? How do we even know what level it employs? Are social science occupations, such as historians or geographers, automatically STEM occupations, or should only some belong?

It quickly becomes apparent that a well-defined set of criteria must be developed and adhered to in order to create a consistent, comprehensive and credible list of STEM occupations. The Alaska Department of Labor and Workforce Development’s Research and Analysis Section took on this task beginning in 2010 and released its first STEM list in January of 2011 (See our article in the February 2011 issue of *Alaska Economic Trends:* *http://laborstats.alaska.gov/trends/feb11art1.pdf*).

In April of 2013, the list was updated and 38 healthcare occupations were added to the STEM list (healthcare occupations were originally excluded from consideration). The new list has a total of 173 STEM occupations.

Defining STEM

The occupations for consideration were based on the 2010 Standard Occupational Classification (SOC) system. Occupations were evaluated on the basis of five relevant subjects: mathematics, computer technology, architecture (plus surveying and cartography), engineering, and science (physical and life sciences). An occupation could qualify for consideration by passing criteria in one or more of the five fields. Exhibit 1 gives the basic criteria used to determine which occupations qualified.

Exhibit 1. Qualifying STEM related fields

STEM Related Field	Criteria
Mathematics	The occupation exclusively or almost exclusively requires the application of advanced mathematics (all of the SOC 15-2000 Mathematical Sciences occupations); or
	The occupation actively applies intermediate to advanced mathematics that requires reasoning and judgment; and the relevant activities are an essential function of the occupation
Computer Technology	The occupation exclusively or almost exclusively requires the application of expertise in computer science specifically (all of the SOC 15-1000 Computer Specialists occupations); or
	The occupation uses computer technology at a relatively high level and actively and creatively as opposed to passively or incidentally; and the relevant activities are an essential function of the occupation
Architecture, Surveying or Cartography	The occupation exclusively or almost exclusively requires the application of expertise in architecture, surveying or cartography specifically (all of the SOC 17-1000 and 17-3010 occupations and 17-3031); or
	The occupation applies architecture and/or surveying and/or cartography knowledge, skills and abilities at a relatively high level; and the relevant activities are an essential function of the occupation
Engineering	The occupation exclusively or almost exclusively requires the application of expertise in engineering specifically (all of the SOC 17-2000 and 17-3020 occupations); or
	The occupation actively applies engineering knowledge, skills and abilities at a relatively high level and the relevant activities are an essential function of the occupation
Science	The occupation exclusively or almost exclusively requires the application of expertise in the life or physical sciences specifically (all of the SOC 19-1000 and 19-2000 occupations); or
	The occupation actively applies life or physical science knowledge, skills and abilities at a relatively high level and the relevant activities are an essential and central function of the occupation

Data obtained from the O*NET (http://online.onetcenter.org/) data base were the primary tool for evaluating whether or not occupations met the criteria outlined in Exhibit 1. Three occupational characteristics from the database were used: knowledge, skills and abilities. Ratings of the most STEM-relevant elements of these characteristics were evaluated for importance and level. In addition, tools, technologies and tasks from the O*NET database were reviewed to evaluate the context, complexity and application of the STEM related knowledge, skills and abilities. Exhibit 2 summarizes the determinants we used, along with descriptions and evaluation guidelines. The following section gives the details.

Exhibit 2. STEM Determinants

Determinants for meeting the STEM criteria:	Description	Evaluation Guidelines
O*NET survey knowledge ratings	Indicates the level and importance of education and training in one or more STEM disciplines	Occupation should have a relatively high score in one or more relevant knowledge elements
O*NET survey skills and abilities ratings	Indicates the level and importance of a combination of STEM related skills and abilities	Occupation should have a relatively high score in a combination of relevant skills and abilities
O*NET survey technologies data	Used to identify STEM related technologies (such as STEM specific software programs) used by workers	Occupation should use at least one STEM related technology in a relatively sophisticated manner
O*NET survey tasks data	Used to assess how (i.e., active versus passive) and at what level of expertise and skill relevant technologies and knowledge are used	Occupation should use STEM related technology or knowledge in an active manner and at a relatively high level
Analyst judgment	Analyst evaluates all of the determinants collectively in context and draws a final conclusion	Based on the preponderance of the evidence and context, select or reject the occupation

O*NET Occupational Characteristics

Exhibit 3 gives a description and examples of occupational characteristics from the O*NET data base. O*NET data is based on surveys of actual workers or expert analysts. Workers and analysts are asked to rate specific knowledge, skill, and ability elements on the basis of the element's importance to the occupation and the level that is required to perform their job.

Exhibit 3

O*NET Occupational Characteristics		
Category	**O*NET's Description**	**Examples**
Knowledge	Organized sets of principles and facts applying in general domains	Engineering and technology knowledge; chemistry knowledge; mathematics knowledge
Skills	Developed capacities that facilitate learning or the more rapid acquisition of knowledge or facilitate performance of activities that occur across jobs	Science skills; critical thinking skills; technology design; programming skills
Abilities	Enduring attributes of the individual that influence performance	Mathematical reasoning; deductive reasoning; inductive reasoning

Workers and analysts are asked to rate the level of an element on a scale of 0 to 7. Exhibit 4 gives an example of three different level ratings that could have been given for mathematics

skill. These so-called “level scale anchors” are provided as a guideline for assigning a rating between 0 and 7.

Exhibit 4. Level anchors

“Level anchors” for mathematical skills		
Skill	**Level Rating**	**Example**
Mathematics	2	Count the amount of change to be given to a customer
	4	Calculate the square footage of a new home under construction
	6	Develop a mathematical model to simulate and resolve an engineering problem

In general, a rating of 5 means the worker is working at a relatively high level and a rating of 6 or 7 means the worker is working at an exceptionally high level that requires advanced skills. A rating of 3 or less indicates the worker’s skill level in that element is below average and does not require much beyond very basic skills or none at all. These types of “anchors” are also provided for knowledge and ability elements and the same general assessment applies to those elements as well. For each occupation, O*NET averages respondents’ level ratings for each element.

Workers and analysts are also asked to rate knowledge, skill and ability elements on the basis of importance on a scale of 1 to 5. A rating of 4 would indicate that the element is important to the function of the job; a rating of 5 would indicate that the element is absolutely crucial to the function of the job. As with the level ratings, respondents’ importance ratings were averaged for each element.

We selected the most relevant skills, knowledge, and abilities elements. For a listing and descriptions of the elements we selected, see Appendix I. Then, for each relevant element, we calculated a composite score by multiplying the importance and level ratings together[1]. We multiplied the two ratings together rather than adding them so that a score would be penalized when either of the ratings was very low[2]. Exhibit 5 gives a general guide to how the scores were interpreted. To see the actual scores for the occupations selected for the STEM list, see Appendix II.

[1] The actual formula was Importance * (1 + Level). The one was added to the level rating to make both scales start with 1. Despite the fact that the range of the scale for the level rating was wider than for importance, survey responses for level were clustered more around the middle and lower-middle and the average ratings for both importance and level were not far apart.

[2] By multiplying, if either rating is low, the composite score will be lower (in relative terms) than if the scores are added. So, the occupation is penalized if either rating is low. For example, consider one case where the rating for importance is 3 and the rating for level is 5; and another case where the importance rating is 1 and the level rating is 7. If the ratings are added, the score would be 8 for both cases. If the ratings are multiplied, the score for the first case would be 3 * 5 = 15; and the score for the second case would be 1 * 7 = 7. The method using multiplication significantly down-weights the relative score when either rating is very low. This is what we want when we evaluate for STEM, because a high level rating in a STEM related element is not that meaningful if it is not that important to the job (and vice versa).

Exhibit 5. Evaluating element scores

Composite Score[2]	Evaluation
15 to 16	above average
17 to 19	strong
20 to 22	very strong
> 22	exceptional

Technologies and Tasks

The O*NET data base provides detailed lists of the technologies used by workers in specific occupations and tasks that workers in occupations perform. Using information on technologies (e.g., computer software) and tasks helped us evaluate *how* STEM related knowledge, skills and abilities were being used (See Exhibit 6).

Exhibit 6. O*NET: Tasks and Technologies

Category	Description	Example Tasks or Tools/Technology
Tasks	Occupation-specific tasks	Analyze data to determine validity, quality, and scientific significance
Tools and Technology	Tools and technologies used	(A) Analytical or scientific software: SPSS; (B) Field radiological measuring devices

When we evaluated technologies and tasks, we required that the use of technology must be direct and active or creative, and not passive or indirect. We also required that STEM related knowledge, skills and/or abilities were being applied to an important function of the job.

Active or creative use means workers in the occupation use the technology in a sophisticated manner, employing relevant skills, knowledge and abilities to achieve a result. Passive use means that the technology is doing most or all of the work—there is little reasoning, creation or application of relevant skills or knowledge (See Exhibit 7).

Besides the delineation between active and passive use of technologies, tasks were reviewed for context and complexity as related to the technologies used. Appendix III provides examples of the most STEM-relevant tasks for each occupation on the STEM list.

Exhibit 7. Examples of active versus passive use of software

An occupation must use software or other STEM related technology in an active and original or creative capacity rather than passively or indirectly.	
Examples of active, creative use	**Examples of passive or indirect use**
A computer programmer or a researcher writes an original program to achieve a result	A worker enters the names and addresses of clients into a database
A worker creates an original publication with expert use of sophisticated software	An employee produces computer-generated photos by pulling up a menu and hitting “Enter”
A worker uses a combination of software programs to develop an original product design	An employee executes an established query to generate a routine report
A worker uses expertise to modify a database or database management systems	A manager makes a decision based on a monthly report generated by a statistician (example of indirect use)
A worker uses advanced knowledge in chemistry or biology to order and interpret tests and diagnose a condition (example of active/direct application of advanced knowledge and skill)	A worker runs routine lab tests for a more advanced worker and does not do significant analysis or interpretation

Summary of Selection Process

An occupation was selected or rejected by the following process:

1. Scores in relevant elements of knowledge were considered. Those with average or worse than average scores in all relevant knowledge elements were eliminated.
2. Scores in relevant skills and abilities were considered. Those that did not have at least one above average core skill score or two relevant ability scores were eliminated from consideration. An exception was made if the occupation had very high scores in at least one core knowledge element or above average to high scores in more than one core knowledge element.
3. Technologies (such as software) and tasks were reviewed. The occupation was kept for further consideration if the occupation was using one or more relevant technologies in an active or creative manner at a relatively high level; or if the occupation was actively and directly applying advanced STEM knowledge.
4. Of those remaining, selections were made on the basis of the “preponderance of the evidence,” with these principles in mind:
    a. If the qualifying score(s) in knowledge are only above average, some of the scores in skills and abilities should be strong to exceptional and/or multiple tasks should clearly demonstrate that above average or higher knowledge/skill is being applied in a direct, sophisticated and independent fashion.
    b. If the occupation’s best scores in knowledge, skills and abilities are mostly in the above average range, a review of its technologies and tasks must unambiguously show that active and creative use/application of relatively sophisticated technology/knowledge is vital to an essential function of the job

c. Even if an occupation's scores in some elements are very strong, there must be at least one vital task that shows workers in that occupation are applying those elements in an active and direct manner.

Although the summary above implies a fair bit of judgment, the vast majority of the occupations selected for the STEM list were obvious choices when the scores and a review of technologies and tasks were applied to the criteria (a review of the appendices should make that clear). Still, there were some occupations that required more judgment than others. In most of these cases, the review of the occupation's technologies and tasks was the pivotal determinant because it gave context to the knowledge, skills and abilities scores.

A work in progress?

On our original list released in 2011, occupations in the health care category were excluded from consideration. There was no precedent for including them and healthcare was treated as a separate category. In retrospect, we believe this was a mistake as we did not exclude other occupations on the basis of occupational category. When the STEM list was updated in 2013, healthcare occupations were considered. Using the same criteria used for the original list, 38 healthcare occupations qualified and were added to the list. A further review of the original list and other occupations that were previously excluded did not result in any other changes.

Although we believe we have a solid and complete list of STEM occupations (under our established criteria), the list and its criteria may still be a work in progress. We hope to collaborate further with other states and researchers to cement a universally accepted list of STEM occupations.

Appendix I.a O*NET knowledge elements used for STEM evaluation

Knowledge Elements	O*NET description of knowledge elements
Computers and Electronics	Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
Engineering and Technology	Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
Design	Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
Mathematics	Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
Physics	Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub- atomic structures and processes.
Chemistry	Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
Biology	Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.
Geography	Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.
Economics and Accounting	Knowledge of economic and accounting principles and practices, the financial markets, banking and the analysis and reporting of financial data.
Psychology	Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.
Sociology and Anthropology	Knowledge of group behavior and dynamics, societal trends and influences, human migrations, ethnicity, cultures and their history and origins.
Medicine and Dentistry	Knowledge of the information and techniques needed to diagnose and treat human injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures.
Education and Training	Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.
History and Archeology	Knowledge of historical events and their causes, indicators, and effects on civilizations and cultures.
Telecommunications	Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.
Communications and Media	Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.

Appendix I.b O*NET skill elements used for STEM evaluation

Skill Elements	O*NET description of skill elements
Mathematics	Using mathematics to solve problems.
Science	Using scientific rules and methods to solve problems.
Technology Design	Generating or adapting equipment and technology to serve user needs.
Programming	Writing computer programs for various purposes.
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making.
Complex Problem Solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

Appendix I.c O*NET ability elements used for STEM evaluation

Ability Elements	O*NET description of ability elements
Deductive Reasoning	The ability to apply general rules to specific problems to produce answers that make sense.
Inductive Reasoning	The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
Mathematical Reasoning	The ability to choose the right mathematical methods or formulas to solve a problem.
Fluency of Ideas	The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
Category Flexibility	The ability to generate or use different sets of rules for combining or grouping things in different ways.
Number Facility	The ability to add, subtract, multiply, or divide quickly and correctly.
Problem Sensitivity	The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
Visualization	The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

Appendix II. Element Scores

KNOWLEDGE — SKILLS AND ABILITIES[5]

SOC	SOCTITLE	CORE STEM KNOWLEDGE[3]							RELATED DISCIPLINES[4]								CORE STEM SKILLS				ANCILLARY SKILLS			CORE ABILITIES			ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
113021	Computer and Information Systems Managers	30			15								*			16						20	16	18	19	19		15	15		19	15	
119011	Farm, Ranch, and Other Agricultural Managers				19		17	23		17			*									18	15	15	17	17			15		19		
119012	Farmers and Ranchers							15					*									16		15	15	15			17		19		
119041	Engineering Managers	25	35	29	26	19							*	17						17		19	16	19	20	18	20	15	17	16	20	15	15
119121	Natural Sciences Managers	15	17		19		20	17					*							16	24	20	19	17	23	22		16	17	15	18	18	
131051	Cost Estimators	18	22	15	29					16			*							20		20	16	16	19	16	20	15	15	22			
131081	Logisticians	25			18								*	18								21		18	22	19		15			18	17	
132011	Accountants and Auditors	19			21					29			*							17		19	16	15	19	18	19		16	20	19		
132031	Budget Analysts	18			24					29			*							15		18	15	15	17	17	21			22	18		
132041	Credit Analysts				18					20			*							17		22	18		21	18	19			20	20		
132051	Financial Analysts	18			25					30			*	15						16		19	16	16	21	17	16			17	17		
132099	Financial Specialists, All Other	18			19					18	19		*	18								20	16	16	20	20		15	15		18		
151011	Computer and Information Scientists, Research	35	18	17	28								*	25		17				17		20	20	19	22	21	16	19	18		21	16	
151021	Computer Programmers	37			20								*								26	17		16	18	17	15				16		
151031	Computer Software Engineers, Applications	36	15		23								*							18		18		21	20	18	18	18	16	16	19	16	
151032	Computer Software Engineers, Systems Software	35	22	16	17								*								18	20	16	17	19	17					18		
151041	Computer Support Specialists	33											*			16						18			15	16					16		
151051	Computer Systems Analysts	29	16		17								*	20							15	21	19	18	21	19	15	19	17		19	17	15
151061	Database Administrators	30			17								*									18	16	18	17	16			16		18		
151071	Network and Computer Systems Administrators	33											*	16		20						20	16	18	19	18		15	16		19		
151081	Network Systems and Data Communications Analysts	32	15										*	16		26						16	18	16	18	16					18		
151099	Computer Specialists, All Other	30	17	16	17								*									19	16	17	19	17		15	15		18		
152011	Actuaries	24			39					26			*							26		24	17	22	23	22	26	16	18	26	21		
152021	Mathematicians	26	19		39	17							*							35	19	24	25	22	24	22	31	21	18	23	16	23	
152031	Operations Research Analysts	23	21		37								*							25	17	22	20	23	22	21	26	20	17	23	19	18	
152041	Statisticians	23			23								*							23	15	16	22	18	17	23	21	24		18	19	19		
152091	Mathematical Technicians	21			33								*							31	19		27	21	20	23		35			33		
171011	Architects, Except Landscape and Naval	16	31	39	17								*	18						17		23	19	22	25	20	18	23	21	20	23	22	25
171012	Landscape Architects	21	23	35	18			21	26		15	17	*									18		17	19	17		16	17		18	17	18
171021	Cartographers and Photogrammetrists	22							29				*									16	15		16	17					15		
171022	Surveyors	23	23	19	31				24				*	18						21		19	15	16	19	17	22		16	20	16		16
172011	Aerospace Engineers	23	33	30	27	28							*	15						21	23	23	17	20	23	20	22	16	15	16	18	15	15
172021	Agricultural Engineers	22	36	33	31	28	18	16					*							18		22	16	21	20	21	17		18	16	20		15

Appendix II. Element Scores

SOC	SOCTITLE	KNOWLEDGE: CORE STEM KNOWLEDGE[3]							KNOWLEDGE: RELATED DISCIPLINES[4]									SKILLS AND ABILITIES[5]: CORE STEM SKILLS				SKILLS AND ABILITIES[5]: ANCILLARY SKILLS			SKILLS AND ABILITIES[5]: CORE ABILITIES			SKILLS AND ABILITIES[5]: ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
172031	Biomedical Engineers	25	32	25	31	26	25	32					*					21	26	17	15	24	21	22	27	25	20	18	20	16	24	22	18
172041	Chemical Engineers	19	37	23	29	25	31						*	17				22	27			22	20	22	23	22	21	17	23	20	22	19	17
172051	Civil Engineers	17	38	36	30	24	16						*					24	18			22	19	22	23	21	22	17	20	21	23	18	21
172061	Computer Hardware Engineers	35	26	17	19								*	19		17	15					18	18	19	22	20					20		
172071	Electrical Engineers	27	34	33	27	23							*					15				20	15	18	20	20	15	15	16	15	21		
172072	Electronics Engineers, Except Computer	30	31	31	25	17							*					15				19	16	18	18	19	19	15	17		19	16	16
172081	Environmental Engineers	16	33	26	25	24	24	15					*					18	17			22	17	21	24	23	20	18	20	17	26	15	19
172111	Health and Safety Engineers, Except Mining	16	29	24	23	21	19						*	18					18			21	18	17	21	21		16	16		23	15	15
172112	Industrial Engineers	17	27	22	23								*	18				15				19	15	19	18	19	15		16		20		15
172121	Marine Engineers and Naval Architects	21	32	27	24	20							*					20	16			21	19	19	23	21	20	17	16	19	21	17	20
172131	Materials Engineers		29		17	15	23						*						19			20	16	18	21	21	15		17		22	15	
172141	Mechanical Engineers	20	33	32	27	23							*	15				23	20	16		21	19	22	24	19	24	15	19	19	20	17	19
172151	Mining and Geological Engineers, Including Safety	16	31	25	23	17	15		15				*					21	17			23	17	22	23	21	19	17	20	15	22	16	18
172161	Nuclear Engineers	24	37	26	30	32	24						*	18				18	21			22	18	19	20	20	16	15	18	15	25	15	
172171	Petroleum Engineers	21	33		26	23	17			16			*					15	15			20	17	20	19	21	17	16	19		20	15	
172199	Engineers, All Other	22	31	25	26	22							*					19	17			20	18	19	22	20	20	17	18	17	21	17	17
173011	Architectural and Civil Drafters	19	23	32	20								*					16				16			15	15	15		15		17		18
173012	Electrical and Electronics Drafters	16	19	25	16								*									15		15	15	15							
173013	Mechanical Drafters	16	26	33	19								*					16					15		16		16						17
173021	Aerospace Engineering and Operations Technicians	26	36	18	17								*									18		15	18	18			15		20		15
173022	Civil Engineering Technicians	16	23	21	22								*									15			17		15				16		17
173023	Electrical and Electronic Engineering Technicians	24	18	15	16								*									16		15	16	15					17		
173024	Electro-Mechanical Technicians	24	21		24								*									17	15		17	17					16		16
173025	Environmental Engineering Technicians		24	16	16	15							*					17				22	19	16	22	20	16		17	16	24		
173026	Industrial Engineering Technicians	19	25	20	23								*	18				18				20	15	19	19	18	15	15	16	16	18	16	15
173027	Mechanical Engineering Technicians	16	24	23	19	15							*									16			18	16			16		18		15
173029	Engineering Technicians, Except Drafters, All Other	24	27	23	25	19							*	15				16				18	15	17	19	18	16		16	15	18		18
173031	Surveying and Mapping Technicians	20	15	17	22				22				*					17				15		15	16		16				16		
191011	Animal Scientists	17			24		22	32					*	20					22			20	18	19	21	22		16	17		20	15	
191012	Food Scientists and Technologists		21		22	19	30	25					*	16								20	18	18	20	22	16	16	20	16	20	16	
191013	Soil and Plant Scientists	18			24	15	24	28	19				*	22			16	15	24			20	18	19	22	23	15	18	20	16	19	20	
191021	Biochemists and Biophysicists	17	21	15	18	15	24	31					*	20				19	24			24	24	16	24	26	18	22	24	16	23	23	
191022	Microbiologists	16			19		23	37					*	19				16	25			22	22	17	24	27	17	19	24	16	24	19	15

Appendix II. Element Scores

SOC	SOCTITLE	CORE STEM KNOWLEDGE[3]							RELATED DISCIPLINES[4]								CORE STEM SKILLS				ANCILLARY SKILLS			CORE ABILITIES			ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
191023	Zoologists and Wildlife Biologists	18			18			33	18				*	16					20			20	16	16	18	19			16		19		
191029	Biological Scientists, All Other	18			22		25	38					*	22				19	24			23	22	19	23	24	20	19	20	17	21	18	
191031	Conservation Scientists	16	15		15			24	21				*	19								19	15	16	18	18			15		19	15	
191032	Foresters				16			19					*									22	16	22	20	18		16	19		22	19	
191041	Epidemiologists	21			28			25			16	17	*	21				16	27			22	19	20	22	23	17	17	18	16	24	16	
191042	Medical Scientists, Except Epidemiologists	17			26		24	30					*	20			21	17	27			24	20	22	24	28	16		18		24	15	
192011	Astronomers	25	20		36	38	15						*	19				20	25			21	22	17	22	23	21	17	19	18	17	19	
192012	Physicists	26	26		36	36							*					30	31		19	25	25	24	27	28	32	25	24	28	23	27	20
192021	Atmospheric and Space Scientists	23			25	24			28				*	15			15		23			20	19	16	21	20	15		16		20		
192031	Chemists	20			26		33						*					17	26			18	17	18	20	20	18		20	18	19		
192032	Materials Scientists	15	24		23		36						*	15					25			20	16	18	20	21	15	15	18		20	18	
192041	Environmental Scientists and Specialists, Including Health	20	18		23	15	22	22	19				*					18	24			21	19	20	22	25	18	17	19	18	24	16	
192042	Geoscientists, Except Hydrologists and Geographers	22	27		24	21	15		26				*						22			17		17	19	19	15		18		19		
192043	Hydrologists	20	26	19	27	24	23	20	25				*	16				19	19			22	18	18	20	22	20	17	16	16	21	17	15
192099	Physical Scientists, All Other	27	18		24	18			33				*					18	19			19	16	20	21	20	19	15	16	16	20		
193011	Economists	22			27					27			*					18				20	17	19	19	18	17	15		17	17		
193021	Market Research Analysts	18			17								*									17	15	17	20	19	17	18	17	15	17		
193022	Survey Researchers	16			21								*					17				18	15	16	19	18	18		16	18			
193032	Industrial-Organizational Psychologists	17			25						33	19	*	30			15	18	18			22	17	19	21	19	17	18	17	15	19	18	
193041	Sociologists	16			23						19	38	*	19					20			22	19	17	21	20					16	15	
193051	Urban and Regional Planners	20		18	19				21	15			*	18	15							20	17	16	20	16		17	15		20	15	16
193091	Anthropologists and Archeologists				18				25			38	*	23	33		16		24			23	19	18	22	24		17	20		18	16	
193092	Geographers	22			19				39			23	*	21	16				20			19	18	17	19	20	15		19	15	18		
194011	Agricultural and Food Science Technicians				16		15	15					*									15			15						16		
194021	Biological Technicians				17		20	28					*						16			18	15	15	17	19	15		17		17		
194031	Chemical Technicians	22	15		22		28						*						20			17			19	19			17		17		
194041	Geological and Petroleum Technicians	22	18		22	16	16		17				*									15			15	15			15		15		
194051	Nuclear Technicians				18	19	16						*									17			18	17					20		
194061	Social Science Research Assistants	17			16								*									16			16	15					16		
194091	Environmental Science and Protection Technicians, Including Health	20			18		20	17					*						15			18			17	17					17		
194092	Forensic Science Technicians	18			15		19						*	18								21	16	18	22	21		16	18		21		
194093	Forest and Conservation Technicians	15			16				20				*	16								17			17	15					16		
194099	Life, Physical, and Social Science Technicians, All Other	22			19			16	16				*									16			18	17	15		16		17		

Appendix II. Element Scores

KNOWLEDGE — SKILLS AND ABILITIES[5]

SOC	SOCTITLE	CORE STEM KNOWLEDGE[3]							RELATED DISCIPLINES[4]									CORE STEM SKILLS				ANCILLARY SKILLS			CORE ABILITIES			ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
251021	Computer Science Teachers, Postsecondary	34	17		25								*	33		17						21	21	19	22	20				15		
251022	Mathematical Science Teachers, Postsecondary	18			36								*	30				21				21	19	19	20	20	24			18			
251031	Architecture Teachers, Postsecondary	19	21	34	17	16			20		15	16	*	34	23		16					21	19	19	20	20					17	17	15
251032	Engineering Teachers, Postsecondary	27	35	30	37	29	16						*	33		17	15	17				19	17	15	18	19	17	16	16	16	18	18	
251041	Agricultural Sciences Teachers, Postsecondary	20			21		16	23					*	31			16		15			21	21	18	20	20							
251042	Biological Science Teachers, Postsecondary	16			19		22	34					*	29					16			21	20	18	19	20			16				
251043	Forestry and Conservation Science Teachers, Postsecondary	22			27			27	19				*	27			15		15			20	21	19	20	20					16	15	
251051	Atmospheric, Earth, Marine, Space Sciences Teachers, PS	24	19		34	32	22	17	26				*	33			15		17			20	20	19	20	21			16		15		
251052	Chemistry Teachers, Postsecondary	19			27	23	38	19					*	31					21			20	19	18	21	20					16		
251053	Environmental Science Teachers, Postsecondary	19	15		25	17	24	29	23				*	33					22			20	21	17	20	20					15		
251054	Physics Teachers, Postsecondary	25	22	15	34	35	19						*	30					22			20	18	18	20	20					15		
251061	Anthropology and Archeology Teachers, Postsecondary	18			15				26			38	*	27	31		17		22			21	20	19	19	21			15		15	15	
251063	Economics Teachers, Postsecondary	18			29					33			*	27								18	16	16	19	16	15			18	17		
251064	Geography Teachers, Postsecondary	20			20				37			24	*	27	19		16		17			22	21	18	18	18							
251067	Sociology Teachers, Postsecondary	17			17						23	35	*	32	19		16		18			21	21	16	19	19					15		
254013	Museum Technicians and Conservators	16					21						*		18										15	15		15			15		
259011	Audio-Visual Collections Specialists	28											*	21		15	21					18			15			15			16		16
271014	Multi-Media Artists and Animators	23		26									*				29					16			16	15		15	15		16	16	18
271021	Commercial and Industrial Designers	19	27	34	16								*									20	16	18	21	17		19	17		18	22	19
271024	Graphic Designers	22		29									*				23					15						17				19	16
274011	Audio and Video Equipment Technicians	23											*			21	22					16			15	15					16		
274012	Broadcast Technicians	25	21		15								*			23	22					16			16						18		
274014	Sound Engineering Technicians	26	19										*				20					16											
274032	Film and Video Editors	23											*				27					15			15	15		15	16			16	15
291011	Chiropractors							23			22		31	19					18			19	16	17	20	20			15		22		
291021	Dentists, General			16			19	26		17	24		34	17					18			24	20	19	25	28		15	19		27	17	15
291022	Oral and Maxillofacial Surgeons							23			18		37	19					17			22	18	20	23	24		15	16		27	16	15
291023	Orthodontists							23		17	19		36	17					18			20	18	16	19	20					25		
291024	Prosthodontists		16				17	18			20		34	15								18		16	16	16					16		
291031	Dietitians and Nutritionists				19		20	25			25	18	20	25					15			20	16	18	20	16		16	19		20	17	
291041	Optometrists				21	15		20			18		27						20			19	16		20	23			16		23		
291051	Pharmacists	21			22		28	24			23		25	23					19			20	18	15	19	20			19	15	21		
291061	Anesthesiologists				15	15	19	31			21		39						20			23	18	17	25	27					33		

Appendix II. Element Scores

SOC	SOCTITLE	KNOWLEDGE: CORE STEM KNOWLEDGE[3]							KNOWLEDGE: RELATED DISCIPLINES[4]								SKILLS AND ABILITIES[5]: CORE STEM SKILLS				SKILLS AND ABILITIES[5]: ANCILLARY SKILLS			SKILLS AND ABILITIES[5]: CORE ABILITIES			SKILLS AND ABILITIES[5]: ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
291062	Family and General Practitioners				19		16	26			33		37	18					21			24	19	20	22	26				32			
291063	Internists, General						15	28			26		36	25					24			22	20	21	22	28			17		30		
291064	Obstetricians and Gynecologists	15			16		17	31			26		38	22					22			24	20	20	24	28			15		34		
291065	Pediatricians, General							23			25		34	15					24			24	20	16	21	28					28		
291066	Psychiatrists							21			37	17	32	15					23			22	21	20	23	23		15	16		26		
291067	Surgeons	18					15	26			23		37	25					20			24	23	24	26	27		17	18		31	17	18
291069	Physicians and Surgeons, All Other	18			17		17	28			19		35	22					18			23	22	21	24	28		16	19		28	16	
291071	Physician Assistants				15		17	29			28	15	34	16					18			22	16	15	22	22			16		24		
291081	Podiatrists	17			16			17			15		32	23					17			21	22	18	24	25			16		26		
291124	Radiation Therapists	17			16	17		18			19		21	16								16			17				15		20		
291126	Respiratory Therapists	16			15	15	15	18			19		27	21					16			20	17	15	17	17			15		21		
291131	Veterinarians				19		19	29					25	16					23			20	18	15	22	25					25		
291141	Registered Nurses				16			20			29	18	26	24					15			19	18	15	20	22		15	16		25		
291151	Nurse Anesthetists				21	21	25	25			19		33	20					20			19	16	17	20	20			15		24		
291161	Nurse Midwives							22			26	20	34	20					15			20	17	16	20	21			15		24		
291171	Nurse Practitioners				18		20	26			32	24	31	22					23			20	19	18	20	23			16		25		
291181	Audiologists	18									20		19	16								20	20	16	22	24					24		
291199	Health Diagnosing and Treating Practitioners, All Other							20			24		28	16					16			20	16	15	20	22			16		22		
292011	Medical and Clinical Laboratory Technologists						18	25					15						16			17			18	18			16		19		
292012	Medical and Clinical Laboratory Technicians	18			17		26	18					19						16			15			15	15			15		17		
292032	Diagnostic Medical Sonographers	15				21					15		22	16					15			15				15					16		
292033	Nuclear Medicine Technologists	19			19		17	18					19						15			15			15	15					16		
292034	Radiologic Technologists	17			15	16							23												15						16		
292054	Respiratory Therapy Technicians	16			16		15	15			19		24	17								15			16	17					20		
292091	Orthotists and Prosthetists		24	21		15					23		20	18								19	15	15	19	20			15		20		16
299011	Occupational Health and Safety Specialists	15	19		21	17	22	15			17			23								19	16	17	20	19			15		24	15	
299012	Occupational Health and Safety Technicians	15	20		19		17				16			26								17		16	16	17					19		
299092	Genetic Counselors				23			30			27	21	24	17								18	17	17	21	21			15		19		
332021	Fire Inspectors and Investigators	15					18				16		*	23								19	15	15	20	21			17		22		
394011	Embalmers						24	18					*	16											15						17		
419031	Sales Engineers	23	27	20	19								*									20	19	18	21	19	16	19	18	16	19	17	
439031	Desktop Publishers	25		22									*				16					18		15	16			18	17		15	17	22
439111	Statistical Assistants	23			26								*					26			16	18	17	16	17	15	27		17	24			

Appendix II. Element Scores

SOC	SOCTITLE	KNOWLEDGE: CORE STEM KNOWLEDGE[3]							KNOWLEDGE: RELATED DISCIPLINES[4]								SKILLS AND ABILITIES[5]: CORE STEM SKILLS				SKILLS AND ABILITIES[5]: ANCILLARY SKILLS			SKILLS AND ABILITIES[5]: CORE ABILITIES			SKILLS AND ABILITIES[5]: ANCILLARY ABILITIES					
		Computers and Electronics	Engineering and Technology	Design[1]	Mathematics	Physics	Chemistry	Biology	Geography	Economics and Accounting	Sociology and Anthropology	Psychology	Medicine and Dentistry	Education and Training	History and Archeology[2]	Telecommunications	Communications and Media	Mathematics	Science	Technology Design	Programming	Critical Thinking	Active Learning	Complex Problem Solving	Deductive Reasoning	Inductive Reasoning	Mathematical Reasoning	Fluency of Ideas	Category Flexibility	Number Facility	Problem Sensitivity	Originality	Visualization
474011	Construction and Building Inspectors		23	21	20	15							*									16		15	16	16					17		
514012	Numerical Tool and Process Control Programmers	16	20	20	26								*	15				15			21	16	15	15			16				16		16
518091	Chemical Plant and System Operators	17			16		18						*									16			16	15					19		
536041	Traffic Technicians	24	29	26	23							16	*	16		15						15			16	15					15		
152099	Mathematical Scientists, All Other	O*NET data is unavailable																															
173019	Drafters, All Other	O*NET data is unavailable																															
191099	Life Scientists, All Other	O*NET data is unavailable																															
291029	Dentists, All Other Specialists	O*NET data is unavailable																															
292035	Magnetic Resonance Imaging Technologists	O*NET data is unavailable																															

* Not evaluated for this occupation

[1]Includes knowledge relevant to architecture and drafting

[2]The history component is not relevent; this element is only evaluated in the context of archeology

[3]Direct qualifying knowledge; a high score in one or more of these elements would automatically make the occupation a strong candidate for inclusion, but corroboration from scores in skills and abilites, and a positive evaluation of technologies and how they are used is also required.

[4]These knowledge elements are disciplines that are oftern associated with STEM but a high score in one of these elements is not by itself as meaningful as a score in a core knowledge element

[5]O*NET's skills and abilities data do not fully represent all STEM related skills and abilities, in particular those that are associated with architects, drafters and some engineers.

Score = Importance Rating * (1 + Level Rating)

Scale: 15-16 Above Average; 17-19 Strong; 20-22 Very Strong; 23+ Exceptional

20+ Light red shading with bold red type

17-19 Bold red type

15-16 Gray type

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Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
113021	Computer and Information Systems Managers	Provide users with technical support for computer problems. Develop computer information resources, providing for data security and control, strategic computing, and disaster recovery. Manage backup, security and user help systems. Evaluate the organization's technology use and needs and recommend improvements, such as hardware and software upgrades.
119011	Farm, Ranch, and Other Agricultural Managers	Determine plant growing conditions, such as greenhouses, hydroponics, or natural settings, and set planting and care schedules. Devise and participate in activities to improve fish hatching and growth rates, and to prevent disease in hatcheries. Inspect orchards and fields to determine maturity dates of crops, or to estimate potential crop damage from weather. Analyze soil to determine types and quantities of fertilizer required for maximum production. Identify environmental requirements of a particular species, and select and oversee the preparation of sites for species cultivation.
119012	Farmers and Ranchers	Monitor crops as they grow in order to ensure that they are growing properly and are free from diseases and contaminants. Plan crop activities based on factors such as crop maturity and weather conditions. Breed and raise stock such as cattle, poultry, and honeybees, using recognized breeding practices to ensure continued improvement in stock. Maintain pastures or grazing lands to ensure that animals have enough feed, employing pasture-conservation measures such as arranging rotational grazing.
119041	Engineering Managers	Analyze technology, resource needs, and market demand, to plan and assess the feasibility of projects. Develop and implement policies, standards and procedures for the engineering and technical work performed in the department, service, laboratory or firm. Set scientific and technical goals within broad outlines provided by top management. Direct the engineering of water control, treatment, and distribution projects. Administer highway planning, construction, and maintenance.
119121	Natural Sciences Managers	Plan and direct research, development, and production activities. Conduct own research in field of expertise. Develop innovative technology and train staff for its implementation.
131051	Cost Estimators	Analyze blueprints and other documentation to prepare time, cost, materials, and labor estimates. Conduct special studies to develop and establish standard hour and related cost data or to effect cost reduction.
131081	Logisticians	Provide project management services, including the provision and analysis of technical data. Direct and support the compilation and analysis of technical source data necessary for product development. Manage the logistical aspects of product life cycles, including coordination or provisioning of samples, and the minimization of obsolescence. Perform system life-cycle cost analysis and develop component studies.
132011	Accountants and Auditors	Collect and analyze data to detect deficient controls, duplicated effort, extravagance, fraud, or non-compliance with laws, regulations, and management policies. Prepare, analyze, and verify annual reports, financial statements, and other records, using accepted accounting and statistical procedures to assess financial condition and facilitate financial planning. Analyze business operations, trends, costs, revenues, financial commitments, and obligations, to project future revenues and expenses or to provide advice.
132031	Budget Analysts	Analyze monthly department budgeting and accounting reports to maintain expenditure controls. Compile and analyze accounting records and other data to determine the financial resources required to implement a program. Perform cost-benefit analyses to compare operating programs, review financial requests, or explore alternative financing methods.
132041	Credit Analysts	Analyze credit data and financial statements to determine the degree of risk involved in extending credit or lending money. Analyze financial data such as income growth, quality of management, and market share to determine expected profitability of loans.
132051	Financial Analysts	Inform investment decisions by analyzing financial information to forecast business, industry, or economic conditions. Prepare plans of action for investment, using financial analyses.
132099	Financial Specialists, All Other	Analyze financial data to detect irregularities in areas such as billing trends, financial relationships, and regulatory compliance procedures.
151011	Computer and Information Scientists, Research	Apply theoretical expertise and innovation to create or apply new technology, such as adapting principles for applying computers to new uses. Conduct logical analyses of business, scientific, engineering, and other technical problems, formulating mathematical models of problems for solution by computers. Design computers and the software that runs them.
151021	Computer Programmers	Write, analyze, review, and rewrite programs, using workflow chart and diagram, and applying knowledge of computer capabilities, subject matter, and symbolic logic. Conduct trial runs of programs and software applications to be sure they will produce the desired information and that the instructions are correct. Perform or direct revision, repair, or expansion of existing programs to increase operating efficiency or adapt to new requirements.
151031	Computer Software Engineers, Applications	Modify existing software to correct errors, allow it to adapt to new hardware, or to improve its performance. Design, develop and modify software systems, using scientific analysis and mathematical models to predict and measure outcome and consequences of design. Store, retrieve, and manipulate data for analysis of system capabilities and requirements.
151032	Computer Software Engineers, Systems Software	Modify existing software to correct errors, to adapt it to new hardware or to upgrade interfaces and improve performance. Store, retrieve, and manipulate data for analysis of system capabilities and requirements. Design and develop software systems, using scientific analysis and mathematical models to predict and measure outcome and consequences of design.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
151041	Computer Support Specialists	Answer user inquiries regarding computer software or hardware operation to resolve problems. Enter commands and observe system functioning to verify correct operations and detect errors. Modify and customize commercial programs for internal needs. Conduct office automation feasibility studies, including workflow analysis, space design, or cost comparison analysis.
151051	Computer Systems Analysts	Use informatics science to design or implement health information technology applications to resolve clinical or health care administrative problems. Use object-oriented programming languages, as well as client and server applications development processes and multimedia and Internet technology. Coordinate and link the computer systems within an organization to increase compatibility and so information can be shared. Analyze information processing or computation needs and plan and design computer systems, using techniques such as structured analysis, data modeling and information engineering. Utilize the computer in the analysis and solution of business problems such as development of integrated production and inventory control and cost analysis systems.
151061	Database Administrators	Modify existing databases and database management systems or direct programmers and analysts to make changes. Write and code logical and physical database descriptions and specify identifiers of database to management system or direct others in coding descriptions. Develop data model describing data elements and how they are used, following procedures and using pen, template or computer software.
151071	Network and Computer Systems Administrators	Maintain and administer computer networks and related computing environments including computer hardware, systems software, applications software, and all configurations. Modify computer security files to incorporate new software, correct errors, or change individual access status. Encrypt data transmissions and erect firewalls to conceal confidential information as it is being transmitted and to keep out tainted digital transfers. Design, configure, and test computer hardware, networking software and operating system software. Perform risk assessments and execute tests of data processing system to ensure functioning of data processing activities and security measures.
151081	Network Systems and Data Communications Analysts	Work with other engineers, systems analysts, programmers, technicians, scientists and top-level managers in the design, testing and evaluation of systems. Design and implement systems, network configurations, and network architecture, including hardware and software technology, site locations, and integration of technologies. Adapt and modify existing software to meet specific needs.
151099	Computer Specialists, All Other	Design, build, or maintain web sites, using authoring or scripting languages, content creation tools, management tools, and digital media. Develop testing programs that address areas such as database impacts, software scenarios, regression testing, negative testing, error or bug retests, or usability. Perform computer programming, data analysis, or software development for Geographic Information Systems (GIS) applications, including the maintenance of existing systems or research and development for future enhancements. Develop conceptual, logical, or physical network designs. Develop application-specific software.
152011	Actuaries	Analyze statistical information to estimate mortality, accident, sickness, disability, and retirement rates. Construct probability tables for events such as fires, natural disasters, and unemployment, based on analysis of statistical data and other pertinent information.
152021	Mathematicians	Apply mathematical theories and techniques to the solution of practical problems in business, engineering, the sciences, or other fields. Develop computational methods for solving problems that occur in areas of science and engineering or that come from applications in business or industry. Develop mathematical or statistical models of phenomena to be used for analysis or for computational simulation. Design, analyze, and decipher encryption systems designed to transmit military, political, financial, or law-enforcement-related information in code.
152031	Operations Research Analysts	Formulate mathematical or simulation models of problems, relating constants and variables, restrictions, alternatives, conflicting objectives, and their numerical parameters. Define data requirements and gather and validate information, applying judgment and statistical tests. Specify manipulative or computational methods to be applied to models. Design, conduct, and evaluate experimental operational models in cases where models cannot be developed from existing data.
152041	Statisticians	Write program code to analyze data using statistical analysis software. Design research projects that apply valid scientific techniques and use information obtained from baselines or historical data to structure uncompromised and efficient analyses. Develop or implement data analysis algorithms. Analyze clinical data using appropriate statistical tools. Develop or use mathematical models to track changes in biological phenomena such as the spread of infectious diseases.
171011	Architects, Except Landscape and Naval	Prepare scale drawings. Integrate engineering element into unified design. Prepare information regarding design, structure specifications, materials, color, equipment, estimated costs, or construction time.
171012	Landscape Architects	Prepare graphic representations and drawings of proposed plans and designs. Compile and analyze data on conditions such as location, drainage, and location of structures for environmental reports and landscaping plans. Inspect landscape work to ensure compliance with specifications, approve quality of materials and work, and advise client and construction personnel.
171021	Cartographers and Photogrammetrists	Revise existing maps and charts, making all necessary corrections and adjustments. Prepare and alter trace maps, charts, tables, detailed drawings, and three-dimensional optical models of terrain using stereoscopic plotting and computer graphics equipment. Build and update digital databases. Examine and analyze data from ground surveys, reports, aerial photographs, and satellite images to prepare topographic maps, aerial-photograph mosaics, and related charts. Delineate aerial photographic detail such as control points, hydrography, topography, and cultural features using precision stereoplotting apparatus or drafting instruments.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
171022	Surveyors	Compute geodetic measurements and interpret survey data to determine positions, shapes, and elevations of geomorphic and topographic features. Conduct surveys to determine exact positions, measurement of points, elevations, lines, areas, volumes, contours, or other features of land surfaces. Compute horizontal and vertical coordinates of control networks using direct leveling or other geodetic survey techniques such as triangulation, trilateration, and traversing to establish features of the earth's surface. Determine orientation of tracts of land including position, boundaries, size, and shape using theodolites, electronic distance measuring equipment, satellite-based positioning equipment, land information systems or other geodetic survey equipment. Survey bodies of water to determine navigable channels and to secure data for construction of breakwaters, piers, and other marine structures.
172011	Aerospace Engineers	Formulate conceptual design of aeronautical or aerospace products or systems to meet customer requirements. Formulate mathematical models or other methods of computer analysis to develop, evaluate, or modify design according to customer engineering requirements. Plan and conduct experimental, environmental, operational and stress tests on models and prototypes of aircraft and aerospace systems and equipment. Develop design criteria for aeronautical or aerospace products or systems, including testing methods, production costs, quality standards, and completion dates.
172021	Agricultural Engineers	Design agricultural machinery components and equipment using computer-aided design (CAD) technology. Design and supervise environmental and land reclamation projects in agriculture and related industries. Design food processing plants and related mechanical systems. Design structures for crop storage, animal shelter and loading, and animal and crop processing, and supervise their construction. Design sensing, measuring, and recording devices, and other instrumentation used to study plant or animal life.
172031	Biomedical Engineers	Design and deliver technology to assist people with disabilities. Design and develop medical diagnostic and clinical instrumentation, equipment, and procedures, using the principles of engineering and biobehavioral sciences. Develop new applications for energy sources, such as using nuclear power for biomedical implants. Develop models or computer simulations of human biobehavioral systems to obtain data for measuring or controlling life processes.
172041	Chemical Engineers	Conduct research to develop new and improved chemical manufacturing processes. Perform laboratory studies of steps in manufacture of new product and test proposed process in small scale operation such as a pilot plant. Develop processes to separate components of liquids or gases or generate electrical currents using controlled chemical processes. Design measurement and control systems for chemical plants based on data collected in laboratory experiments and in pilot plant operations.
172051	Civil Engineers	Analyze survey reports, maps, drawings, blueprints, aerial photography, and other topographical or geologic data to plan projects. Plan and design transportation or hydraulic systems and structures, following construction and government standards, using design software and drawing tools. Direct or participate in surveying to lay out installations and establish reference points, grades, and elevations to guide construction. Conduct studies of traffic patterns or environmental conditions to identify engineering problems and assess the potential impact of projects.
172061	Computer Hardware Engineers	Test and verify hardware and support peripherals to ensure that they meet specifications and requirements, by recording and analyzing test data. Store, retrieve, and manipulate data for analysis of system capabilities and requirements. Build, test, and modify product prototypes using working models or theoretical models constructed with computer simulation. Design and develop computer hardware and support peripherals, including central processing units (CPUs), support logic, microprocessors, custom integrated circuits, and printers and disk drives.
172071	Electrical Engineers	Design, implement, maintain, and improve electrical instruments, equipment, facilities, components, products, and systems for commercial, industrial, and domestic purposes. Perform detailed calculations to compute and establish manufacturing, construction, and installation standards and specifications. Plan layout of electric power generating plants and distribution lines and stations. Conduct field surveys and study maps, graphs, diagrams, and other data to identify and correct power system problems.
172072	Electronics Engineers, Except Computer	Operate computer-assisted engineering and design software and equipment to perform engineering tasks. Design electronic components, software, products or systems for commercial, industrial, medical, military, or scientific applications. Prepare engineering sketches and specifications for construction, relocation, and installation of equipment, facilities, products, and systems. Plan and develop applications and modifications for electronic properties used in components, products, and systems, to improve technical performance.
172081	Environmental Engineers	Provide environmental engineering assistance in network analysis, regulatory analysis, and planning or reviewing database development. Design and supervise the development of systems processes or equipment for control, management, or remediation of water, air, or soil quality. Provide technical-level support for environmental remediation and litigation projects, including remediation system design and determination of regulatory applicability.
172111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	Design fire detection equipment, alarm systems, and fire extinguishing devices and systems. Compile, analyze, and interpret statistical data related to occupational illnesses and accidents. Design and build safety equipment. Study the relationships between ignition sources and materials to determine how fires start.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
172112	Industrial Engineers	Draft and design layout of equipment, materials, and workspace to illustrate maximum efficiency using drafting tools and computer. Develop manufacturing methods, labor utilization standards, and cost analysis systems to promote efficient staff and facility utilization. Apply statistical methods and perform mathematical calculations to determine manufacturing processes, staff requirements, and production standards. Analyze statistical data and product specifications to determine standards and establish quality and reliability objectives of finished product.
172121	Marine Engineers and Naval Architects	Prepare, or direct the preparation of, product or system layouts and detailed drawings and schematics. Design layout of craft interior, including cargo space, passenger compartments, ladder wells, and elevators. Design complete hull and superstructure according to specifications and test data, in conformity with standards of safety, efficiency, and economy. Analyze data to determine feasibility of product proposals.
172131	Materials Engineers	Analyze product failure data and laboratory test results to determine causes of problems and develop solutions. Design processing plants and equipment. Modify properties of metal alloys, using thermal and mechanical treatments. Replicate the characteristics of materials and their components with computers.
172141	Mechanical Engineers	Conduct research that tests and analyzes the feasibility, design, operation and performance of equipment, components and systems. Design test control apparatus and equipment and develop procedures for testing products. Apply engineering principles and practices to emerging fields such as robotics, waste management, and biomedical engineering.
172151	Mining and Geological Engineers, Including Mining Safety Engineers	Design, implement, and monitor the development of mines, facilities, systems, or equipment. Design, develop, and implement computer applications for use in mining operations such as mine design, modeling, or mapping or for monitoring mine conditions. Conduct or direct mining experiments to test or prove research findings.
172161	Nuclear Engineers	Design and develop nuclear equipment such as reactor cores, radiation shielding, and associated instrumentation and control mechanisms. Analyze available data and consult with other scientists to determine parameters of experimentation and suitability of analytical models.
172171	Petroleum Engineers	Analyze data to recommend placement of wells and supplementary processes to enhance production. Develop plans for oil and gas field drilling, and for product recovery and treatment. Simulate reservoir performance for different recovery techniques, using computer models. Conduct engineering research experiments to improve or modify mining and oil machinery and operations.
172199	Engineers, All Other	Develop optical or imaging systems such as optical imaging products, optical components, image processes, signal process technologies, and optical systems. Develop and test photonic prototypes or models. Design electro-optical sensing or imaging systems. Write algorithms and programming code for ad hoc robotic applications. Design laser-machining equipment for purposes such as high speed ablation.
173011	Architectural and Civil Drafters	Produce drawings using computer-assisted drafting systems (CAD) or drafting machines, or by hand using compasses, dividers, protractors, triangles and other drafting devices. Draft plans and detailed drawings for structures, installations, and construction projects such as highways, sewage disposal systems, and dikes, working from sketches or notes. Lay out and plan interior room arrangements for commercial buildings using computer-assisted drafting (CAD) equipment and software. Correlate, interpret, and modify data obtained from topographical surveys, well logs, and geophysical prospecting reports. Analyze technical implications of architect's design concept, calculating weights, volumes, and stress factors.
173012	Electrical and Electronics Drafters	Draft detail and assembly drawings of design components, circuitry and printed circuit boards, using computer-assisted equipment or standard drafting techniques and devices. Draw master sketches to scale showing relation of proposed installations to existing facilities and exact specifications and dimensions. Compare logic element configuration on display screen with engineering schematics and calculate figures to convert, redesign, and modify element. Key and program specified commands and engineering specifications into computer system to change functions and test final layout.
173013	Mechanical Drafters	Develop detailed design drawings and specifications for mechanical equipment, dies, tools, and controls, using computer-assisted drafting (CAD) equipment. Lay out and draw schematic, orthographic, or angle views to depict functional relationships of components, assemblies, systems, and machines. Compute mathematical formulas to develop and design detailed specifications for components or machinery using computer-assisted equipment.
173022	Civil Engineering Technicians	Draft detailed dimensional drawings and design layouts for projects and to ensure conformance to specifications. Analyze proposed site factors and design maps, graphs, tracings, and diagrams to illustrate findings. Plan and conduct field surveys to locate new sites and analyze details of project sites.
173023	Electrical and Electronic Engineering Technicians	Draw or modify diagrams and write engineering specifications to clarify design details and functional criteria of experimental electronics units. Design basic circuitry and draft sketches for clarification of details and design documentation under engineers' direction, using drafting instruments and computer aided design (CAD) equipment. Write computer or microprocessor software programs.
173025	Environmental Engineering Technicians	Conduct pollution surveys, collecting and analyzing samples such as air and ground water. Perform statistical analysis and correction of air or water pollution data submitted by industry and other agencies. Improve chemical processes to reduce toxic emissions.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
173026	Industrial Engineering Technicians	Study time, motion, methods, and speed involved in maintenance, production, and other operations to establish standard production rate and improve efficiency. Interpret engineering drawings, schematic diagrams, or formulas and confer with management or engineering staff to determine quality and reliability standards. Compile and evaluate statistical data to determine and maintain quality and reliability of products.
173027	Mechanical Engineering Technicians	Devise, fabricate, and assemble new or modified mechanical components for products such as industrial machinery or equipment and measuring instruments. Draft detail drawing or sketch for drafting room completion or to request parts fabrication by machine, sheet or wood shops. Calculate required capacities for equipment of proposed system to obtain specified performance and submit data to engineering personnel for approval.
173029	Engineering Technicians, Except Drafters, All Other	Develop or maintain programs associated with automated production equipment. Prepare layouts, drawings, or sketches of machinery and equipment such as shop tooling, scale layouts, and new equipment design using drafting equipment or computer-aided design software. Create computer applications for manufacturing processes or operations using computer-aided design (CAD) or computer-assisted manufacturing (CAM) tools. Design plant layouts and production facilities. Write software programs for microcontrollers and computers in machine, assembly, and other languages.
173031	Surveying and Mapping Technicians	Perform calculations to determine earth curvature corrections, atmospheric impacts on measurements, traverse closures and adjustments, azimuths, level runs, and placement of markers. Conduct surveys to ascertain the locations of natural features and man-made structures on the Earth's surface, underground, and underwater using electronic distance-measuring equipment and other surveying instruments. Prepare topographic and contour maps of land surveyed, including site features and other relevant information such as charts, drawings, and survey notes. Form three-dimensional images of aerial photographs taken from different locations, using mathematical techniques and plotting instruments.
191011	Animal Scientists	Conduct research concerning animal nutrition, breeding, or management to improve products or processes. Research and control animal selection and breeding practices to increase production efficiency and improve animal quality. Determine genetic composition of animal populations and heritability of traits, utilizing principles of genetics.
191012	Food Scientists and Technologists	Check raw ingredients for maturity or stability for processing and finished products for safety, quality, and nutritional value. Study methods to improve aspects of foods, such as chemical composition, flavor, color, texture, nutritional value, and convenience. Develop new or improved ways of preserving, processing, packaging, storing, and delivering foods, using knowledge of chemistry, microbiology, and other sciences. Study the structure and composition of food or the changes foods undergo in storage and processing.
191013	Soil and Plant Scientists	Develop methods of conserving and managing soil that can be applied by farmers and forestry companies. Study soil characteristics to classify soils on the basis of factors such as geographic location, landscape position, and soil properties. Develop improved measurement techniques, soil conservation methods, soil sampling devices, and related technology. Conduct experiments investigating how soil forms, changes, and interacts with land-based ecosystems and living organisms. Study insect distribution and habitat and recommend methods to prevent importation and spread of injurious species.
191021	Biochemists and Biophysicists	Study the chemistry of living processes, such as cell development, breathing and digestion, and living energy changes such as growth, aging, and death. Study physical principles of living cells and organisms and their electrical and mechanical energy, applying methods and knowledge of mathematics, physics, chemistry, and biology. Examine the molecular and chemical aspects of immune system functioning. Isolate, analyze, and synthesize vitamins, hormones, allergens, minerals, and enzymes, and determine their effects on body functions. Research how characteristics of plants and animals are carried through successive generations.
191022	Microbiologists	Isolate and maintain cultures of bacteria or other microorganisms in prescribed or developed media, controlling moisture, aeration, temperature, and nutrition. Study growth, structure, development, and general characteristics of bacteria and other microorganisms to understand their relationship to human, plant, and animal health. Investigate the relationship between organisms and disease including the control of epidemics and the effects of antibiotics on microorganisms. Study the structure and function of human, animal and plant tissues; cells; pathogens; and toxins. Conduct chemical analyses of substances such as acids, alcohols, and enzymes.
191023	Zoologists and Wildlife Biologists	Study animals in their natural habitats, assessing effects of environment and industry on animals, interpreting findings and recommending alternative operating conditions for industry. Study characteristics of animals such as origin, interrelationships, classification, life histories and diseases, development, genetics, and distribution. Organize and conduct experimental studies with live animals in controlled or natural surroundings. Analyze characteristics of animals to identify and classify them. Collect and dissect animal specimens and examine specimens under microscope.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
191029	Biological Scientists, All Other	Design molecular or cellular laboratory experiments, oversee their execution, and interpret results. Compile and analyze molecular or cellular experimental data and adjust experimental designs as necessary. Evaluate genetic data by performing appropriate mathematical or statistical calculations and analyses. Analyze determinants responsible for specific inherited traits, and devise methods for altering traits or producing new traits. Create or use statistical models for the analysis of genetic data.
191031	Conservation Scientists	Apply principles of specialized fields of science, such as agronomy, soil science, forestry, or agriculture, to achieve conservation objectives. Analyze results of investigations to determine measures needed to maintain or restore proper soil management. Study forage plants and their growth requirements to determine varieties best suited to particular range. Develop new and improved instruments and techniques for activities such as range reseeding.
191032	Foresters	Analyze effect of forest conditions on tree growth rates and tree species prevalence and the yield, duration, seed production, growth viability, and germination of different species. Map forest area soils and vegetation to estimate the amount of standing timber and future value and growth. Study different tree species' classification, life history, light and soil requirements, adaptation to new environmental conditions and resistance to disease and insects.
191041	Epidemiologists	Plan and direct studies to investigate human or animal disease, preventive methods, and treatments for disease. Investigate diseases or parasites to determine cause and risk factors, progress, life cycle, or mode of transmission. Conduct research to develop methodologies, instrumentation and procedures for medical application, analyzing data and presenting findings. Prepare and analyze samples to study effects of drugs, gases, pesticides, or microorganisms on cell structure and tissue.
191042	Medical Scientists, Except Epidemiologists	Plan and direct studies to investigate human or animal disease, preventive methods, and treatments for disease. Conduct research to develop methodologies, instrumentation and procedures for medical application, analyzing data and presenting findings. Evaluate effects of drugs, gases, pesticides, parasites, and microorganisms at various levels. Study animal and human health and physiological processes.
192011	Astronomers	Analyze research data to determine its significance, using computers. Study celestial phenomena, using a variety of ground-based and space-borne telescopes and scientific instruments. Calculate orbits and determine sizes, shapes, brightness, and motions of different celestial bodies.
192012	Physicists	Perform complex calculations as part of the analysis and evaluation of data, using computers. Analyze data from research conducted to detect and measure physical phenomena. Design computer simulations to model physical data so that it can be better understood.
192021	Atmospheric and Space Scientists	Study and interpret data, reports, maps, photographs, and charts to predict long- and short-range weather conditions, using computer models and knowledge of climate theory, physics, and mathematics. Apply meteorological knowledge to problems in areas including agriculture, pollution control, and water management, and to issues such as global warming or ozone depletion. Develop and use weather forecasting tools, such as mathematical and computer models. Collect and analyze historical climate information such as precipitation and temperature records to help predict future weather and climate trends. Conduct numerical simulations of climate conditions to understand and predict global and regional weather patterns.
192031	Chemists	Analyze organic and inorganic compounds to determine chemical and physical properties, composition, structure, relationships, and reactions, utilizing chromatography, spectroscopy, and spectrophotometry techniques. Compile and analyze test information to determine process or equipment operating efficiency and to diagnose malfunctions. Induce changes in composition of substances by introducing heat, light, energy, and chemical catalysts for quantitative and qualitative analysis.
192032	Materials Scientists	Conduct research on the structures and properties of materials, such as metals, alloys, polymers, and ceramics, to obtain information that could be used to develop new products or enhance existing ones. Study the nature, structure and physical properties of metals and their alloys, and their responses to applied forces. Test material samples for tolerance under tension, compression, and shear to determine the cause of metal failures.
192041	Environmental Scientists and Specialists, Including Health	Collect, synthesize, analyze, manage, and report environmental data, such as pollution emission measurements, atmospheric monitoring measurements, meteorological and mineralogical information, and soil or water samples. Research sources of pollution to determine their effects on the environment and to develop theories or methods of pollution abatement or control. Conduct applied research on environmental topics, such as waste control and treatment and pollution abatement methods. Plan and develop research models, using knowledge of mathematical and statistical concepts.
192042	Geoscientists, Except Hydrologists and Geographers	Analyze and interpret geological data, using computer software. Locate and estimate probable natural gas, oil, and mineral ore deposits and underground water resources, using aerial photographs, charts, or research and survey results. Conduct geological and geophysical studies to provide information for use in regional development, site selection, and development of public works projects. Design geological mine maps, monitor mine structural integrity, or advise and monitor mining crews.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
192043	Hydrologists	Design and conduct scientific hydrogeological investigations to ensure that accurate and appropriate information is available for use in water resource management decisions. Develop computer models for hydrologic predictions. Evaluate research data in terms of its impact on issues such as soil and water conservation, flood control planning, and water supply forecasting. Design civil works associated with hydrographic activities and supervise their construction, installation, and maintenance.
192099	Physical Scientists, All Other	Analyze data acquired from aircraft, satellites, or ground-based platforms using statistical analysis software, image analysis software, or Geographic Information Systems (GIS). Manage or analyze data obtained from remote sensing systems to obtain meaningful results. Develop and build databases for remote sensing and related geospatial project information. Develop new analytical techniques or sensor systems.
193011	Economists	Study economic and statistical data in area of specialization, such as finance, labor, or agriculture. Compile, analyze, and report data to explain economic phenomena and forecast market trends, applying mathematical models and statistical techniques.
193021	Market Research Analysts	Gather data on competitors and analyze their prices, sales, and method of marketing and distribution. Devise and evaluate methods and procedures for collecting data, such as surveys, opinion polls, or questionnaires, or arrange to obtain existing data. Collect and analyze data on customer demographics, preferences, needs, and buying habits to identify potential markets and factors affecting product demand. Forecast and track marketing and sales trends, analyzing collected data. Conduct research on consumer opinions and marketing strategies, collaborating with marketing professionals, statisticians, pollsters, and other professionals.
193022	Survey Researchers	Analyze data from surveys, old records, or case studies, using statistical software. Conduct surveys and collect data, using methods such as interviews, questionnaires, focus groups, market analysis surveys, public opinion polls, literature reviews, and file reviews. Determine and specify details of survey projects, including sources of information, procedures to be used, and the design of survey instruments and materials.
193032	Industrial-Organizational Psychologists	Analyze data, using statistical methods and applications, to evaluate the outcomes and effectiveness of workplace programs. Conduct research studies of physical work environments, organizational structures, communication systems, group interactions, morale, and motivation to assess organizational functioning.
193041	Sociologists	Analyze and interpret data in order to increase the understanding of human social behavior. Plan and conduct research to develop and test theories about societal issues such as crime, group relations, poverty, and aging. Develop, implement, and evaluate methods of data collection, such as questionnaires or interviews.
193051	Urban and Regional Planners	Conduct field investigations, surveys, impact studies or other research to compile and analyze data on economic, social, regulatory and physical factors affecting land use.
193091	Anthropologists and Archeologists	Plan and direct research to characterize and compare the economic, demographic, health care, social, political, linguistic, and religious institutions of distinct cultural groups, communities, and organizations. Construct and test data collection methods. Examine museum collections of hominid fossils to classify anatomical and physiological variations and to determine how they fit into evolutionary theory. Participate in forensic activities, such as tooth and bone structure identification, in conjunction with police departments and pathologists. Build geographic information systems (GIS) to record, analyze, and cartographically represent the distribution of languages, cultural and natural resources, land use, and settlement patterns of specific populations.
193092	Geographers	Develop, operate, and maintain geographical information (GIS) computer systems, including hardware, software, plotters, digitizers, printers, and video cameras. Create and modify maps, graphs, or diagrams, using geographical information software and related equipment, and principles of cartography such as coordinate systems, longitude, latitude, elevation, topography, and map scales. Analyze geographic distributions of physical and cultural phenomena on local, regional, continental, or global scales. Gather and compile geographic data from sources including censuses, field observations, satellite imagery, aerial photographs, and existing maps.
194011	Agricultural and Food Science Technicians	Analyze test results to classify products, or compare results with standard tables. Compute moisture or salt content, percentages of ingredients, formulas, or other product factors, using mathematical and chemical procedures. Examine chemical and biological samples to identify cell structures and to locate bacteria, or extraneous material, using a microscope.
194021	Biological Technicians	Conduct research or assist in the conduct of research, including the collection of information and samples, such as blood, water, soil, plants and animals. Analyze experimental data and interpret results to write reports and summaries of findings.
194031	Chemical Technicians	Compile and interpret results of tests and analyses. Develop and conduct programs of sampling and analysis to maintain quality standards of raw materials, chemical intermediates, and products. Design and fabricate experimental apparatus to develop new products and processes. Develop new chemical engineering processes or production techniques.
194041	Geological and Petroleum Technicians	Test and analyze samples in order to determine their content and characteristics, using laboratory apparatus and testing equipment. Prepare, transcribe, and/or analyze seismic, gravimetric, well log or other geophysical and survey data. Evaluate and interpret core samples and cuttings, and other geological data used in prospecting for oil or gas.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
194051	Nuclear Technicians	Calculate equipment operating factors, such as radiation times, dosages, temperatures, gamma intensities, and pressures, using standard formulas and conversion tables. Test materials' physical, chemical, or metallurgical properties, using equipment such as tensile testers, hardness testers, metallographic units, micrometers, and gauges.
194061	Social Science Research Assistants	Prepare, develop and maintain maps and databases. Prepare, manipulate, and manage extensive databases. Perform descriptive and multivariate statistical analyses of data, using computer software. Design and create special programs for tasks such as statistical analysis and data entry and cleaning.
194091	Environmental Science and Protection Technicians, Including Health	Perform statistical analysis of environmental data. Calculate amount of pollutant in samples or compute air pollution or gas flow in industrial processes, using chemical and mathematical formulas. Determine amounts and kinds of chemicals to use in destroying harmful organisms and removing impurities from purification systems. Examine and analyze material for presence and concentration of contaminants such as asbestos, using variety of microscopes.
194092	Forensic Science Technicians	Use chemicals and other substances to examine latent fingerprint evidence and compare developed prints to those of known persons in databases. Interpret laboratory findings and test results to identify and classify substances, materials, and other evidence collected at crime scenes. Reconstruct crime scenes to determine relationships among pieces of evidence. Examine and analyze blood stain patterns at crime scenes. Identify and quantify drugs and poisons found in biological fluids and tissues, in foods, and at crime scenes.
194093	Forest and Conservation Technicians	Survey, measure, and map access roads and forest areas such as burns, cut-over areas, experimental plots, and timber sales sections. Develop and maintain computer databases. Inspect trees and collect samples of plants, seeds, foliage, bark and roots to locate insect and disease damage. Conduct laboratory or field experiments with plants, animals, insects, diseases and soils.
194099	Life, Physical, and Social Science Technicians, All Other	Compile and analyze geospatial data to determine agricultural implications of factors such as soil quality, terrain, field productivity, fertilizers, and weather conditions. Compare crop yield maps with maps of soil test data, chemical application patterns, or other information to develop site-specific crop management plans. Draw and read maps such as soil, contour, and plat maps. Process and analyze data from harvester monitors to develop yield maps. Analyze remote sensing imagery to identify relationships between soil quality, crop canopy densities, light reflectance and weather history.
251021	Computer Science Teachers, Postsecondary	Prepare and deliver lectures to undergraduate or graduate students on topics such as programming, data structures, and software design. Supervise students' laboratory work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Direct research of other teachers or of graduate students working for advanced academic degrees. Provide professional consulting services to government or industry.
251022	Mathematical Science Teachers, Postsecondary	Prepare and deliver lectures to undergraduate or graduate students on topics such as linear algebra, differential equations, and discrete mathematics. Conduct research in a particular field of knowledge and publish findings in books, professional journals, or electronic media. Supervise undergraduate or graduate teaching, internship, and research work. Provide professional consulting services to government or industry.
251031	Architecture Teachers, Postsecondary	Prepare and deliver lectures to undergraduate or graduate students on topics such as architectural design methods, aesthetics and design, and structures and materials. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media.
251032	Engineering Teachers, Postsecondary	Prepare and deliver lectures to undergraduate or graduate students on topics such as mechanics, hydraulics, and robotics. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Supervise students' laboratory work. Provide professional consulting services to government or industry.
251041	Agricultural Sciences Teachers, Postsecondary	Supervise laboratory sessions and field work and coordinate laboratory operations. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Provide professional consulting services to government or industry.
251042	Biological Science Teachers, Postsecondary	Supervise students' laboratory work. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Provide professional consulting services to government or industry.
251043	Forestry and Conservation Science Teachers, Postsecondary	Conduct research in a particular field of knowledge and publish findings in books, professional journals, or electronic media. Supervise undergraduate or graduate teaching, internship, and research work. Supervise students' laboratory or field work. Provide professional consulting services to government or industry.
251051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Supervise undergraduate or graduate teaching, internship, and research work. Supervise laboratory work and field work. Provide professional consulting services to government or industry.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
251052	Chemistry Teachers, Postsecondary	Supervise students' laboratory work. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media.
251053	Environmental Science Teachers, Postsecondary	Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Supervise students' laboratory and field work. Provide professional consulting services to government or industry.
251054	Physics Teachers, Postsecondary	Supervise students' laboratory work. Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Provide professional consulting services to government or industry.
251061	Anthropology and Archeology Teachers, Postsecondary	Conduct research in a particular field of knowledge, and publish findings in professional journals, books, and/or electronic media. Supervise undergraduate or graduate teaching, internship, and research work. Supervise students' laboratory or field work. Provide professional consulting services to government or industry.
251063	Economics Teachers, Postsecondary	Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Supervise undergraduate or graduate teaching, internship, and research work. Provide professional consulting services to government or industry.
251064	Geography Teachers, Postsecondary	Supervise undergraduate or graduate teaching, internship, and research work. Supervise students' laboratory and field work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Perform spatial analysis and modeling using geographic information system techniques. Maintain geographic information systems laboratories, performing duties such as updating software.
251067	Sociology Teachers, Postsecondary	Supervise undergraduate or graduate teaching, internship, and research work. Conduct research in a particular field of knowledge and publish findings in professional journals, books, or electronic media. Supervise students' laboratory and field work.
254013	Museum Technicians and Conservators	Perform tests and examinations to establish storage and conservation requirements, policies, and procedures. Plan and conduct research to develop and improve methods of restoring and preserving specimens. Recommend preservation procedures, such as control of temperature and humidity, to curatorial and building staff. Study object documentation or conduct standard chemical and physical tests to ascertain the object's age, composition, original appearance, need for treatment or restoration, and appropriate preservation method.
259011	Audio-Visual Collections Specialists	Produce rough and finished graphics and graphic designs. Plan and prepare audiovisual teaching aids and methods for use in school systems. Develop preproduction ideas and incorporate them into outlines, scripts, story boards, and graphics. Determine formats, approaches, content, levels, and mediums necessary to meet production objectives effectively and within budgetary constraints. Acquire, catalog, and maintain collections of audiovisual material such as films, video- and audio-tapes, photographs, and software programs.
271014	Multi-Media Artists and Animators	Design complex graphics and animation, using independent judgment, creativity, and computer equipment. Create two-dimensional and three-dimensional images depicting objects in motion or illustrating a process, using computer animation or modeling programs. Script, plan, and create animated narrative sequences under tight deadlines, using computer software and hand drawing techniques. Use models to simulate the behavior of animated objects in the finished sequence. Convert real objects to animated objects through modeling, using techniques such as optical scanning.
271021	Commercial and Industrial Designers	Prepare sketches of ideas, detailed drawings, illustrations, artwork, or blueprints, using drafting instruments, paints and brushes, or computer-aided design equipment. Modify and refine designs, using working models, to conform with customer specifications, production limitations, or changes in design trends. Direct and coordinate the fabrication of models or samples and the drafting of working drawings and specification sheets from sketches. Design graphic material for use as ornamentation, illustration, or advertising on manufactured materials and packaging or containers.
271024	Graphic Designers	Draw and print charts, graphs, illustrations, and other artwork, using computer. Use computer software to generate new images. Create designs, concepts, and sample layouts based on knowledge of layout principles and esthetic design concepts. Develop graphics and layouts for product illustrations, company logos, and Internet websites. Produce still and animated graphics for on-air and taped portions of television news broadcasts, using electronic video equipment.
274011	Audio and Video Equipment Technicians	Record and edit audio material such as movie soundtracks, using audio recording and editing equipment. Compress, digitize, duplicate, and store audio and video data. Analyze and maintain data logs for audiovisual activities. Mix and regulate sound inputs and feeds, or coordinate audio feeds with television pictures. Edit videotapes by erasing and removing portions of programs and adding video or sound as required.
274012	Broadcast Technicians	Edit broadcast material electronically, using computers. Monitor strength, clarity, and reliability of incoming and outgoing signals, and adjust equipment as necessary to maintain quality broadcasts. Control audio equipment to regulate the volume and sound quality during radio and television broadcasts. Record sound onto tape or film for radio or television, checking its quality and making adjustments where necessary. Produce graphics for broadcasts.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
274014	Sound Engineering Technicians	Create musical instrument digital interface programs for music projects, commercials, or film postproduction. Synchronize and equalize prerecorded dialogue, music, and sound effects with visual action of motion pictures or television productions, using control consoles. Reproduce and duplicate sound recordings from original recording media, using sound editing and duplication equipment. Separate instruments, vocals, and other sounds, and combine sounds later during the mixing or postproduction stage.
274032	Film and Video Editors	Set up and operate computer editing systems, electronic titling systems, video switching equipment, and digital video effects units to produce a final product. Program computerized graphic effects. Manipulate plot, score, sound, and graphics to make the parts into a continuous whole, working closely with people in audio, visual, music, optical or special effects departments.
291011	Chiropractors	Diagnose health problems by reviewing patients' health and medical histories, questioning, observing, and examining patients and interpreting x-rays. Perform a series of manual adjustments to the spine or other articulations of the body to correct the musculoskeletal system. Evaluate the functioning of the neuromuscularskeletal system and the spine using systems of chiropractic diagnosis. Analyze x-rays to locate the sources of patients' difficulties and to rule out fractures or diseases as sources of problems.
291021	Dentists, General	Evaluate dental health, diagnose diseases or abnormalities, and plan appropriate treatments. Diagnose and treat diseases, injuries, or malformations of teeth, gums, or related oral structures and provide preventive or corrective services.
291022	Oral and Maxillofacial Surgeons	Evaluate the position of the wisdom teeth to determine whether problems exist currently or might occur in the future.Perform surgery to prepare the mouth for dental implants, and to aid in the regeneration of deficient bone and gum tissues.
291023	Orthodontists	Diagnose teeth and jaw or other dental-facial abnormalities. Design and fabricate appliances, such as space maintainers, retainers, and labial and lingual arch wires.
291024	Prosthodontists	Design and fabricate dental prostheses, or supervise dental technicians and laboratory bench workers who construct the devices. Replace missing teeth and associated oral structures with permanent fixtures, such as implant-supported prostheses, crowns and bridges, or removable fixtures, such as dentures
291031	Dietitians and Nutritionists	Assess nutritional needs, diet restrictions and current health plans to develop and implement dietary-care plans and provide nutritional counseling. Organize, develop, analyze, test, and prepare special meals such as low-fat, low-cholesterol and chemical-free meals.Plan and conduct training programs in dietetics, nutrition, and institutional management and administration for medical students, health-care personnel and the general public.
291041	Optometrists	Diagnose, manage, and treat conditions and diseases of the human eye and visual system. Analyze test results and develop a treatment plan. Prescribe therapeutic procedures to correct or conserve vision.
291051	Pharmacists	Compound and dispense medications as prescribed by doctors and dentists, by calculating, weighing, measuring, and mixing ingredients, or oversee these activities. Review prescriptions to assure accuracy, to ascertain the needed ingredients, and to evaluate their suitability. Assess the identity, strength, or purity of medications.
291061	Anesthesiologists	Administer anesthetic or sedation during medical procedures, using local, intravenous, spinal, or caudal methods. Examine patient, obtain medical history, and use diagnostic tests to determine risk during surgical, obstetrical, and other medical procedures.
291062	Family and General Practitioners	Diagnose, treat, and help prevent diseases and injuries that commonly occur in the general population. Prescribe or administer treatment, therapy, medication, vaccination, and other specialized medical care to treat or prevent illness, disease, or injury. Order, perform, and interpret tests and analyze records, reports, and examination information to diagnose patients' condition.
291063	Internists, General	Diagnose and provide non-surgical treatment of diseases and injuries of internal organ systems. Prescribe or administer medication, therapy, and other specialized medical care to treat or prevent illness, disease, or injury. Analyze records, reports, test results, or examination information to diagnose medical condition of patient. Make diagnoses when different illnesses occur together or in situations where the diagnosis may be obscure.
291064	Obstetricians and Gynecologists	Provide medical care related to pregnancy or childbirth. Diagnose, treat, and help prevent diseases of women, particularly those affecting the reproductive system. Prescribe or administer therapy, medication, and other specialized medical care to treat or prevent illness, disease, or injury. Analyze records, reports, test results, or examination information to diagnose medical condition of patient.
291065	Pediatricians, General	Diagnose, treat, and help prevent children's diseases and injuries. Prescribe or administer treatment, therapy, medication, vaccination, and other specialized medical care to treat or prevent illness, disease, or injury in infants and children. Examine patients or order, perform, and interpret diagnostic tests to obtain information on medical condition and determine diagnosis.
291066	Psychiatrists	Diagnose, treat, and help prevent disorders of the mind.Prescribe, direct, or administer psychotherapeutic treatments or medications to treat mental, emotional, or behavioral disorders. Analyze and evaluate patient data or test findings to diagnose nature or extent of mental disorder. Examine or conduct laboratory or diagnostic tests on patients to provide information on general physical condition or mental disorder.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
291067	Surgeons	Treat diseases, injuries, and deformities by invasive, minimally-invasive, or non-invasive surgical methods, such as using instruments, appliances, or by manual manipulation. Operate on patients to correct deformities, repair injuries, prevent and treat diseases, or improve or restore patients' functions. Analyze patient's medical history, medication allergies, physical condition, and examine results to verify operation's necessity and to determine best procedure. Diagnose bodily disorders and orthopedic conditions and provide treatments, such as medicines and surgeries, in clinics, hospital wards, and operating rooms.
291071	Physician Assistants	Make tentative diagnoses and decisions about management and treatment of patients. Examine patients to obtain information about their physical condition. Interpret diagnostic test results for deviations from normal. Prescribe therapy or medication with physician approval.
291081	Podiatrists	Diagnose and treat diseases and deformities of the human foot. Diagnose diseases and deformities of the foot using medical histories, physical examinations, x-rays, and laboratory test results. Prescribe medications, corrective devices, physical therapy, or surgery. Make and fit prosthetic appliances.
291124	Radiation Therapists	Provide radiation therapy to patients as prescribed by a radiologist according to established practices and standards. Conduct most treatment sessions independently, in accordance with the long-term treatment plan and under the general direction of the patient's physician. Calculate actual treatment dosages delivered during each session. Administer prescribed doses of radiation to specific body parts, using radiation therapy equipment according to established practices and standards.
291126	Respiratory Therapists	Assess, treat, and care for patients with breathing disorders. Assume primary responsibility for all respiratory care modalities, including the supervision of respiratory therapy technicians. Initiate and conduct therapeutic procedures. Monitor patient's physiological responses to therapy, such as vital signs, arterial blood gases, or blood chemistry changes, and consult with physician if adverse reactions occur. Measure arterial blood gases and review patient information to assess patient condition.
291131	Veterinarians	Diagnose, treat, or research diseases and injuries of animals. Treat sick or injured animals by prescribing medication, setting bones, dressing wounds, or performing surgery. Examine animals to detect and determine the nature of diseases or injuries. Operate diagnostic equipment, such as radiographic or ultrasound equipment, and interpret the resulting images.
291141	Registered Nurses	Assess patient health problems and needs, develop and implement nursing care plans. Order, interpret, and evaluate diagnostic tests to identify and assess patient's condition.Modify patient treatment plans as indicated by patients' responses and conditions.
291151	Nurse Anesthetists	Assess patients' medical histories to predict anesthesia response. Select, order, or administer anesthetics, adjuvant drugs, accessory drugs, fluids or blood products as necessary. Develop anesthesia care plans. Monitor patients' responses, including skin color, pupil dilation, pulse, heart rate, blood pressure, respiration, ventilation, or urine output, using invasive and noninvasive techniques.
291161	Nurse Midwives	Diagnose and coordinate all aspects of the birthing process, either independently or as part of a healthcare team. Order and interpret diagnostic or laboratory tests. Perform physical examinations by taking vital signs, checking neurological reflexes, examining breasts, or performing pelvic examinations.
291171	Nurse Practitioners	Diagnose and treat acute, episodic, or chronic illness, independently or as part of a healthcare team. Prescribe medication dosages, routes, and frequencies based on patients' characteristics such as age and gender. Order, perform, or interpret the results of diagnostic tests such as complete blood counts (CBCs), electrocardiograms (EKGs), and radiographs (x-rays). Develop treatment plans based on scientific rationale, standards of care, and professional practice guidelines.
291181	Audiologists	Assess and treat persons with hearing and related disorders. Evaluate hearing and balance disorders to determine diagnoses and courses of treatment. Program and monitor cochlear implants to fit the needs of patients. Plan and conduct treatment programs for patients' hearing or balance problems.
292011	Medical and Clinical Laboratory Technologists	Perform complex medical laboratory tests for diagnosis, treatment, and prevention of disease. Conduct chemical analysis of body fluids, including blood, urine, or spinal fluid, to determine presence of normal or abnormal components. Analyze laboratory findings to check the accuracy of the results. Analyze samples of biological material for chemical content or reaction.
292032	Diagnostic Medical Sonographers	Provide sonogram and oral or written summary of technical findings to physician for use in medical diagnosis; decide which images to include, looking for differences between healthy and pathological areas. Observe screen during scan to ensure that image produced is satisfactory for diagnostic purposes, making adjustments to equipment as required. Select appropriate equipment settings and adjust patient positions to obtain the best sites and angles. Determine whether scope of exam should be
292033	Nuclear Medicine Technologists	Prepare, administer, and measure radioactive isotopes in therapeutic, diagnostic, and tracer studies using a variety of radioisotope equipment. Detect and map radiopharmaceuticals in patients' bodies, using a camera to produce photographic or computer images. Calculate, measure, and record radiation dosage or
292034	Radiologic Technologists	Review and evaluate developed x-rays, video tape, or computer-generated information to determine if images are satisfactory for diagnostic purposes. Key commands and data into computer to document and specify scan sequences, adjust transmitters and receivers, or photograph certain images.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
292035	Magnetic Resonance Imaging Technologists	Select appropriate imaging techniques or coils to produce required images. Inspect images for quality, using magnetic resonance scanner equipment and laser camera.
292054	Respiratory Therapy Technicians	Collect and analyze arterial blood gas samples. Read and evaluate physicians' orders and patients' chart information to determine patients' condition and treatment protocols. Assess patients' response to treatments and modify treatments according to protocol if necessary. Perform diagnostic procedures to assess the severity of respiratory dysfunction in patients.
292091	Orthotists and Prosthetists	Design, measure, fit, and adapt orthopedic braces, appliances or prostheses, such as limbs or facial parts for patients with disabling conditions. Construct and fabricate appliances or supervise others constructing the appliances. Fit, test, and evaluate devices on patients, and make adjustments for proper fit, function, and comfort. May use CAD software.
299011	Occupational Health and Safety Specialists	Review, evaluate, and analyze work environments and design programs and procedures to control, eliminate, and prevent disease or injury caused by chemical, physical, and biological agents or ergonomic factors. Investigate accidents to identify causes or to determine how such accidents might be prevented in the future. Collaborate with engineers or physicians to institute control or remedial measures for hazardous or potentially hazardous conditions or equipment.
299012	Occupational Health and Safety Technicians	Implement and conduct evaluation of programs designed to limit chemical, physical, biological, and ergonomic risks to workers. Evaluate situations or make determinations when a worker has refused to work on the grounds that danger or potential harm exists. Recommend corrective measures to be applied based on results of environmental contaminant analyses. Conduct worker studies to determine whether specific instances of disease or illness are job-related.
299092	Genetic Counselors	Assess individual or family risk for a variety of inherited conditions, such as genetic disorders and birth defects. May help conduct research related to genetic conditions or genetic counseling. Interpret laboratory results and communicate findings to patients or physicians. Determine or coordinate treatment plans by requesting laboratory services, reviewing genetics or counseling literature, and considering histories or diagnostic data. Analyze genetic information to identify patients or families at risk for
332021	Fire Inspectors and Investigators	Examine fire sites and collect evidence such as glass, metal fragments, charred wood, and accelerant residue for use in determining the cause of a fire. Analyze evidence and other information to determine probable cause of fire or explosion. Review blueprints and plans for new or remodeled buildings to ensure the structures meet fire safety codes. Search for clues as to the cause of a fire, once the fire is completely extinguished. Investigate causes of fires, collecting and preparing evidence and presenting it in
394011	Embalmers	Incise stomach and abdominal walls and probe internal organs, using trocar, to withdraw blood and waste matter from organs. Make incisions in arms or thighs and drain blood from circulatory system and replace it with embalming fluid, using pump. Pack body orifices with cotton saturated with embalming fluid to prevent escape of gases or
419031	Sales Engineers	Plan and modify product configurations to meet customer needs. Prepare and deliver technical presentations that explain products or services to customers and prospective customers. Train team members in the customer applications of technologies. Write technical documentation for products.
439031	Desktop Publishers	Operate desktop publishing software and equipment to design, lay out, and produce camera-ready copy. Prepare sample layouts for approval, using computer software. Position text and art elements from a variety of databases in a visually appealing way to design print or web pages, using knowledge of type styles and size and layout patterns. Edit graphics and photos using pixel or bitmap editing, airbrushing, masking, or image retouching. Create special effects such as vignettes, mosaics, and image combining, and add elements such as sound and animation to electronic publications.
439111	Statistical Assistants	Compute and analyze data, using statistical formulas and computers or calculators. Select statistical tests for analyzing data.
474011	Construction and Building Inspectors	Inspect bridges, dams, highways, buildings, wiring, plumbing, electrical circuits, sewers, heating systems, and foundations during and after construction for structural quality, general safety and conformance to specifications and codes. Review and interpret plans, blueprints, site layouts, specifications, and construction methods to ensure compliance to legal requirements and safety regulations. Use survey instruments, metering devices, tape measures, and test equipment, such as concrete strength measurers, to perform inspections.
514012	Numerical Tool and Process Control Programmers	Write programs in the language of a machine's controller and store programs on media such as punch tapes, magnetic tapes, or disks. Prepare geometric layouts from graphic displays, using computer-assisted drafting software or drafting instruments and graph paper. Analyze job orders, drawings, blueprints, specifications, printed circuit board pattern films, and design data in order to calculate dimensions, tool selection, machine speeds, and feed rates. Observe machines on trial runs or conduct computer simulations to ensure that programs and machinery will function properly and produce items that meet specifications. Modify existing programs to enhance efficiency.
518091	Chemical Plant and System Operators	Draw samples of products, and conduct quality control tests in order to monitor processing, and to ensure that standards are met. Interpret chemical reactions visible through sight glasses or on television monitors, and review laboratory test reports for process adjustments. Calculate material requirements or yields according to formulas.

Appendix III. STEM occupations: selected STEM related tasks[1]

SOC	OCCUPATION	SELECTED STEM RELATED TASKS[1]
536041	Traffic Technicians	Analyze data related to traffic flow, accident rate data, and proposed development to determine the most efficient methods to expedite traffic flow. Plan, design, and improve components of traffic control systems to accommodate current and projected traffic and to increase usability and efficiency. Prepare drawings of proposed signal installations or other control devices, using drafting instruments or computer-automated drafting equipment.

[1]Not all workers in an occupation will perform all of the tasks listed. Also, the tasks listed are examples and not necessarily a complete list of all STEM related tasks.

If a STEM occupation does not appear on this table, it means that there was no O*NET tasks data available for that occupation

Source: O*NET online: http://www.onetonline.org/ and 2010 Standard Occupational Classification Manual

Appendix IV.

Notes on STEM distinctions within broad standard occupational groups[1]

This appendix is not meant to be additional or separate criteria from that outlined in the body of this document. This section is meant to clarify why certain occupations within broad occupation groups were designated as STEM occupations and others weren't.

Social Scientists

Some researchers have chosen to include all occupations in the social scientists category as STEM occupations, apparently for no better reason than the category contains the word "scientists." When we applied our objective criteria to the Social Scientists and Related Workers (19-3000) category, not all social scientists made the list.

Those occupations that made the list qualified on the strength of life or physical science and/or mathematics and computer technology. Those that did not make the list were not especially strong in any of the relevant subjects. Examples of social science occupations that made the STEM list are economists (mathematics and qualifying use of software technology) and geographers (physical science and qualifying use of mapping and other software technology). Examples of social science occupations that were excluded are historians and political scientists. These occupations typically use STEM related technologies more passively or indirectly and have their highest scores in elements unrelated to STEM.

Business and Financial Operations Occupations

The biggest factors in determining whether or not a business or finance related occupation was a STEM occupation were:

> Does the occupation actively use mathematics that goes beyond basic business math and requires math reasoning or independent analysis?
>
> Do workers in this occupation use software actively as opposed to passively? If a worker is using "canned" software that automatically generates a result from a pre-defined formula, then it's probably not a STEM occupation. If the worker writes custom programs for forecasting or does original analysis requiring a high level of reasoning and knowledge, it is more likely to make the list.
>
> Is the focus almost entirely on sales and/or marketing? Is the basis for inclusion solely knowledge requirements? Do the typical tasks performed by the occupation imply only indirect or passive use of qualifying technologies? If so, the occupation is probably not a STEM occupation.

[1] Based on the Standard Occupational Classification manual

Examples of business and finance STEM occupations are budget analysts, financial analysts and logisticians. These occupations are using intermediate to advanced mathematics and relatively sophisticated software to analyze data or create forecasts. Examples of those that are excluded are loan counselors, tax preparers and personal financial advisors. These occupations are primarily customer service related and/or are mostly using canned programs to inform their decisions.

Management Occupations

These fell out similarly to the business and finance occupations. Having the required knowledge was not enough for qualification. The manager must be actively employing a STEM technology and not simply delegating these tasks to workers in other occupations. Most management occupations were excluded. An example of a qualifying management occupation is computer and information systems managers. An example of an excluded management occupation is marketing managers.