In this unit, students are introduced to careers in Technology. They read and analyze graphs about the labor market in general, and they learn about job trends specific to the Technology sector. Students also learn about the different types of employers in this sector.

1. **WHAT IS THE TECHNOLOGY SECTOR?**

Technology is a vast field. Students read a description of what the Technology sector is, which careers are included and what types of businesses have careers in Technology.

2. **DEVELOPING A LABOR VOCABULARY: WHAT ARE WE TALKING ABOUT WHEN WE TALK ABOUT LABOR?**

Students learn the language of labor—careers, jobs, industries, sectors—what does it all mean?

3. **CONTEXT CLUES: DEVELOPING A TECHNOLOGY VOCABULARY**

Students learn the language of the Technology sector. Which terms are important to know for people who work in Technology careers?

4. **INTERPRETING GRAPHS ABOUT TECHNOLOGY EMPLOYMENT SERIES**

Students read about the local labor market by analyzing bar graphs and pie charts of job growth and loss.

4.1 • **Interpreting Bar Graphs: Job Losses and Gains Across Sectors**
Students predict then analyze a graph showing the job losses and gains by sector and consider which fields are ones to watch.

4.2 • **Interpreting Graphs and Charts: Total Employment in Technology**
Students read, analyze and write about a bar graph and chart describing the number of Technology workers between 2010 and 2015, identifying trends.

4.3 • **Interpreting a Pie Chart: Where Are the STEM Jobs?**
Students use prediction and pie charts to understand where the biggest demand will be for STEM jobs in the coming decade.

4.4 • **Technology Careers Brainstorm**
Students identify the various ways they use technology as first-hand and second-hand users, and the careers involved in those technologies.
5. **HOW DOES TECHNOLOGY AFFECT TODAY’S LABOR MARKET?**

Students learn how technology both positively and negatively impacts the workplace, including the number and type of jobs available, the job search process and the need to stay current on technology to remain a valuable worker.

**5.1 • Written Response: Technology’s Effect on Workers**

In this scaffolded writing activity, students develop a five paragraph response about the impact of technology on workers.

6. **INNOVATIONS IN TECHNOLOGY: 3D PRINTING ACROSS SECTORS**

Students learn about the rise of 3D printing and its current and future impact across sectors.

7. **EMPLOYER TYPES IN TECHNOLOGY**

Students read about the various types of employers who hire technology workers.
What is the Technology Sector?

Students read a description of the Technology sector as a whole, then take a closer look at the three areas that comprise it.

PREP

Navigate to careercruising.com. The Career Cruising website requires a subscription username and password. If your program does not subscribe to Career Cruising, use the CareerZone website. Once in Career Cruising, navigate to the Careers section. This is a resource for the teacher to learn background information about the Technology sector.

Next click on Industries.
Navigate to **Information** and read about technical positions. While not all of the careers in this area are technical, many are.

**MATERIALS**

- *Profile of the Technology Sector*
- Chart paper and markers

**EXPLAIN**

1. **Ask:** When you think of jobs in Technology, what jobs do you think of?
   - *Computer programmers, computer repair people, computer salespeople.*

2. Are all people who use computers at work part of the Technology sector? For example, are cashiers part of the Technology sector? Why or why not?
   - *Many jobs require the use of computerized equipment. School secretaries, for example, use computers. But the Technology sector focuses on careers and businesses that have technology as their primary focus, as opposed to those that use technology as a means to accomplish other tasks.*

3. We are going to read about which careers make up the Technology sector, and where to find jobs in Technology. Distribute the *Profile of the Technology Sector* and ask students to read it in pairs. When they are finished, ask each pair to write three sentences describing the main ideas of the article.
4 Ask pairs to share their sentences about the main ideas of the article.

5 Assign each pair one of the numbered paragraphs or a group of paragraphs. It’s okay if more than one group is assigned the same numbered set of paragraphs. Ask each pair to write 1-3 sentences summarizing the main ideas of their assigned paragraphs.

6 Ask pairs to share their summaries with the class.
Profile of the Technology Sector

Source: Labor Market Information Service, May 2016

Technology is everywhere, but what exactly is the Technology sector? Is everyone who uses a computer at work part of the Technology sector? What about people who work for computer companies but don’t have technological jobs?

Because it is an important tool in today’s labor market, most people use electronic devices to do their jobs. For example, medical secretaries gather health information from patients and enter it into an Electronic Health Record (EHR) system, but because the focus of their work is on serving as the information go-between between patients and medical providers, they are considered part of the Healthcare sector, not part of the Technology sector. People who work in the Technology sector focus on developing and using computer hardware, software and networks.

Hardware includes the physical parts of a computer, such as the microchips, screen, keyboard and mouse. Software includes the operating systems, such as Microsoft Windows, and the applications, such as Microsoft Word, which are used on computers and other devices. Networks are groups of devices, such as computers and printers, which are connected to each other and to the Internet, and are able to communicate or transfer information. For example, there are local area networks (LAN), which connect devices in a small area such as a home or school, and wide area networks (WAN), which connect devices in a big area such as a country.

What do Technology workers do?

People who work in Technology do one or more of the following activities:

Research and develop applications and systems
This involves coming up with an idea about a technological device or program, figuring out how to make it work and then creating it. Software Developers and Computer Programmers do this. Software Developers design computer applications and Computer Programmers develop the code, forms, and script that allow computer applications to run.

Infrastructure design and maintenance
This involves building the networks that computers, printers and other electronic devices use and making sure they work. Network Engineers and Network Administrators do this. For example, a Network Engineer may design an organization’s local area network (LAN), wide area network (WAN) or Internet system and a Network Administrator may install and configure them and make sure they work. The Network Administrator may also monitor an organization’s website to ensure that it operates without interruption.

User Support
This involves providing technical assistance to computer users—in person, on the telephone or electronically. Help Desk Specialists do this.

Where are technology jobs?

Now that we know what people who work in Technology do, let’s think about where they work. It is helpful to group Technology jobs into the following three categories:

‘Tech’ jobs inside technology companies
There are ‘tech’ jobs in technology companies such as hardware engineers who work for Apple.

‘Tech’ jobs outside of technology companies
There are also ‘tech’ jobs in other settings. For example, you could provide support to computer users in a college or manage a database for a
hospital. In these situations, you would be an employee of the college or hospital.

‘Non-tech’ jobs inside technology companies

There are people who work for technology companies doing ‘non-tech’ jobs too, such as administrative assistants, office managers and salespeople.

When thinking about where technology jobs are, an important practice to highlight is that many companies outsource their technology work. For example, company A may not want to manage its own computer system or have a tech support team, so they will hire company B to do these things for them because company B can do them better.

Regardless of where they are done, technology jobs require people who are flexible and quick learners because the field is developing quickly. And, while there are entry-level technology jobs that may only require basic training or a professional certification, such as help desk specialists and field technicians, most technology jobs require at least a college degree. This includes jobs such as software developer, data security analyst and quality assurance analyst. Some ‘non-tech’ jobs in technology companies, such as administrative assistant, have different profiles and may not require a college degree, but knowing how to use technology is a must.

The number of higher-level technology jobs is growing quickly, so investing in these skills can pay off.

Sector Highlights:

• Technology is a dynamic area of the economy. It is constantly evolving due to factors such as the never-ending development of new and improved products and a significant number of new businesses. It is also a very competitive industry; tech companies cannot afford to rest because their competitors are working hard to develop the next best product.

• There are varying opinions about the behavior of the Technology industry. Some say that it follows the broader highs and lows of the economy. Others say it does not follow these predictable patterns. Technology is sensitive to changes in the economy, but may not be hit as hard or at the same time during downturns as other companies.

When organizations and people are thriving, they can invest in technology, for example by buying new computers and phones or trying out new programs. When there are downturns in the economy, organizations and individuals may invest less in technology, but not stop completely because we have become so dependent on items such as phones and computers. Technology is also sensitive to government policy. For example, government funding for start-ups helped technology grow in Brooklyn and other areas. Another factor that seems to shape technology is whether or not there are enough highly skilled workers to help technology companies make new and improved products. Also, how strong demand is, from sectors such as healthcare, for innovative technological solutions to the challenges they face.

• In many regions of New York State, there are a significant number of jobs in Technology and in some regions, the number seems to be growing. For example, since the late 1990s, a hub of technology companies and educational facilities with a focus on biotech, nanotechnology and life sciences has been developing in Albany and the surrounding region. It is known as ‘Tech Valley’.

• Technology jobs usually pay annual salaries that exceed the regional average.

• Experts expect the Technology sector to continue to grow over the next decade.
Developing a Labor Vocabulary: What Are We Talking About When We Talk About Labor?

Students learn and practice using terms common to the consideration of careers, laying the groundwork for future reading, discussions and career research.

PREP

- Become familiar with the terms on the Labor Terminology information sheet.

MATERIALS

- Labor Definitions information sheet
- Labor Terminology worksheet
- Labor Vocabulary Questions worksheet

DISCUSS

1. Explain that you are going to talk about careers. Ask students what words come to mind when they think about careers. Discuss the meanings of these words.

2. Distribute the Labor Terminology worksheet and ask students to work in pairs to write what they think each of the terms means.

3. Discuss the definitions, using the Labor Terminology information sheet as a guide. Ask students where and when they have heard each term in the past, for example on the news, in readings for school, etc. Feel free to alter the language of the definitions to make them most meaningful to students. Ask students to take notes on the definitions.

4. Distribute the Labor Vocabulary Questions worksheet and ask students to complete it, in pairs during class or alone for homework.
# Labor Terminology

Read the term in the left-hand column. Then write what you think the term means in the center column. As the class discusses each definition, take notes and write the definition in the right-hand column.

<table>
<thead>
<tr>
<th>Term</th>
<th>What I Think it Means</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td></td>
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<tr>
<td>Occupation</td>
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<td>Profession</td>
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<tr>
<td>Job</td>
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<tr>
<td>Employment</td>
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<tr>
<td>Career</td>
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<tr>
<td>Labor Force</td>
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</tbody>
</table>
**Labor Definitions Information Sheet**

**Industry**
An industry is a group of organizations that do the same type of work. It is a way of grouping employers. All of the employers in healthcare, for example, hospitals, nursing homes and physical therapy practices, provide services to keep people healthy. The word “sector” means the same thing as “industry.”

**Occupation**
An occupation is a group of jobs that involve performing the same type of activities. It is a way of grouping workers. For example, people who work as nursing assistants or home health aides all help people who are sick. You can do this type of work in different places for example, in a patient’s home, in a hospital, or in a nursing home.

**Profession**
A profession is a group of jobs that requires advanced degrees and qualifications, such as being a doctor, a nurse, a lawyer, or a teacher.

**Job**
A paid position with a particular employer. The job-holder is the employee.

**Employment**
A relationship between an employer and an employee in which the employee is paid to do work for the employer. Employment can be part-time or full-time. It also can be temporary or permanent.

**Career**
One job or a series of related jobs that a person has over a period of several years. For example, a person could be a teacher for a long time and have a career in education. Or he could have a job as a home health aide and after several years of experience and more education, he could advance to a job as a medical assistant. This would be a career in healthcare. This person has a career in healthcare. A person can have more than one career over a lifetime.

**Labor Force**
The United States labor force refers to all the people in this country who are 16 years of age or older who are either able to work, are looking for work or are working. Labor force can also mean all of the people who work for a particular employer or in a specific city, for example, Target’s labor force or New York City’s labor force. Workforce and labor force mean the same thing.

By Lesley Hirsch and Alison Richardson, The New York City Labor Market Information Service of the CUNY Graduate Center, 2015
Labor Vocabulary Questions

Use the vocabulary definitions from the Labor Terminology worksheet to answer the following questions.

1. What is the difference between a job and a profession?

2. Does a person with a profession likely earn more than a person with a job? Why or why not?

3. For each of the following, circle the correct definition:
   1. An employee is a worker / boss
   2. An employer is a worker / boss
   Is the boss always the same as the employer? Why or why not?

4. Healthcare, retail and construction are examples of industry sectors. Give an example of a career within each of these industry sectors:
   a. Healthcare
   b. Retail
   c. Construction

5. What is one industry that you might be interested in working in and why?
Context Clues: Developing a Technology Vocabulary

Students use context clues to determine the meaning of technology vocabulary, then answer questions and write original sentences using the new terms.

PREP

- Be prepared to explain the vocabulary terms listed on definitions handout.

MATERIALS

- Developing a Technology Vocabulary worksheet
- Technology Definitions handout

EXPLAIN

1. What are some words whose meanings it is helpful to know if you are trying to use a computer or the internet? Write answers on the board as students brainstorm.
   
   - Monitor, laptop, keyboard, email, wifi, browser, laptop, usb.

2. Technology is an enormous and growing field of work. There are many new terms to learn as you build your tech knowledge and new technology is being invented all the time. Today we’re going to learn some vocabulary words that tech professionals often use. How might technology vocabulary be useful even if you aren’t interested in a career in technology?
   
   - Most people use technology in their day to day life. Knowing more vocabulary might help you use, maintain, repair or buy your personal technology.

3. Distribute the Developing a Technology Vocabulary worksheet and ask students to work on Parts I and II in pairs.

4. When students are finished, have them discuss their answers as a class. Clarify students’ understanding of the terms and offer additional information from the Technology Definitions handout.

5. After the discussion, distribute the Technology Definitions handout to students and ask students to complete Part III of the worksheet on their own in class or for homework.
Developing a Technology Vocabulary

For each word, read the sentence and try to guess the meaning of the underlined vocabulary word from the context. Explain the meaning in your own words.

1. Computer Hardware
I went to the computer hardware store today because I accidentally spilled juice on my computer’s keyboard and now I need to buy a new one.

Meaning of the word__________________________

2. Computer Software
The computer software engineers who work for Microsoft are responsible for designing Microsoft Office, which includes the programs Word, Powerpoint, and Excel.

Meaning of the word__________________________

3. Cloud Computing
If you run out of storage space on your laptop’s hard drive, you can use cloud computing as an alternative.

Meaning of the word__________________________

4. Networking Devices
When I told the IT specialist my home wifi wasn’t working, she asked me to check all of the networking devices in the house to make sure they were connected and turned on.

Meaning of the word__________________________
5 Cybersecurity
When choosing an online bank, you should make sure it has good cybersecurity practices so that your financial information is protected.

Meaning of the word

6 Web Development
The web development department was notified because a link was not working on their company’s new website.

Meaning of the word

7 Graphic Design
John needed to make a flyer to promote his new band, so he hired a writer and someone experienced in graphic design.

Meaning of the word

8 Coding
Jenay wanted to learn how to make her own mobile app, so she took a beginning class on coding.

Meaning of the word
II. Answer the following questions using complete sentences. Make sure to use the vocabulary word in your answer.

1. Have you ever had a piece of computer hardware not work properly or break while you were using it? What did you do?

2. What was the first computer software program that you learned how to use? How did you learn it?

3. Do you think cloud computing is a useful invention? Why or why not?

4. If a networking device is broken, will you be able to connect to the internet? Why or why not?

5. Cybersecurity is often the number one concern of online shopping customers. Why do you think this is?
6. Web development is one of the fastest growing careers in the tech industry. Why do you think this is?

7. Name a situation in which someone might need to hire a graphic designer and explain why.

8. Name three things you love to use in your life that wouldn’t exist without coding and explain why they wouldn’t exist.
III. For each of the vocabulary words, write an original sentence that demonstrates the meaning of the word. You must use the vocabulary word in your sentence.

1. **Computer Hardware:**

2. **Computer Software:**

3. **Cloud Computing:**

4. **Networking Device:**

5. **Cybersecurity:**

6. **Web Development:**

7. **Graphic Design:**

8. **Coding:**
Technology Definitions

**Computer Hardware**
Computer hardware refers to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives, and RAM. External hardware devices include monitors, keyboards, mice, printers, and scanners.

**Computer Software**
Computer software is a general term that describes computer programs. Related terms such as software programs, applications (often called “apps”), scripts, and instruction sets all fall under the category of computer software. A combination of hardware and software working together makes a computer system.

*Certification associated with this profession: CompTIA A+*

**Cloud Computing**
Cloud computing refers to applications and services offered over the internet. These services are offered from data centers all over the world, which collectively are referred to as the “cloud.” Any user with an Internet connection can access the cloud and the services it provides. Since these services are often connected, users can share information between multiple systems and with other users. Examples of cloud computing include online backup services, social networking services, and personal data services such as Apple’s MobileMe.

*Certifications associated with this profession: CompTIA Cloud +, CCSP & Amazon Web Services.*

**Networking Devices**
When you have two or more computers connected to each other, you have a network. The purpose of a network is to enable the sharing of files and information between multiple systems. Networking devices are physical devices which are required for networking, or sharing of information, between devices. Examples of networking devices include cables, such as Ethernet cables or phone lines, and wireless networking cards that send and receive data through the air.

*Certifications associated with this profession: CompTIA Network+ and Cisco CCNA.*
**Cybersecurity**
The state of being protected against the criminal or unauthorized use of electronic data, or the measures taken to achieve this.

*Certifications Associated with this profession: CompTIA Security +.*

**Web Development**
Refers to building, creating and maintaining websites. It includes aspects such as web design, web publishing and database management. Web development can range from developing a simple page of plain text to the most complex web-based internet applications, electronic businesses, and social networking services.

*Some Languages associated with this field: HTML, CSS, Javascript & Ruby on Rails, PHP.*

**Graphic Design**
The art of creating visual concepts, using computer software or by hand, to communicate ideas that inspire, inform, and captivate consumers. Graphic designers develop the overall layout and production design for various applications such as advertisements, brochures, magazines, and corporate reports.


**Coding**
Also known as programming. A formal computer language or constructed language designed to communicate instructions to a machine, particularly a computer, creating new software or apps.

*Languages associated with this profession: C++, Java, Python & Ruby.*

Adapted from www.techterms.com
Students learn about the local Technology labor market by analyzing graphs about employment in the sector.

**ACTIVITIES IN THIS SERIES**

4.1 • Interpreting Bar Graphs: Job Losses and Gains Across Sectors

4.2 • Interpreting Graphs and Charts: Total Employment in Technology

4.3 • Interpreting a Pie Chart: Where are the STEM Jobs?

4.4 • Technology Careers Brainstorm
Interpreting Bar Graphs:
Job Losses and Gains Across Sectors

Students predict, then read a graph detailing how various industries fared in New York City* in 2004 and 2014.

PREP

• Read the graph, Job Losses and Gains

MATERIALS

• Job Losses and Gains Graph
• Prediction Guide: Rising and Falling Industries worksheet

EXPLAIN

1 Before planning a career, it helps to know which industries are growing, which are shrinking, and which are staying level. At any point in time, the number of jobs in some industries is increasing, and in others, decreasing.

First off, what do we mean by industry?

› An industry is a collection of related jobs. For example, what industry do an x-ray technician and a medical biller belong to? Healthcare.

If a particular industry is growing, what does that mean for job seekers—people looking for jobs?

› There are jobs that need to be filled.

If it is shrinking, what happens to jobs?

› There are fewer jobs. Some people might lose their jobs and there won’t be many new openings.

Which industries do you think are growing in New York City* right now?

2 Distribute the prediction guide, one per pair, and explain that in partners, students are going to predict which industries increased in 2014, which decreased and which remained level.

3 When students are finished, distribute Job Losses and Gains Graph and ask them to read it carefully.
DISCUSSION

Before we think about how the data compares to your predictions, let’s discuss how to read this graph.

• According to the title, what is this graph about?

• What do the words going down the left side of the page tell you?

• What do the numbers across the bottom of the page tell you?

• What do the darker and lighter bars represent?

• What do the bold black vertical lines represent?

• What do the fine black vertical lines represent?

• Where on this graph is the key? What does it tell you?

• Why are there two years shown on this graph?

• What does it mean when a darker bar is longer than its partner light-colored bar?

• What does it mean when a lighter bar is longer than its partner dark-colored bar?

• The bold black vertical lines represent an increase of 200,000 jobs. How much of an increase does each fine black vertical line represent? How did you arrive at that answer?

• Ask students to find the corresponding industry sectors from the graph listed on their worksheets and discuss how these numbers compare to their predictions.

PAIR ACTIVITY

In pairs, write three statements about the graph, two that are true and one that isn’t. When you are finished, share with another pair. Each pair should determine which of the other pair’s statements are true and which is false.
FOLLOW-UP DISCUSSION

1. Which sector showed the most job growth from 2004 to 2014? How do you know?

2. Which sector showed the least job growth from 2004 to 2014? How do you know?

3. Why are the industries listed in this order?

4. How is the information in this graph relevant to a job-seeker?
**Prediction Guide: Rising and Falling Industries**

With a partner, decide whether you think each of the industries below increased, decreased or remained level between 2004 and 2014, marking a check in the corresponding boxes below. Discuss the reasons for your choices.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Financial Services</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade, Transportation and Utilities</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Professional and Business Services</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Leisure and Hospitality</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Education and Health</td>
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</tbody>
</table>
Department of Labor and CareerKit Sectors

The data on labor statistics included in the CareerKits comes from the Department of Labor, which collects information on hundreds of jobs and businesses. The table below describes the intersection of Department of Labor and CareerKit sectors, which are categorized similarly in many cases, though some differences exist. When considering which sectors to study with students based on the availability of local jobs, use this table alongside the Job Losses and Gains graph.

<table>
<thead>
<tr>
<th>Department of Labor Sectors</th>
<th>CareerKit Sectors, Reflected in the Job Losses and Gains Graph</th>
<th>CareerKit Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Organizations that build things. This includes organizations that build houses, office buildings, sewer pipes, power lines, highways and bridges. It includes organizations that employ people with general skills such as managing a building project and specialty skills such as carpenters, electricians and plumbers.</td>
<td>Construction</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>The CareerKits divide Manufacturing into two sectors: Manufacturing, which includes organizations that make products such as clothing, machines, electronics and cars, and Food Production, which includes organizations that grow, raise and produce products such as apples, bacon, yogurt and milk.</td>
<td>Manufacturing Food Production</td>
</tr>
<tr>
<td>Mining and Logging</td>
<td>Organizations that prepare natural resources for use. Some examples of natural resources are coal, metals, minerals, oil, gas and trees.</td>
<td>Does not appear in the CareerKits</td>
</tr>
<tr>
<td>Education, Healthcare and Social Assistance</td>
<td>Organizations that offer childcare, education and training as well as healthcare and social assistance. This includes daycare centers, schools, colleges, hospitals, shelters and soup kitchens.</td>
<td>Healthcare Education and Childcare Community and Social Assistance</td>
</tr>
<tr>
<td>Government</td>
<td>Sometimes called “public administration” or “the public sector,” the Government sector includes local, state, and federal agencies. This includes organizations that are in charge of public housing, trash collection and national security as well as prisons, the police and the fire department, among others.</td>
<td>Public sector careers are addressed in every CareerKit sector.</td>
</tr>
<tr>
<td>Entertainment, Food and Hospitality</td>
<td>Organizations that provide art, fun, food and places to stay overnight. This includes organizations involved in theater, dance and music, as well as museums, parks, bowling alleys, restaurants and hotels.</td>
<td>Hospitality and Tourism</td>
</tr>
<tr>
<td>Professional and Administrative Services</td>
<td>Organizations that provide support services to other organizations. This includes services such as accounting, advertising, billing, security, mailing packages and cleaning.</td>
<td>Organizations that are dedicated to these tasks are not included in the CareerKits, however administrative careers are included in every CareerKit.</td>
</tr>
<tr>
<td>Banking, Insurance and Real Estate</td>
<td>This sector includes organizations that deal with money. This includes banks as well as insurance and mortgage companies. It also includes organizations that rent property, vehicles or machinery, such as buildings, cars, refrigerators, televisions and bulldozers.</td>
<td>Does not appear in the CareerKits</td>
</tr>
</tbody>
</table>

Continued...
| Information | Organizations involved in producing, processing and distributing different types of information. This includes publishers of books, newspapers and computer software as well as producers of movies, music, radio and television programs. | Some of these careers are included in the Technology CareerKit |
| Trade, Transportation and Utilities | The CareerKits divide this sector into Retail and Transportation & Warehousing. Retail includes businesses that sell products such as clothing, cars, telephones and furniture. Transportation & Warehousing includes airlines, taxi and limousine companies, shipping and trucking. Some utilities are addressed in other sectors, such as phone/internet in Technology and others, and water and sewage treatment are included in the Community and Social Services CareerKits. | Transportation and Warehousing Retail Technology Community and Social Services |
| Other | This catchall includes organizations that do things not captured by the other sectors. This sector includes car, computer and shoe repair shops, beauty salons, laundromats, parking lots and religious organizations. | Community and Social Services |
Job Losses and Gains Graph: How Did You Do?*

Read the graph below noting the employment numbers for each industry sector in 2004 and 2014.

* Regional adaptations of this graph will be provided upon request.
Interpreting Graphs and Charts: Total Employment in Technology

Students read a bar graph containing data for the total number of Technology workers from 2010–2015. In groups they discuss the graph and answer open ended questions, followed by a class discussion. Then students write short paragraphs about the information in the graph and use the data to make a prediction about the job outlook for the Technology field.

PREP

- Review Workers in Technology-Related Occupations graph, to prepare for class discussion.
- Write 6-10 questions based on the sample discussion questions listed below.

MATERIALS

- Workers in Technology-Related Occupations graph
- Technology Employees by Level of Education in 2010 and 2015, New York State
- Jobs in Technology Writing Assignment

EXPLAIN

1. Today we are going to look at a graph titled, Workers in Technology-Related Occupations. Read the header of the graph. Can you predict what this data might show?
   - How many people held jobs in Technology in New York State between 2010 and 2015.

2. Do you think this graph will show us how many jobs exist today, in the past, or in the future? Why do you think that?
   - They will show jobs held in the past, but we might be able to see trends that could exist in the future.

3. Why might it be useful to look at this graph?
   - To determine if jobs are available, have been available, or are likely to become available. To help us decide if we want to go into the Technology field.

*RAENs will provide regional adaptations.
Let’s see if your predictions are correct. Divide students into groups of three and distribute the *Workers in Technology-Related Occupations* graph.

Ask students to discuss the graph together and answer the following questions:

- What do you notice? (write down as many things as you can)
- What do you see that interests you?
- What do you want to know more about?
- What do you have questions about?

Ask students to write down their group’s answers to be discussed afterward as a class.

**DISCUSSION GUIDELINES**

Facilitate a discussion in which students share what they talked about in groups and also ultimately discuss:

- The structure and organization of the graph
  - For example: *What information is on the X axis? What information is on the Y axis? What increments of time are used?*

- How to read the graph
  - For example: *Can you describe how you would find the number of Bachelor degree holders who worked in Technology in 2014? What about the total number of people who worked in Technology in 2014?*

- The purpose of the graph
  - For example: *Why is this graph useful?*

- The content included in the graph
  - For example: *During what year was the number of Bachelor’s degree holders in technology highest?*

- Any patterns the data shows and possible reasons for the patterns
  - For example: *What trends do you see in this graph? What does this graph show about Technology workers with Bachelor degrees? With Associate’s degrees? With high school diplomas?*

- Implications of the data
  - For example: *What level of education do you recommend for people interested in pursuing a career in Technology? What in the graph makes you say this?*
Students should back up their thinking with evidence from the graph. Ask follow up questions that help students explain their thinking, delve more deeply into the questions, and cite evidence from the graph. Some sample questions might include:

- How do you know that?
- Where in the graph do you see that?
- Why do you think that?
- What else do you notice?
- Can you say more about that?
- What do you think that means?

**SAMPLE DISCUSSION QUESTIONS:**

What does this graph show?

- The number of people employed in Technology in New York State from 2010–2015, according to their highest level of education attained.

How do you know?

- Because the vertical axis shows the total number of workers employed in Technology and the bars show the level of education of those workers. The title lets us know the geographic area—New York State.

During which periods did ________________? Why do you think that is?

What other things did you notice about the total number of jobs in Technology from 2010-2015? Why do you think that? Can you say more about that?

Do you think now is a good time to look for a job in Technology? Why do you think that?
Workers in Technology-Related Occupations

Source: NYCLMIS analysis of U.S. Census Bureau, American Community Survey Public Use Microdata Sample, 2010-2015.
Part 2: Chart of Technology Employment by Education Level

EXPLAIN

1. What does the bar graph of employment in Technology show about Technology workers with Bachelor’s degrees?
   - *The number of people employed in Technology who have Bachelor’s degrees increased every year between 2010 and 2015.*

While the number of Bachelor degree holders working in Technology has been steadily increasing, the graph doesn’t show which specific careers are employing people with Bachelor’s degrees. We’re going to read a chart that shows this kind of information. Why would this be important?
   - *Knowing which fields are looking for people with Bachelor’s degrees can help guide choices about how much and what kind of education to pursue, and which careers to pursue. It helps get a clearer picture of the profession.*

2. Distribute the chart, *Technology Employees by Level of Education in 2010 and 2015, New York State.* Ask students to read the chart and describe the kind of information presented.
   - *The change in Technology employment between 2010 and 2015, according to level of degree attainment. Some careers had more Bachelor-degree holding employees in 2015 than in 2010, for example, and some had fewer.*

3. Ask students:

   According to the chart, are the following statements true?
   - *In all Technology careers listed, there were more Bachelor-degree holding employees in 2015 than there were in 2010. Use evidence from the chart to justify your response.*
   - *In all Technology careers listed, there were more Associates-degree holding employees in 2015 than there were in 2010. Provide evidence for your response.*

   What statement can you make about high school diploma holders in the Technology careers listed in the chart? Provide evidence for your response.

4. Write three true statements about Technology employment based on the information in this chart.
## Technology Employees by Level of Education in 2010 and 2015, New York State

<table>
<thead>
<tr>
<th>Occupations In Technology</th>
<th>High School Degree or Less</th>
<th>Associate's Degree or Some College</th>
<th>Bachelor's Degree or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and Information Systems Managers</td>
<td>1,453</td>
<td>1,184</td>
<td>3,672</td>
</tr>
<tr>
<td>Computer and Information Research Scientists</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Computer Systems Analysts</td>
<td>1,151</td>
<td>1,486</td>
<td>5,922</td>
</tr>
<tr>
<td>Information Security Analysts</td>
<td>176</td>
<td>194</td>
<td>678</td>
</tr>
<tr>
<td>Computer Programmers</td>
<td>1,271</td>
<td>701</td>
<td>5,761</td>
</tr>
<tr>
<td>Software Developers</td>
<td>730</td>
<td>1,946</td>
<td>5,878</td>
</tr>
<tr>
<td>Web Developers</td>
<td>1,517</td>
<td>507</td>
<td>2,060</td>
</tr>
<tr>
<td>Computer Support Specialists</td>
<td>3,263</td>
<td>2,642</td>
<td>8,918</td>
</tr>
<tr>
<td>Database Administrators</td>
<td>652</td>
<td>723</td>
<td>852</td>
</tr>
<tr>
<td>Network and Computer Systems Administrators</td>
<td>497</td>
<td>1,165</td>
<td>4,702</td>
</tr>
<tr>
<td>Computer Network Architects</td>
<td>70</td>
<td>469</td>
<td>1,946</td>
</tr>
<tr>
<td>Computer Hardware Engineers</td>
<td>566</td>
<td>0</td>
<td>827</td>
</tr>
<tr>
<td>Computer Occupations (All Other)</td>
<td>2,885</td>
<td>2,620</td>
<td>7,323</td>
</tr>
</tbody>
</table>

Source: NYCLMIS Analysis of U.S. Census Bureau, American Community Survey Public Use Microdata Sample, 2010 and 2015.
OPTIONAL WRITING ASSIGNMENT

1. Distribute *Jobs in Technology Writing Assignment* worksheet.

2. Ask students to write a paragraph in a journalistic style that describes the data in the graph or the chart and makes a prediction about the future of Technology jobs in the region citing evidence from the graph or the chart. Encourage students to write more about trends in the data rather than to report a series of individual pieces of data.
Jobs in Technology Writing Assignment

Writing Prompt: You work for a newspaper. Your editor wants a short article describing the trends in Technology employment between 2010 and 2015. Write a paragraph that describes the number of people with Technology jobs in New York State between 2010 and 2015. Assume your reader cannot see the graph. Include a prediction for Technology jobs in the near future—Do you think Technology jobs will rise or fall in the near future? How does a job applicant’s level of education impact employment? Explain why you think this. Back up your prediction with evidence from the graph.
Interpreting a Pie Chart: Where Are the STEM Jobs?

Students learn about the distribution of science, technology, engineering and math jobs within the larger STEM field, first predicting, then interpreting a pie chart to check their predictions.

PREP

• Read the pie chart, Where the STEM Jobs Are.

Note: This activity presumes that students have experience reading pie charts and calculating percents.

MATERIALS

• Prediction Guide: Where Are the STEM Jobs? worksheet
• Where the STEM Jobs Are pie chart

EXPLAIN

1. Ask if anyone knows what STEM stands for.

   Science, technology, engineering, and math.

   Explain: Many people, from the heads of companies to the president of the United States, are worried that in the future there will be many STEM jobs and not enough people with the STEM skills to fill them. Of course, some parts of the STEM fields will have more jobs than others. Most STEM jobs require at least a Bachelor’s degree. Before beginning an educational program, it helps to know in which fields the jobs are plentiful. In the next activity, you will find out which parts of the STEM fields will have the most jobs in the future and which parts will have fewer jobs.

2. Distribute the Prediction Guide, one per pair, and explain that with their partner, students are going to predict which parts of STEM will have the most jobs in the future. Review the instructions as a class, including an explanation of the relationship between parts per 100 and percents.

3. Circulate to help students make a percent prediction and label the pie chart. Alternately, students can simply predict which areas will have the greatest and least jobs in the future.
After students have created their pie charts, distribute the graph. Have students correct their answers using the graph, emphasizing that the goal was not only to guess correctly, but also to learn something they did not know about STEM.

**DISCUSS**

- Which areas will have the most jobs? Which areas do you think will have the least jobs? Why do you think that is?
  - Greatest: Computing. Least: Math

- What does the box on the right tell you? How does it relate to the pie chart? What can you learn from it?
  - The career categories within Computing.

- What is the date on the graph? How can researchers know this about the future? Do they know for sure?
  - 2012-2022. They can make predictions based on past employment trends.

- How can information like this help you with your education or career?
  - The pie chart shows which fields are expected to have jobs in the future and which are expected to not have many. Studying a field which is not expected to have many jobs is not a good use of time, energy or money.
Prediction Guide: Where Are the STEM Jobs?

The field of STEM is growing. Which areas are growing the most? Make a prediction by labeling the graph below, and predicting which percent of new jobs will go to engineering, math, computing and science.

Which science and technology jobs are growing?

According to your prediction:

Out of every 100 new science jobs, how many will be engineering jobs? _____ ( ____ %)

Out of every 100 new science jobs, how many will be math jobs? _____ ( ____ %)

Out of every 100 new science jobs, how many will be computing jobs? _____ ( ____ %)

Out of every 100 new science jobs, how many will be physical/life science jobs? _____ ( _ %)
Where the STEM Jobs Are

This graph takes its numbers from the Bureau of Labor Statistics (BLS). BLS is part of the United States Department of Labor and collects statistics and information on employment in the United States. It reports on current employment numbers, and makes predictions based on past patterns of employment. It also provides descriptions of careers for career explorers. It can be searched at www.bls.gov.

Lesson Guide

Technology Careers Brainstorm

Students consider ways that they use technology, first-hand and via workers they come in contact with, and brainstorm careers in the Technology sector.

EXPLAIN

1. Many businesses use computerized technology. Even streetlights are computerized. Think about all the ways you use technology on a regular basis.

2. In pairs, brainstorm all the ways you use technology on a regular basis, including the name of the device and what you use it to do. Write complete sentences.
   
   - I use ATMs to get cash and also to deposit my paychecks. I use my smartphone to text and access the internet.

3. Add ways that merchants or service providers you use utilize technology, for example, the cashier at your grocery store, the teller at your bank, the receptionist at your doctor’s office. Include the name of the technology and what it is used to do.

4. Based on these lists, brainstorm careers that design, make, or maintain any of these forms of technology.

   * For example:
     - Cable installer or repairperson
     - HVAC installer or repair
     - Web Developer
     - Software Engineer
     - Computer Repair Technician
     - Help Desk Specialist
     - Video Game Developer

5. Discuss with your partner: Which of these careers, if any, sound interesting to you? Explain why.
How Does Technology Affect Today’s Labor Market?

Students read an article and consider the positive and negative effects of technology on the workplace across labor sectors.

MATERIALS

- Technology Opinionaire
- Technology in the Workplace reading
- Chart paper & markers

INTRODUCE

1. Distribute the Technology Opinionaire. Ask students to read each statement, and circle whether they agree or disagree. Then they should choose one of the statements to explain (in writing) their reasoning.

2. Write on the board:

   How has technology changed the labor market?

3. Distribute Technology in the Workplace, and ask students to read and annotate it, making sure to take notes about how technology has changed how people look for jobs, what kinds of jobs are available, and what their lives are like at work.

4. Put students in groups. Tell them to turn over the article (so they’re not looking at it), and make a list on chart paper of all the ways they can remember from the article how technology has changed the world of work. Groups share findings with the class.

5. When the groups are finished, ask them to look back at the article, and see if they missed anything. If they did, they can add to their lists.

6. Point students back to their opinionaires. Ask if anyone has changed their mind. For example, did anyone who started out feeling positively about technology start to feel more negatively, or the other way around?
Technology Opinionaire

For each of the statements below, circle whether you agree or disagree.

1. Overall, technology is improving our world today more than technology is hurting our world.
   Agree / Disagree

2. Technology these days makes it easier to find a career.
   Agree / Disagree

3. I would rather be looking for a job in today’s job market than I would 20 years ago.
   Agree / Disagree

Choose one of the above statements, and explain why you agreed or disagreed:
Technology in the Workplace

Technology has affected the world of work since the rise of factories in the 19th Century. For example, a machine called the cotton gin, that removes seeds from cotton after it is picked, made cotton manufacturing quicker and easier. When we talk about technology today, we usually mean hardware, such as hard drives and monitors; software, such as word processing programs; the internet; or networks, which allow computers to communicate with one another. Technology also refers to data collection, analysis and storage. It affects today’s labor market in many ways: the way we find work, the types of jobs we do, the education and skills we need, the way we do work, and the way companies operate.

1. **The way we find work**
   Long ago, people often looked for jobs in local newspapers, but today they use technology. Job search websites such as Monster, Indeed.com and Glass Door have become popular. People use social media sites like LinkedIn and Facebook to make themselves known, connect to others and find opportunities. Employers use these sites too, to find employees and research job applicants.

2. **The type of jobs we do**
   Advances in technology have made some jobs disappear and others appear. For example, because companies like Netflix can offer movies on the internet, there are fewer video rental stores. We used to see a travel agent, baggage collector, porter and ticket agent when we traveled by plane or train. There are fewer of those jobs now that we use websites to book our tickets, and electronic machines to get our tickets and to check our bags. Advances in technology create new jobs too, like ‘app developers’, social media specialists, and health information managers.

3. **The education and skills we need**
   A lot of work relies on technology. We use it to do simple tasks like answering phone calls. More and more employers rely on people to do more difficult work that requires innovative thinking, flexibility, creativity, and social skills. You need a person to plan the layout of products in a store so customers can find them easily and you need a person to provide hands-on care for sick patients. You need technology, for cashiers to use during transactions and to store medical information of patients. In this technology driven labor market, individuals who want...
to get, keep and advance in a good job need to make sure that they have the education and skills that employers are looking for. This means knowing how to use technology and learning the skills that must be done by people.

4. **The way we do work**

Technology has also changed the way we work, by:

- **Making workers more productive**—Using technology can help you do your job better. You can complete more tasks, do them faster and sometimes more accurately. For example, with programs like Word, you can create and edit a letter more quickly than if you were to do it by hand or on a typewriter.

- **Reducing the tasks workers do themselves**—Some tasks that workers used to do themselves are now done by technology. For example, lawyers can use computer programs to search through thousands of documents to find certain information. This allows them to spend more time doing work computers can’t do, such as developing arguments for the courtroom.

- **Replacing some workers**—More and more, we rely on machines to do work without any help from humans. This is called automation. Many people wonder if machines or even robots will one day replace workers. Right now, machines can assemble car parts, answer customer calls and check passengers in at airports. Robots can work together to fulfill warehouse orders. Experts disagree on what kind of impact automation will have on work in the future.

- **Making some workers more mobile**—Mobile phones, computers and the internet have allowed employees to do work from almost anywhere at almost any time. For example, some office workers can work from home for a local company or for a company based in another country. And, they can check email after the official end of the workday. Because of videoconferencing, we can even have meetings with people who are in different places around the world.

- **Directly connecting people who need goods or services to people who can offer it**—Businesses like Uber, Airbnb and Ebay allow sellers to connect with customers in moments. They offer transportation, accommodations and products to potential buyers through the internet.
5. **The way companies operate**

With technology, organizations can produce goods and provide services more quickly, more accurately, on a larger scale and in new and improved ways. They can reach more customers. And, they can use huge amounts of information about individuals—known as ‘big data’—to help them sell more to customers. For many organizations, the way they use technology is what sets them apart from the rest.

Technology has changed the world of work in these five ways, but not all types of technology have the same impact. Some technologies totally transform the way people and organizations work. The internet is a good example; it changed everything. Other technologies that may transform our lives include driverless cars and advanced robots that can work alongside or replace employees altogether. And, some jobs seem to be effected by technology more than others. For example, jobs that involve activities such as data entry, assembly line work or routine design work have all become reliant on technology.

Technology has had many positive effects, but it has also had some negative. For example, the internet has allowed a wide range of individuals to access an incredible amount of information quickly, but it has made security and privacy an important issue. Hackers now can get confidential information that they were not intended to have. Governments are catching up to these changes by making new laws and regulations to keep people more safe.

Jobseekers and employees in today’s labor market must make sure they are tech-savvy. This can include:

- knowing how to operate a computerized cash register
- being proficient in Microsoft Office including Word and Excel programs
- operating medical technology that can require ongoing training as the technology evolves

Employees can raise their awareness by staying current with technological trends in their field, by reading online or print materials about their industry. Jobseekers can prepare for interviews doing job research and getting training. Jobseekers who are not tech-savvy may be at a disadvantage to their more tech-savvy peers.
EXTENSION ACTIVITY

Written Response: Technology’s Effect on Workers

In this scaffolded writing activity, students first write sentences summarizing the ideas in the article, using quotations as evidence to support their ideas. They then use those sentences as the basis of a five paragraph response. Teachers are encouraged to use any other writing development techniques they have been using in class, such as note-taking, outlining, or pair pre-write discussions.

MATERIALS

- Written Response: How Technology Affects Workers assignment

INTRODUCE

1. Distribute Written Response: How Technology Affects Workers assignment. Ask students to read it, and explain what they are expected to do.

2. Ask students to work on it individually, then share their responses as a class. Students will likely need more space to write and can use separate sheets of paper in addition to the worksheet.

3. Using any writing development techniques you have been using in class, ask students to use the worksheet to write a five paragraph response, including an introduction, conclusion, and three body paragraphs. Discuss the importance of making a claim that is supported with evidence. In this case, evidence is a quotation from the reading. The significance of quotations should always be explained.

4. Adaptation for lower levels: Responses can include one or two body paragraphs.
Written Response: How Does Technology Affect Workers?

Complete the worksheet below, explaining the author’s views on how technology affects workers. For each reason, include a quote from the text and explain its significance.

The writer of *Technology in the Workplace* believes that technology has had a ________________ impact on workers.

**FIRST REASON:**
Technology has been ________________ for workers because...

Quote:

This is important because...

**SECOND REASON:**
Another reason the writer thinks technology is ________________ for workers is...

Quote:

This is important because...

**THIRD REASON:**
A third reason the writer thinks technology is ________________ for workers is...

For example...

This is important because...
Innovations in Technology: 3D Printing Across Sectors

Students watch a video about 3D printing, take notes and discuss the video. They then read an article about the future of 3D printing’s impact across labor sectors and identify facts, opinions and predictions from the article.

PREP

• Preview the video: https://www.youtube.com/watch?v=Vx0Z6LplaMU in preparation for discussion.

• Pre-teach vocabulary: hype, data, aggregate, the expression “bread and butter”, disruptor.

(In Tech, a “disruptor” or “disruptive technology” is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry. An example of a disruptive technology is the personal computer (PC) which displaced the typewriter and forever changed the way we work and communicate.)

MATERIALS

• This activity requires computers and projector

• Why 3D is More Than a Passing Fad for Jobs article

• 3D Printing: Facts, Opinions and Predictions worksheet

EXPLAIN

1 Technology’s impact on the way we work is undeniable. From the invention of the printing press to the Xerox machine to our present day home printers, copiers and scanners, the way we are able to produce and share information changes the way we relate to each other and do business. But there’s a new kind of technology gaining popularity today, that some say, has the potential to change the way nearly everything is made, sold and bought: 3D printing.

2 What do you know about 3D printing? (It’s ok if students are unfamiliar with the term.)
3 We are going to watch a short video on 3D printing. Ask students to think about the following questions while they watch the video and take notes that will help them answer the questions:

- How does 3D printing work?
- Why is 3D printing important?

4 Play the video: https://www.youtube.com/watch?v=Vx0Z6LplaMU

DISCUSS

- How does 3D printing work?
  - A file is created that tells the printer how to print an object. Then the printer prints the object by creating very thin layers of material that are layered one on top of another until the object is complete.

- Why do you think 3D printing is important?
  - It is faster, cheaper, and more accessible to the average person than traditional manufacturing is.

- When a new technology is created, can we know for a fact that it will become popular or change the way we live and work? Why or why not?
  - No, but we can make predictions based on how a technology does when it’s first introduced or by studying the popularity or effects of similar technologies.

EXPLAIN

5 We are going to read an article about the impact of 3D printing on industry and about what people predict for the future of 3D printing.

Distribute Why 3D is More Than a Passing Fad for Jobs article. Ask students to read and annotate it, noting parts they think are important, interesting, confusing or surprising.

6 When students are finished, ask: What is the difference between a fact, an opinion and a prediction?

- A fact has been proven with evidence. An opinion is what someone thinks and may be backed up by facts. A prediction is an educated guess about what might happen in the future and is usually supported by evidence.
8 How can we tell the difference between them?
   By looking for evidence, fact checking, determining if sources are credible, the statement’s context and language used (“I think, I believe, in the future, I predict, experts predict,” etc.). Teacher may want to write a list of these phrases on the board as students brainstorm them.

9 Why is it important to be able to tell the difference between them?
   To be able to tell what is true or accurate, what might be inaccurate, and what is untrue.

10 Distribute 3D Printing: Facts, Opinions and Predictions worksheet and ask students to complete it in pairs.
Why 3D is More Than a Passing Fad for Jobs

By Bryan Borzykowski
January 28, 2016

Adapted from http://www.bbc.com/capital/story/20160127-model-your-career-in-3-d

The print anything revolution is real. Just a few years ago 3D, or three-dimensional, printing was hyped as manufacturing’s second coming. Many experts thought we’d all be making tools and toys at home by now. And, they declared, everything from cars to planes to medical devices would be easily and cheaply made. While it is theoretically possible to print much of what was promised, 3D printing hasn’t yet made the advances some thought it would.

But to many industry experts, that’s OK. They say we’re on the verge of a 3D printing boom, in part because an increasing number of engineers, designers, technologists and researchers are learning about additive manufacturing, another name for 3D printing, in schools around the world. At the same time, more industries are finding uses for 3D printing, from making car parts to manufacturing tools.

Wanted Analytics, a software firm that collects hiring data trends, reported that the number of job ads asking for 3D printing skills increased by 1,834% between 2010 and 2014. The most sought after employees with 3D experience, the firm found were industrial engineers, mechanical engineers, software developers, commercial and industrial designers and marketing managers.

The main reason for job demand growth is that the interest in 3D printing is still expanding at a phenomenal rate, even if we’re not printing our own knick knacks at home. Statista, another data company, estimates that the 3D printing market, which includes printing, materials and associated services, sales will top $16.2bn in 2019, up from $3.8bn in 2014, while Gartner Research, a global IT research firm, estimates that sales of cheaper printers in the less than $1,000 range—an important driver of the market—will account for 28.1% of sales by 2018, up from 11.6% in 2014.

**Specialized skills**

Despite what Wanted Analytics found, Nima Mirpourian, a branch manager at Robert Half Technology, a company that specializes in IT staffing, hasn’t yet seen many job postings requiring 3D technology skills, but he expects that to change soon. “We’re starting to hear rumblings about the hiring pickup in 3D printing,” he says.

Although 3D printing “is a very specialized area of expertise,” said Mirpourian, anyone with an interest in this space could land themselves a job with the right education, as there are opportunities for people in almost any field. First of all, 3D printing is often considered more of a technology than a manufacturing application, meaning that developers, coders, programmers and other technology-related staffers will be needed to create and develop the software required to run 3D printing machines.

There should also be more opportunities for creative types, such as designers and artists, who will help create the products printed by these printers. More manual labor will also be needed to operate printers and handle parts and prototypes, said Todd Grimm, a member of the 3D Printing Association’s advisory board.

There are also opportunities in research and development, where scientists and academics are developing new theories on how additive materials should be used and made, said Pete Basiliere, Gartner’s research vice-president of imaging and print services.

Those with some 3D printing knowhow are likely to be heavily recruited as the industry grows. “Experience trumps all,” said Mirpourian. “This is a disruptor in the marketplace and because of that, these skills, especially on the development and design side, are super relevant.”

**Reasons for optimism**

There are several reasons why Basiliere and others think that 3D printing is about to take off. One is because of those new graduates who have learned
additive manufacturing skills in college and will apply these into their first jobs. The military sector, which hopes to use 3D printing for everything from food—cartridges are filled with ingredients that then can create eats on-demand—to weapons, is teaching recruits to use this technology.

Prices are also coming down. Over the last eight years, printer costs dropped by thousands of dollars. Grimm said that eight years ago, a small desktop 3D printer cost $20,000. It’s now $400 and the price will continue to fall.

Companies are also starting to wrap their heads around how to incorporate 3D printing into their businesses.

There are three main uses for 3D printing, said Grimm. The first is to make prototypes and models that validate the design of something before it’s manufactured. That’s been the “bread and butter” of the industry for years, he said, and will continue to be a main driver of growth.

Technology has also advanced enough to do a short product runs of about 500 or so products. That allows companies to test goods in the market.

It’s also being used in factories to make the tools, such as screws, that then are used to make other products, said Grimm.

Finally, more companies likely will use 3D printing to make finished goods, or at least parts of finished goods. One of the advantages to this tech is that it allows companies to make far more complicated parts that are thinner, more circular and more flexible than what traditional manufacturing systems can make, said Grimm.

**Sectors with 3D success**
At some point, 3D printing will be used by nearly every industry, but at the moment aerospace is one of the biggest consumers. General Electric, for instance, has made jet engine parts, such as fuel nozzles and turbine systems, out of 3D-printed components. NASA has created a combustion chamber for its rockets out of additive materials.

3D printing, also called additive manufacturing, is seeing rapid growth in healthcare, where the technology is being used to create bones, implants, organs and even hearts.

Most of the growth in printing has been in Europe and North America so far, but Grimm expects China to become a leading player in the market, too. “The country is taking a position for the coming change in the manufacturing world,” he said.
3D Printing: Facts, Opinions and Predictions

List three facts from the article and explain how you know they are facts:

Fact #1: _________________________________________________________________

I know this is a fact because: _____________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

Fact #2: _________________________________________________________________

I know this is a fact because: _____________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

Fact #3: _________________________________________________________________

I know this is a fact because: _____________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________
List two opinions or predictions from the article and explain how you know they are opinions or predictions.

Opinion or Prediction #1: ____________________________________________________________

I know this is an opinion or prediction because: ______________________________________

Opinion or Prediction #2: __________________________________________________________

I know this is an opinion or prediction because: ______________________________________

Employers Types in Technology

Students learn about classifications of employers—corporations, nonprofits, self-employed businesses, cooperatives and civil service.

PREP

- Be prepared to discuss the following terms, defined below: Corporation, Nonprofit, Self-employed, Cooperative and Civil Service, also known as the Public Sector.

MATERIALS

- Sample Employer Types worksheet
- Employers By Type worksheet

EXPLAIN

1. Sometimes the word employer refers to an individual, but it is also used to describe a company or organization. We are going to look at five different types of employers that exist in the Technology sector. Additional types of employers exist in other sectors.

2. Distribute Sample Employer Types worksheet.

3. Have students get into pairs and complete the worksheet together.

4. When they are finished, have students share their answers with the class.

5. After each workplace type is reported back, discuss the corresponding definition below to clarify and answer any questions. The descriptions below are intended for use by the teacher.

- A Corporation is a business that sells goods or services. Many corporations have one person in charge at the top, the CEO or President, then a layer of middle managers who supervise people with lower levels of responsibility. If a corporation makes a large profit, that money might go to the high level managers, or they may choose to share it among the employees. Many, though not all, corporations have a hierarchy with some people holding more power to make decisions than others.

- Nonprofits or Not-for-profits generally prioritize providing services over making money. For example, they might provide shelter or counseling to homeless or low-income people, people with disabilities or other groups of people.
who need assistance. They are governed by a Board of Directors, a group of people interested in the success of the organization, which guides the decision-making. Users or clients often do not pay for the services. Instead, the organizations apply for and receive grants from the government or private funders. This is money that does not have to be repaid and often comes with requirements on the services provided, such as a certain number of people served or certain results of the services provided.

• Self-employed businesses are often a business of one, for example, a handyperson who makes repairs in people’s homes or someone who does hair on their own or in other people’s homes. They set their own hours, prices, get their own clients and run the business themselves. They might hire someone to help with certain aspects, such as a bookkeeper to help manage the finances or an assistant to help them provide the service.

• Cooperatives are businesses that are owned by a group of people together, instead of having one owner or president. They make decisions about the business together and have equal decision-making power. Profits earned often go back in to supporting the business or go to the worker-owners themselves. There are many new cooperatives in New York City.

• Civil service is also known as the public sector or the government. Civil servants are public employees who work in a variety of fields such as teaching, sanitation, health care, management, and administration for the federal, state, or local government. There are standardized prerequisites for employment such as minimal age and educational requirements and residency laws. Employees enjoy job security, promotion and educational opportunities, comprehensive medical insurance coverage, and pension and other benefits often not provided in comparable positions in private employment.

6 Divide the class into three groups and assign each group one of the three readings. Tell students they will share and discuss what they read with the class. They should take notes and be able to summarize the reading.

7 Each group presents their employer to the class, based on what they have read about it.

8 Distribute Employers By Type worksheet and have groups work together to list employers that they think belong in each category.

• They can complete them based on their existing knowledge or use the following websites for research:
  www.greatnonprofits.org and www.nycworker.coop
• If they use websites for research, discuss the importance of paraphrasing.
• Another option is to have them complete this worksheet individually for homework.
Employer Types*

Read the descriptions of employers below and decide whether each one is a corporation, a nonprofit organization, a cooperative, someone who is self-employed or civil service.

1. JW Visions Inc.* in Queens, NY, operates a computer learning lab which helps individuals develop computer skills and resources to transform their economic futures. The goal is to prepare students to enter and advance in the job market. They train participants in the use of computers and the Internet. JW Visions does not charge its students any fees, and instead operates using money from grants and donations.

   Business Type ________________________________

2. The Mount Sinai Health System* is a network of private, for-profit hospitals. It includes the Icahn School of Medicine at Mount Sinai and seven hospital campuses in the New York metropolitan area, as well as a large, regional ambulatory footprint. The mission of the Mount Sinai Health System is to provide compassionate patient care with seamless coordination and to advance medicine through education, research, and outreach in many diverse communities. Mount Sinai is a private hospital system, owned by investors who profit from the cost of services provided by the hospitals. The Mount Sinai Health System offers careers to workers with technological training in Health Information Systems, Information Technology, Radiology, and Diagnostic Medical Sonography, among many others.

   Business Type ________________________________

*RAENs will provide regional adaptations.
3 Palante Technology* works to help non-profit, progressive organizations improve the way they use technology to better their business. They provide technology consulting services including website and database development, desktop and laptop computer support, technology infrastructure and networking, and managed IT plans. The business is owned by the employees. They make decisions about the business together and have equal decision-making power. Money the business earns goes back into supporting the business or goes to the worker-owners themselves.

**Business Type**

4 The Internal Revenue Service (IRS) has one of the largest Information Technology (IT) organizations in the world—the Modernization and Information Technology Services (MITS) Division. Their IT modernization program is one of the federal government’s most complex initiatives. They develop important IRS information systems that support our nation’s tax system. The MITS offers both entry-level and mid-career IT professional positions, at a wide range of pay levels, depending on education and experience.

**Business Type**

5 Sandra works as an IT consultant. She advises businesses and organizations on how best to use information technology (IT) in achieving their business goals. Sometimes she helps her clients solve technological problems on one specific project, while other times, she advises them on larger technological issues that affect their entire business. Sandra is her own boss, which means she can make her own schedule and take on as many or as few clients as she wants. When she isn’t visiting one of her clients at their office, Sandra works from home in the spare room in her apartment. She loves her job because she is in charge and doesn’t have to report to anyone else.

**Business Type**

Corporation

Xerox

Xerox, a company that began in Rochester, New York, was once only known for its paper copies. It is now a huge, $18 billion company, on the cutting edge of digital reproductions. The Chairman and CEO is Ursula M. Burns, pictured here, the first Black American woman to head a company of this size. Burns was raised by a single mother in the Baruch Houses, a New York City* housing project. Both of her parents were Panamanian immigrants. She obtained a bachelor of science degree in Mechanical Engineering from New York University Polytechnic School of Engineering in 1980 and a master of science in Mechanical Engineering from Columbia University a year later.

Source: http://www.forbes.com/profile/ursula-burns/
https://en.wikipedia.org/wiki/Ursula_Burns
Nonprofit Organization

Mouse

Mouse is a national youth development nonprofit that believes in technology as a force for good. We empower all students to create with technology to solve real problems and make meaningful change in our world. Mouse is committed to creating more diversity in STEM and opening opportunities for students from underserved communities across the country.

Mouse works with schools to develop in-school and after school technology programs for youth that connect students’ interests to tech skills and expertise, apply skills to address local and global issues, engage students with lessons and projects for group and individual work, and build digital age literacies through problem solving and iteration.

Mouse believes that learning technology is no longer about basic engineering, computation, or information alone, but building the skills and senses to apply technology creatively to make a positive impact in the world around them.

Source: www.mouse.org

Mouse empowers all students to use technology as a force for good.
Cooperative

A Bookkeeping Cooperative (ABC)*

ABC was launched in Brooklyn in 2012 in order to provide services and a knowledge to freelancer bookkeepers. We seek to provide our members with benefits, human resources, and training in both bookkeeping and cooperative development. ABC also seeks to have a competitive edge. We stay up to date with industry developments, co-op networks, and keep a low overhead to provide competitive rates.

WHY HIRE US?

**Fraud:** Outsourcing your bookkeeping services is likely to protect you from internal theft. We can help set up checks and balances to make sure your money is secure.

**Legal:** The Department of Labor is cracking down on businesses hiring “freelancers” - by hiring ABC you are assured of full legal protection from labor audits as you would be hiring a company and not an individual.

**Protected & Reputation:** Our reputation as a business is built on how happy our clients are—we welcome you to contact any of them as a reference to how amazing they think we are.

**Committed to Social Justice:** ABC was founded as a worker-cooperative because we are dedicated to the movement much like you are—promoting a living wage for our workers and donating services to small radical organizations. We also offer workshops on finances, taxes and bookkeeping for low/no-cost to help empower our community to take charge for their capital.

**Built In Cost Savings:** Our efficiency and advanced knowledge base ensures that your costs will be less overall as compared to having an in-house bookkeeper, after factoring in training time (included in our budgets for adding new bookkeepers to your account) and other factors.

Source: https://bookkeeping.coop/
Self-Employed

Freelance Computer Repair Technician

A little background on myself: Four years ago, my wife and I were really poor. I was unemployed, she was working a minimum wage job, and we were barely paying the bills every month. So one day I decided to put myself out there on Craigslist as a computer repair technician, and have learned a lot as I've become successful doing it. I started out doing this with literally a Philips screw driver and my home computer. I now have a new car, an iPad I use solely for work, and all kinds of stuff, plus the ability to work from home. Life is good. I help between 3-4 customers a day. I work typically about 3 hours a day, on my own schedule. I make about $150 a day on average.

Things you will need to start. $30 to purchase tools. Lots of guides will tell you to buy a big computer toolkit, but you really don't need that. You need:

1. PATIENCE, I cannot overstate this enough, this will make or break your business!
2. Your tools
3. Cell-phone
4. Car (optional, increases your income potential by a lot though)
5. Mobile tools (if you have a car, pick up a cheap basic toolkit from a drug store or something and just leave it in the car. You'll be surprised how often you use it.)

Key Tips:

1. Your customers think of you in the same way that many people think of mechanics. They don't trust you, they think you're going to try to screw them over. You will have to prove through your words and your actions that you are worthy of trust.
2. Be prepared to not make much for a while until your name gets out there. It takes time to build your reputation, but it will pay off.
3. Be safe! Write down any addresses to new customers and keep them around at your home if you don't know the clients or have never been to their homes before. Let people know where you will be.
4. Patience and good customer service are more important than your actual skill with the computer. Patience will get you repeat customers! Never take any customer for granted. I helped a lady in a Starbucks once. She told her boss about me and I got a $1500 EMR contract to help migrate his dentist office to a new medical billing system.

Source: https://www.reddit.com/r/techsupport/comments/122cw5/how_to_start_being_a_computer_repair_technician/
Civil Service

The New York City Human Resources Administration / Department of Social Services (HRA/DSS)*

The New York City Human Resources Administration/Department of Social Services (HRA/DSS) is dedicated to fighting poverty and income inequality with essential programs that help families and individuals with economic and social service needs.

HRA programs can help New Yorkers with a variety of serious needs, such as food or cash assistance to help make ends meet, one-time emergency assistance to avoid eviction, services for the disabled or those living with HIV and AIDS, temporary shelter to escape domestic violence and much more.

As the largest local social services agency in the country, HRA helps over 3 million New Yorkers through the administration of more than 12 major public assistance programs, with more than 14,000 employees and an operating budget of $9.7 billion.

HRA offers a wide range of careers that require technological knowledge, experience and training from administrative, client service, and outreach positions, to IT specialists, computer service technicians, and computer programmers and analysts.

Source: http://www1.nyc.gov/site/hra/about/about-hra.page
## Employers by Type

List as many local employers as you can in the boxes below, providing the name and what they provide. Use businesses near class, near your home, and ones you are familiar with. If no employers come to mind for a category, do some research. Use readings from class or search online.

<table>
<thead>
<tr>
<th>Corporation</th>
<th>Nonprofit Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name or Service:</td>
<td>Product:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooperative</th>
<th>Self-Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name or Service:</td>
<td>Product:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Civil Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name or Service:</td>
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<td></td>
</tr>
</tbody>
</table>
Additional Reading on Civil Service Careers in Technology

Tech & Telecom

Governments can’t run without computers, networks, and phones. All of the agencies that make up the government must use computers — and sometimes mobile devices like smartphones and tablets — so that they can develop documents, communicate between agencies and with the public, store and analyze data, and manage finances, among other functions. Wherever computers are used, there is a need for technicians to install and fix them, and programmers to create applications to run on them. Just like in the private sector, the more knowledge, skill, and experience you have, the more likely you will be better paid. Software and hardware tech jobs can be found in almost every government agency or department and some departments specialize entirely in tech.

<table>
<thead>
<tr>
<th>ENTRY-LEVEL</th>
<th>MORE EDUCATION &amp; EXPERIENCE</th>
<th>SENIOR-LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Typical Yearly Pay</strong></td>
<td><strong>Typical Yearly Pay</strong></td>
<td><strong>Typical Yearly Pay</strong></td>
</tr>
<tr>
<td>$35,000 to $45,000</td>
<td>$45,000 to $60,000</td>
<td>$60,000 to $80,000</td>
</tr>
<tr>
<td>$80,000+</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sample Pathways</strong></td>
<td><strong>Sample Pathways</strong></td>
<td></td>
</tr>
<tr>
<td>Help Desk Level 1</td>
<td>Desktop Support Technician</td>
<td>Quality Assurance Analyst</td>
</tr>
<tr>
<td>Network Services Specialist</td>
<td>Network Administrator</td>
<td>Network Manager</td>
</tr>
<tr>
<td>Web Content Specialist</td>
<td>Web Developer</td>
<td>Applications Developer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Senior Applications Developer</td>
</tr>
</tbody>
</table>

PLACES YOU MIGHT WORK INCLUDE:

| City of New York             | Department of Information Technology and Telecommunications, Human Resources Administration, Department of Investigation, and the Department of Education |
| New York State               | Office of Information Technology Services, Department of Health, the Attorney General’s Office, the State Insurance Fund, and the State Police Department |
| U.S. Government              | National Telecommunications and Information Administration (Department of Commerce), Treasury Department, Department of Energy, and the Library of Congress |