1 TECHNOLOGY

SKILLS AND STRATEGIES

- Identifying Claims and Evidence
- Managing Unfamiliar Words
- Annotating a Reading

Identifying Claims and Evidence

In academic writing, an author makes claims and cites evidence to assert a thesis and support a point of view. A claim is an arguable statement; evidence is information that shows the statement to be true or untrue. To identify claims and evidence, good readers search for key words and phrases called "lead-in" or "signal" phrases. Signal phrases, such as *in the words of* or *as the author states*, are used to introduce quoted material or to paraphrase the words of another author. Writers often cite and evaluate the ideas of others to support or argue against previously stated claims. Identifying claims and evidence will help you understand and evaluate the major ideas in academic texts.

Examples & Explanations

①**There is no doubt that** new forms of technology have made a great impact on society. ②By working both independently and in teams, inventors and scientists have helped improve many aspects of our lives; not just methods of travel and communication but also in the areas of medicine, engineering, and business. ③However, *where* these specialists work plays a role that is just as important to the development of new ideas as the inventors themselves.

④Cities like San Francisco, California, or Boston, Massachusetts, attract large numbers of engineers and computer scientists with Bachelor of Science degrees from top U.S. universities. ⑤**It is reported that** there are 10 percent more technology and engineering experts working in these two areas compared to the rest of the U.S.

Writers usually make a claim first and then support it with evidence. To identify claims and evidence, good readers ask the following questions as they read a paragraph:

- *What claim does the writer make about the topic?*
- *What evidence does the writer use to support a claim?*
- *What phrases does the writer use to indicate a claim or supporting evidence?*

In this text, sentence 1 introduces *technology* as a general topic. The phrase *there is no doubt that* is used to introduce a claim the writer makes about this topic. Sentence 2 introduces several facts (general knowledge) about technological achievements before asserting the thesis. Sentence 3 then gives the writer's main claim, or thesis, about the role of the places where specialists work.

In sentence 4, the writer mentions specific cities as examples that support his thesis. In sentence 5, he gives a statistic as evidence. The lead-in phrase *it is reported that* signals that the writer will present this evidence.

⑥"Silicon Valley" in northern California stretches from the San Francisco Bay to the Santa Clara Valley and has been the home of American computer innovators and manufacturers since the 1970s. ⑦**According to** expert Enrico Moretti, author of *The New Geography of Jobs*, places like Silicon Valley are "brain hubs" – central locations where great numbers of scientists, engineers, and innovators can meet and work. ⑧In addition, Moretti **states** that workers in these fields generate five times more local jobs than other industries.

In sentence 6, the writer further supports his thesis by introducing another area where specialists create new forms of technology. In sentence 7, he uses a lead-in statement, *according to*, before citing evidence from an expert. Sentence 8 offers additional information and statistics from the expert to support the effects of brain hubs.

⑨Moretti also **analyzes** one of the most fundamental aspects of future job growth in the U.S.: the impact of education with a focus on Science, Technology, Engineering, and Mathematics (STEM) courses at the elementary and high school levels. ⑩He **claims** that STEM students are more apt to go on to college and complete studies in a STEM field. ⑪In one analytical report, **statistics showed** that these college graduates have been moving to areas like New Orleans, Louisiana; Pittsburgh, Pennsylvania; and San Antonio, Texas, among other cities, where the cost of living is not as high as it is in Silicon Valley.

In sentences 9 and 10, the writer uses the words *analyzes* and *claims* in order to make a claim about the impact of STEM courses on college education and job growth. Sentence 11 cites statistics from a report to support the claim that college graduates in science and technology fields are moving to other brain hubs across the U.S.

⑫Brain hubs play an important role in bringing together a diverse group of well-educated scientists and creative thinkers. ⑬These places have lasting effects that can influence the future of technology as well as the global workforce.

Sentences 12 and 13 contain a concluding summary about brain hubs that re-asserts the thesis and supports what the writer has stated previously in the text.

The Language of Claims and Evidence

Academic writers often present and evaluate claims and evidence from outside sources to support their own ideas. Here are some words and phrases that can signal claims and evidence.

SIGNAL VERBS AND NOUNS THAT INTRODUCE CLAIMS		SIGNAL VERBS AND NOUNS THAT INTRODUCE EVIDENCE
admit – admission	*consider – consideration*	*cite – citation*
agree – agreement	*contend – contention*	*indicate – indication*
argue – argument	*insist – insistence*	*point out/to*
assert – assertion	*state – statement*	*prove – proof*
believe – belief	*suggest – suggestion*	*reveal – revelation*
claim – claim		*show*
SIGNAL PHRASES THAT INTRODUCE CLAIMS		**SIGNAL PHRASES THAT INTRODUCE EVIDENCE**
according to		*according to*
in the opinion of		*a study found/showed*
in the words of		*the evidence shows*
it is clear/likely that		*in fact*
there is little/no doubt that		*the fact is/that*
		is evidence of
		it is reported that
		statistics show

Strategies

These strategies will help you identify claims and evidence.

- Identify the writer's main claim, or thesis, as soon as possible. It is often found in the first few paragraphs and summarized in the final paragraph of a text.
- Before you begin reading, scan the text for names, dates, statistics, key words, and phrases that help you identify claims and evidence.
- As you begin each paragraph, ask yourself: *What is the writer's point of view? What claim does the writer make? What evidence does the writer use to support the claim?*
- Identify signal verbs and phrases that a writer uses to give evidence to support a statement.
- Look for signal verbs and phrases that writers use to introduce claims or evidence from other authors or experts.
- Note the use of certain transition words like *although, despite, however, likewise,* and *similarly* that can be used to contrast or compare ideas and evidence with the claims of others.
- As you read, look for sentences that connect statements at the end of one paragraph with the next paragraph. Writers sometimes make a claim at the end of a paragraph

and elaborate on or give evidence for that claim in the first sentence of the next paragraph.

Skill Practice 1

Read the following paragraphs. As you read, underline the signal verbs and phrases that introduce a claim or evidence. Then identify the statement that follows as a claim (*C*) or evidence (*E*). The first one has been done for you.

1 The expression "great minds think alike" is often used when two or more people express the same idea at the same time. Technology blogger Matt Novak believes that this statement can be proven. He asserts that "the concept of the nerdy, lone inventor is a myth." Novak also states that invention is "messy" and takes a great team of developers in order for a great idea to become a reality. Whether we look at specific examples from history, like Serbian-American scientist Nikola Tesla's system for alternating electrical current or one of the many devices credited to the American inventor Thomas Edison, Novak points to the fact that none of these things were actually created by a single individual. The evidence shows that other Italian and German inventors contributed to the development of alternating current, while Edison was only one of a number of inventors of light bulbs. In fact, Novak contends that something called "simultaneous innovation" was much more common throughout history: a situation where more than one person has the same new idea at the same time and makes a great effort to develop that idea and bring it to life.

2 Matt Novak's major assertion regarding the lone inventor controversy is relevant to issues that arise today with patents for devices or ideas. For example, who invented the iPad? Novak cites court cases where "rectangular viewing devices" appeared in science fiction movies from the 1960s and 1970s, thereby "invalidating the patent of the iPad." This supports the argument that no single person came up with the idea for the tablet or iPad and that its designs were simply improvements on the next generation of an earlier concept. It is clear that no matter what they are called, these devices are actually products of "simultaneous innovation" – teams of scientists working on the same problems. Novak insists that to perpetuate and uphold the myth of the lone inventor is to ignore the diverse group that was necessary to create these devices.

Skill Practice 2

Read each paragraph and the claim that follows. Highlight the evidence that supports the claim in the paragraph. Underline any phrases that introduce the evidence.

1 Some of the best-known inventors of all time, including Alexander Graham Bell, Thomas Edison, and the Wright Brothers, began their research in some kind of home

laboratory: a basement workshop, a garden shed, or a kitchen. In the 1950s, this idea evolved into the popular notion that the lone engineer or computer technology expert "tinkered" in a garage or some other place where he could experiment with his own equipment and inventions. However, several modern technology theorists, such as physicist Eric D. Isaacs, assert that none of the greatest inventions of the past century were actually created in a garage. On the contrary, Isaacs points out that these creations were produced by research and development (R&D) teams working in spacious, multimillion-dollar laboratories. Although big companies such as Apple, Hewlett Packard (HP), Google, and Microsoft actually had their earliest origins in a garage, the fact is that their founders often used equipment provided by government or corporate money to get their start. According to tech blogger Jodi Lieberman, "all the real development work occurred in an investor- or government-funded, state-of-the-art lab." Lieberman agrees with Dr. Isaacs that Americans need to "let go of the garage myth" and embrace the fact that innovation clusters and brain hubs, where many exceptional minds work together, are the real homes of great inventions.

Claim: The greatest inventions of the last 100 years were the result of teams of scientists.

2 According to Evan I. Schwartz, in his biography of inventor and electronics wizard Philo Farnsworth, Farnsworth began "tinkering" at the age of 20 in a laboratory above his garage. Farnsworth's work started a ripple effect that would change the world forever. In 1927 he successfully demonstrated the first all-electronic television system, which was based on a design he drew in his high school chemistry class. From the late 1920s to the mid-1930s, Philo Farnsworth was engaged in legal battles with RCA, the corporate giant of the radio airwaves, to secure the rights to the *Television System.* RCA's leaders were determined to gain the rights, and employed Vladimir Zworykin to work simultaneously on a similar system. Zworykin visited Farnsworth's laboratory to view the device that Farnsworth had been tirelessly creating. Though Zworykin held patents for very similar devices, he was unable to produce a working television. After years of court cases against RCA, Farnsworth was finally granted the copyright, or patent. It was not until 1939 that RCA was able to sell their "electronic television cameras." During his lifetime, Farnsworth patented more than 130 different devices, mostly on his own. As the title of Schwartz's book implies, it is clear that Farnsworth was *The Last Lone Inventor.*

Claim: Philo Farnsworth was a lone inventor who should be credited with the invention of the modern television.

Connecting to the Topic

Discuss the following questions with a partner.

1 Look at the title. What do you think the reading will be about?
2 Do you work best in a group or on your own? Explain your answer.
3 Do individuals or teams make the best contributions to society? Explain your answer.
4 The "ripple effect" is a series of things that happen as a result of a particular action or event. How could it apply to inventions and new ideas? Give examples to support your answer.

Previewing and Predicting

You will understand a text more easily if you skim and scan for key words. Look for signal verbs and phrases like names, places, dates, or other facts. Scan for signal phrases in each paragraph.

A Read the first sentence of each paragraph in Reading 1 and scan for key words. Then read the questions. Write the number of the paragraph where you think you will find the answer to the question. The first one has been done for you.

PARAGRAPH	KEY WORDS AND PHRASES
4	Was Thomas Edison really a lone inventor?
	How did Steve Wozniak feel about working in a team?
	Did Steve Jobs think highly of customer feedback?
	What device influenced the development of the computer?
	How do technology specialists collect and measure data?
	How many cell phone and Internet users are there in the world?
	Do customers always give feedback?
	What are the origins of the Internet?
	Who invented the wireless telegraph?
	What do experts suggest is the best solution to the debate between working alone or in a team?

B Compare your answers with a partner's.

While You Read

As you read, stop at the end of each sentence that contains words in bold. Then follow the instructions in the box in the margin.

READING 1

Technology and the Individual

I. The Ripple Effect

1 Nearly 200 years before technology wizards[1] Steve Wozniak and Steve Jobs launched the Apple computer and changed how the world communicates, inventor Charles Babbage came up with a kind of engine that could mechanically perform calculations. This primitive calculator would become the precursor to modern electronic devices. Babbage's ambitious efforts made it possible for twentieth-century computers to evolve from performing complex calculations to being a means for everything from design to communication. Two centuries later, Babbage's original design for a calculator has evolved into something that today's computer users consider a simple "app." Many experts agree that without Babbage's early work, technology of the past century may have progressed much more **slowly**. It is no surprise then, that Babbage is often called the "father of the computer."

2 Similar to Babbage's accomplishments are the innovations of Italian physicist and radio pioneer[2], Guglielmo Marconi. In 1901, Marconi discovered a way to convey information signals around the world. This transatlantic transmission of radio signals – known as the wireless telegraph – was the first ripple in a wave that would develop into the Internet. It can be said that Marconi's research continues to inspire and support advancements in the field of communication and information technology. In 2014, the Marconi Society (founded by Marconi's daughter) gave its highest prize to India-born Arogyaswami Joseph Paulraj, of Stanford University in California, for his invention of a transmission system with multiple "antennae," or receivers. This revolutionary system is at the core of high speed Wi-Fi and Broadband networks, used by billions of people **worldwide**.

3 The invention of the Internet cannot be attributed to one person. Instead, several individuals share the **credit.** While researchers were creating a special email system (Ethernet) to be used among employees at the copier company Xerox PARC, other technology experts were simultaneously developing the infrastructure[3] of the Internet. This is known as Transmission Control Protocol/Internet Protocol (TCP/IP). In simple terms, TCP is a "layer" of transmission that manages the way data files are gathered, sent, and combined to create a message. The lower layer of this system is Internet Protocol (IP). IP ensures that the message gets to

WHILE YOU READ 1
Highlight a signal verb in this sentence that introduces a claim about technology.

WHILE YOU READ 2
Look back at paragraph 2 and highlight two claims.

WHILE YOU READ 3
The writer makes a claim in this sentence. Highlight the evidence for the claim.

[1] *wizard:* a genius or expert
[2] *pioneer:* a person who is among the first to develop or study an area of knowledge or scientific field
[3] *infrastructure:* the basic structure of a system that is necessary for its operation

the right destination. In the journey from wireless telegraph to wireless Internet, the inventions of Babbage and Marconi were significant and necessary steps in the process, resulting in communication systems that could function and deliver messages effectively.

II. "Sheltered Innovation" vs. "Combinatorial Creativity" – Lone Worker or Team Player?

4 Thomas Edison's name may evoke an image of the stereotypical solitary inventor, working tirelessly in a laboratory to perfect the latest version of a device. This image, however, does not reflect the reality of Edison's world. In Menlo Park, New Jersey, Edison created his own "invention factory," a concept that companies in the "brain hubs" of California's Silicon Valley – the home of all things technological – have tried to imitate in their own workspaces. Edison's work environment could be considered the first research and development lab. Though he experienced long periods of working in isolation, he also collaborated with teams of specialists from all over the world. These technicians and machinists, whom he had invited to his facility, aided Edison in the process of producing and perfecting his devices.

5 It is not uncommon for an individual scientist or engineer to work alone at some point in time. This method of working independently to produce something original is often called *sheltered innovation*. Sheltered innovation allows the inventor to be creative without the influence of other scientists' ideas, while also evoking the nostalgic[4] image of the "garage inventor." Some technologists believe that this approach toward product development allows for more creativity. Steve Wozniak, co-creator of Apple/Mac computers, felt that inventors are like artists and work best alone. In the words of Wozniak, "I don't believe anything really revolutionary has ever been invented by a committee. . . I'm going to give you some advice that might be hard to take. . . Work alone. . . Not on a committee. Not on a team." Yet despite his statements, Wozniak was an integral part of the "brain hub" of **Silicon Valley**.

WHILE YOU READ 4

Highlight the transition words in this sentence that introduce evidence that contrasts with claims in the previous quotation.

6 Other Internet experts, however, like Steven Johnson, author of *Where Good Ideas Come From*, assert a different approach to creativity. Johnson contends that ideas must collide, or run into one another, which cannot happen while working **alone**. He refers to this collision of great minds as *combinatorial creativity*. This term was first defined by Margaret Boden, a pioneer researcher in artificial intelligence[5], cognitive and computer science, and psychology. She expressed combinatorial creativity as "the unusual combination of, or association between, familiar ideas. . . ." Boden, however, does not deny that working alone is significant to the creative

WHILE YOU READ 5

Highlight a signal verb in this sentence that introduces a claim.

[4] *nostalgic:* feeling pleasure and sadness at the same time when thinking about the past

[5] *artificial intelligence:* the use of computer programs that have similar qualities of the human mind, such as the ability to recognize language, pictures, and learn from experience

process. Her method somehow bridges that gap between the autonomous inventor, Steve Wozniak, and team player, Steven Johnson.

III. How Are We Doing?: The Individual and Feedback

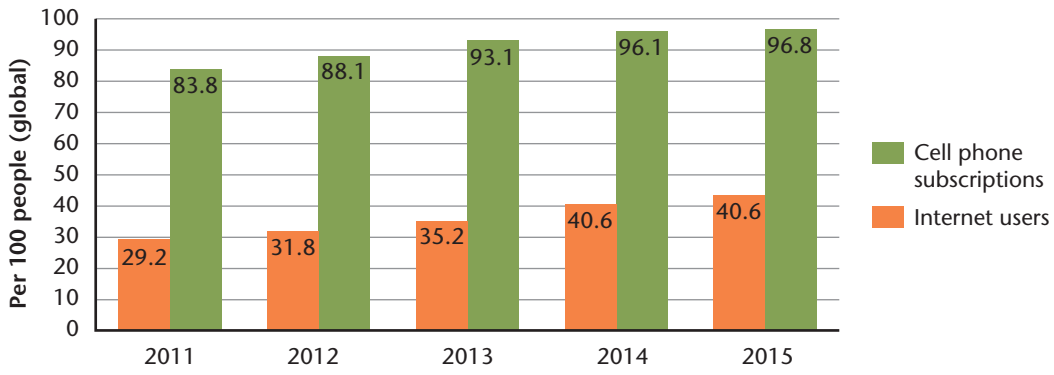
7 Whether innovative undertakings are pursued by an individual or a group, there is no doubt that the globalization of technology has created a shift in the way individuals communicate, work, socialize, and conduct business. From face-to-face meetings and telephone conversations to texting, video chats, and web-based discussions, the world wants and needs immediate access to it all. This rapid progress in technological development has an impact on people in ways that are both observable and measurable. According to a global study, while more than 90 percent of the world's population own cell phones, more than 3 billion people are Internet subscribers. And that number continues to grow. These statistics also raise a number of questions regarding the development of products or services and the individual: With such a high number of users, can an individual user affect how a new device can be improved? How do technologists get feedback from individuals, and what do they really think about it?

8 In 1997, when asked about using customer feedback, Apple co-founder Steve Jobs admitted that he viewed user feedback as an impediment to enhancing Apple products and devices, and placed little value on using focus groups. Jobs claimed that "a lot of times, people don't know what they want until you show it to them." Jobs, like his partner Steve Wozniak, was a supporter of working in isolation.

9 For users to have any influence on modifications or changes to a device, they must communicate information and opinions to the developers. This is generally done through surveys, comments, or direct communication through a company's marketing system. Most technologists get a head start on feedback by testing services or products before they are released to the public.

10 When technologists truly desire feedback from users for the development of a product or the improvement of a system, they conduct their final

Figure 1.1 Internet and Cell Phone Use



stage of product testing known as *beta testing*. Beta testing is a common term used to describe a partnership between companies and potential customers who are willing to try out the product free of charge. Beta testing exists in almost every aspect of technology and the sciences. For example, before launching a new website, a heuristic, or "rule of thumb," evaluation is established to make sure that the website meets the needs of its target audience. This process determines usability factors[6] and compares that data against certain principles. Usability testing is often conducted by interview over the phone or computer while users simultaneously test features of the website or a product. Researchers who conduct these interviews must adhere to specific guidelines to avoid influencing the user in any way. They are encouraged to remain silent, let the user speak freely, and be detached and objective during the conversation. These are the types of activities that can occur in companies located in European innovation clusters, where customers play a significant role in the R&D process.

11 Companies often invite users to participate in focus groups – small groups of people who represent a particular demographic[7] of the population – but there are advantages and disadvantages to beta testing and collecting feedback from individual users. Because of the lack of anonymity in a focus group – everyone in the group sees and hears what each participant has to say – people are not always willing to voice honest opinions. Though a focus group is generally the more reliable method, the results may be unpredictable. In addition, if people do not have an incentive, they are not always willing to participate in a focus group or answer a survey. Besides, what Steve Jobs contended has at times proven true: consumers do not always know what they want until they see the **product**.

A focus group

WHILE YOU READ 6

What is the main idea of paragraph 11? Highlight it.

12 From computers to mobile devices, the technology we use today is the direct result of generations of engineers, inventors, and technologists. Their efforts, whether they started out in garages or developed in "brain hubs," have individually and collectively affected our lives. From the minds of these inventors to the hands of the users, from tangible[8] devices to invisible signals, the development cycle of technology ripples from the world of one to the universe of many.

[6] *usability factors:* characteristics of the degree to which something is easy to use
[7] *demographic:* a population's size, age, education, and other characteristics
[8] *tangible:* real and able to be shown or touched

Main Idea Check

Here are the main ideas from five paragraphs in Reading 1. Match each paragraph to its main idea. Write the number of the paragraph on the blank line.

_____ **A** Before a product reaches the market, objectively gathering data from customers is an important step in the research and development process.

_____ **B** The truth is that none of Edison's great inventions were created in a garage or exclusively by him.

_____ **C** The inventions of nineteenth-century scientists influenced the evolution of the Internet and computer systems.

_____ **D** Some scientists find the need to work independently of others at some point in their research.

_____ **E** Through participation of customers in face-to-face situations, companies are able to collect information about their products.

A Closer Look

Look back at Reading 1 to answer the following questions.

1 Why does the writer discuss the early work of Charles Babbage?

a To support a claim that Babbage's research had an effect on the modern computer
b To give evidence of how technology has evolved over 200 years
c To offer proof that nineteenth-century devices have become useless
d To supply background information on the computer

2 Two scientists are credited with the development of Internet Protocols. **True or False?**

3 According to the reading, which of the following is true? Choose all that apply.

a Johnson argues that great inventors cannot work by themselves.
b Steve Wozniak's views support the concept of *sheltered innovation.*
c Experts agree that creative ideas have been the product of teams of great thinkers.
d Boden believes that inventors who work independently cannot produce creative ideas.

4 Steven Johnson believes that the concept of *sheltered innovation* is better for technology than working in teams. **True or False?**

5 What is true about the globalization of technology? Choose all that apply.

a It has changed the way people communicate.
b Technological advancements happen too quickly to measure.
c Many people can now use video chat instead of talking face-to-face.
d The number of Internet and cell phone users is growing rapidly.

6 What is Steve Jobs's opinion of customer feedback?

a He believed that people never knew what they wanted.
b He thought that collecting surveys was a good use of his time.
c He felt that people needed to see a device before they realized they wanted it.
d He did not place any value on the opinions of his customers.

7 Which statement best supports the writer's point of view about technology?

a The Internet and most devices have evolved because of Edison's early work.
b The wireless telegraph could not have influenced how the Internet developed.
c The best way for technology to develop is for inventors to work alone.
d Regardless of how or where inventions are created, each discovery makes an impact on the other.

Skill Review

In Skills and Strategies 1, you learned to identify claims and evidence in a text. One way is to look for signal verbs and phrases that introduce claims and evidence. Identifying claims and evidence will help with overall comprehension of academic texts.

A Review Reading 1. Match the claim in the middle column with its evidence. Then write the number of the paragraph that contains each claim in the column on the left. The first one has been done for you.

PARAGRAPH	CLAIM	EVIDENCE
10	__d__ Technologists consider user feedback essential to the development of a product.	a In a focus group, the fact that people are seen and heard by the other participants can affect their responses.
	_____ Messages can be conveyed and received over the Internet.	b Scientists and researchers from all over the world worked together at his "invention factory."
	_____ The globalization of technology has changed how people communicate.	c Margaret Boden's theories bridge the gap between the two points of view.
	_____ Steve Wozniak's point of view about working alone does not reflect the reality of his business.	d Beta testing enables customers to participate in the R&D process.

	_____ Customers do not always provide accurate feedback.	e There are two protocol layers that make sure data is collected and sent to the right place.
	_____ Thomas Edison probably started the first research and development lab.	f The Apple team was located in the "brain hub" of Silicon Valley.
	_____ New ideas do not always happen exclusively in isolation or on teams.	g Approximately 90 percent of the world's population uses a cell phone.

B **Compare your answers with a partner's. Discuss any differences you have.**

Definitions

Find the words in Reading 1 that are similar to the definitions below.

1 something that comes before another and influences its development (*n*) Par. 1
2 new ideas or methods (*n pl*) Par. 2
3 the act of sending a signal or message (*n*) Par. 2
4 groups formed from parts connected together (*n pl*) Par. 2
5 to say or think that something is the result or work of something else (*v*) Par. 3
6 existing or acting separately from other things or people (*adj*) Par. 6
7 efforts to do a difficult job (*n pl*) Par. 7
8 a strong effect on a situation or person (*n*) Par. 7
9 something that makes progress difficult or impossible (*n*) Par. 8
10 a situation in which a person is not known by name (*n*) Par. 11

Words in Context

Complete the passages with words or phrases from Reading 1 in the box below.

asserts	guidelines	imitate	rule of thumb	stereotypical
conveys	head start	revolutionary	simultaneously	target audience

1 The _____ concept of the lone inventor is slowly changing.
2 Automobile companies follow specific _____ to ensure that a new vehicle is safe.
3 Companies should consider their _____ and collect feedback before launching a product.
4 Technology experts use a / an _____ to measure results and collect data.
5 At its most basic level, wireless technology _____ voice and data signals without wires or cables.
6 The _____ ideas of the earlier inventors have influenced modern scientists.
7 Summer internships at local businesses can help college students get a _____ on their careers.
8 Many technology experts were working _____ on the development of the Internet.
9 Steven Johnson _____ that ideas must collide, and that working alone is not productive.
10 Some scientists believe that technology developments _____ nature.

Critical Thinking

In Reading 1, the writer offers various arguments for where technological innovations take place (brain hubs, innovation clusters, or garages/workshops), who created them (lone inventor or collaborative team), and how they developed (with feedback or not).

UNDERSTANDING POINT OF VIEW

Writers can present more than one point of view on an issue. They may explain why this point of view is preferable or leave that judgment to the reader.

A Read the following statements. Decide whether the writer opposes, is neutral about, or supports the statement. Then put a check (✓) in the appropriate column.

STATEMENT	OPPOSES	NEUTRAL	SUPPORTS
The computer and Internet would not be possible without the work of Babbage or Marconi.			
Where an inventor creates devices is not significant to the final product.			
Steve Jobs and Steve Wozniak succeeded because they preferred working without customer feedback.			
Margaret Boden's theories on how creativity works offer the best solution to the controversy.			
Innovations in technology create a ripple effect because each one influences the other.			

B Compare your answers with a partner's. Explain your opinions.

Research

Choose an innovative idea or invention that is not mentioned in Reading 1. Find answers to the following questions:

- What is the significance of the invention?
- Who is credited with the invention?
- How was the invention or device perceived by the public?
- How did it develop over time?
- Where was the device developed?

Writing

Write two to three short paragraphs on one technological innovation or invention. Argue whether or not you think the device was created by one individual (*sheltered innovation*) or was the product of a team using *combinatorial creativity.*

Connecting to the Topic

Discuss the following questions with a partner.

1 Have you ever played an interactive video game? Which one?
2 Do you think games can be good for you?
3 What are possible reasons for playing video or online games other than entertainment?
4 What do you think "gamification" is?

Previewing and Predicting

Scanning the first sentence or two of each paragraph for key words or phrases will help you comprehend the main idea of each paragraph as well as the overall gist of the passage.

A Quickly read the first two sentences of each paragraph in Reading 2. Decide what the topic of the paragraph will be. Then read the following topics. Write the number of the paragraph next to the topic that best describes it. The first one has been done for you.

PARAGRAPH	TOPIC
3	While wearing special headgear, patients are able to play games against avatars.
	Virtual reality (VR) games can be used for physical rehabilitation by people of any age.
	Immersive learning in the classroom may help students remember more than learning in traditional ways does.
	Patients who used VR games experienced positive physical and mental effects.
	People used to think that VR could only exist in a science fiction film.
	The concept of a virtual classroom has the potential to expand people's educational opportunities.
	A special space that gives its users a 3D experience has been created.

B Compare your answers with a partner's.

While You Read

As you read, stop at the end of each sentence that contains words in bold. Then follow the instructions in the box in the margin.

READING 2

Virtual Reality and Its Real-World Applications

I. Introduction

1 Daniel is competing in a game of Ping Pong against a young woman named Angela. The sound of the ball echoes as it is volleyed back and forth. It's the final point of the match. Angela has a determined look on her face as she prepares to deliver her final serve. As she makes her last great effort, Daniel moves toward the right corner of the table to return her shot and . . . he wins! This might seem like an ordinary scenario, except for the fact that Daniel's opponent, Angela, is really an avatar[1], and Daniel is 40 years old. He has been playing in a computer-generated[2] world made possible by new technology embedded in a special pair of glasses, and his objective is to improve the range of movement in his right arm.

2 It might sound more like science fiction than fact, but the concept of "virtual worlds" has been a reality for over 20 years. This new digitally enhanced[3] universe – where the user experiences the sensation of being "inside a computer-generated environment" – is no longer limited to the entertainment industry or video games. Instead, virtual reality (VR) has "morphed" into something with multiple uses. To comprehend how VR has evolved into this new model, it is important to note the various settings in which VR now has "real world" practical applications. VR and gamification[4] are changing the way modern society approaches challenges in everything from medicine to **education**.

WHILE YOU READ 1

Look back at paragraphs 1 and 2. Highlight the sentence that best states the main claim (thesis) of the reading.

II. Background: The VR Environment

3 When Daniel enters the small white room, the first thing he notices is the technology-covered walls. On each side are in-sight cameras that capture motion from every angle, 3D motion controllers[5], and three wide-screen High Definition (HD) TVs that project finely detailed images. However, among these familiar items is also the latest innovation of VR: the "headset." VR headsets are based on an old concept – like the visors worn in Sci-Fi movies from the 1980s and '90s, *Tron* or *The Matrix*.

[1] *avatar:* a character or creature that you create to represent yourself in a computer game or on the Internet
[2] *computer-generated:* designed or produced using a computer program
[3] *digitally enhanced:* improved upon by use of technology or computer
[4] *gamification:* creation of a game-like environment in nongaming contexts to encourage users to learn or solve problems
[5] *motion controller:* a device that controls the movement of other objects

But this is neither a movie set nor an electronics showcase: This is a CAVE – a Cave Automatic Virtual Environment – located in a center for outpatient[6] rehabilitation.

III. The Cave Automatic Virtual Environment

4 In VR, simulation is the ability to create an environment that closely resembles the real world and allows the user to interact with that world. The user must be "immersed," much like the heroes of Sci-Fi films; as soon as the visor is placed over the eyes, the player is drawn into the computer universe. By using these special headsets or head-mounted displays (HMDs), the experience and sensations of the user are heightened. In the CAVE, a user is able to see in 3D, while observers who are not wearing visors see a typical 2D screen. Through this unique eyewear, the user perceives an "alternate world," and experiences a point of view that exists outside the real world. Though the process of immersion usually begins with physical rather than mental immersion, as seen in the following case studies, its applications are diverse and have been used successfully in both aspects.

Virtual reality headset

IV. Case Study 1: Physical Rehabilitation with Console- or Desktop-Based VR

5 First launched in 2006, the Nintendo Wii is a console-based[7] video game device that requires no special eyewear. Attached to a television monitor, the Wii offers an interactive form of technology through its gaming controls equipped with motion sensors. An occupational therapist (OT) specializes in helping patients with injuries, diseases, or disabilities through the use of everyday activities. The OT's approach is a mind-body treatment: they work with physical and psychological aspects of a patient's life. Many times the therapist will help the patient by focusing on things like motor skills and coordination. In this part of the case study, patients played games on the Nintendo Wii to work on strengthening weak muscles or improving balance. This could be accomplished through completing simple tasks like the repetitive movement of hitting a Ping-Pong ball or swinging a golf club. Patients who participated in the VR rehabilitation study were encouraged to use gaming modules, like the Wii, throughout their course of treatment at the center, as well as at home.

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[6] *outpatient:* referring to a person who receives medical care from a hospital but does not stay there overnight

[7] *console:* a special box or cabinet that contains electronic equipment like a video game or TV

6 In the first part of the two-part study, occupational therapists interviewed ten male patients with spinal cord[8] injuries, ranging in age from their mid-twenties to mid-fifties. Three to six months after these participants had sustained[9] their injuries, the patients began a course of treatment using console-based VR games. At the end of this period, interviews were conducted with each patient via a 45-point questionnaire. The therapists were also required to complete a special survey regarding their experiences using VR with patients. Then in the second part, the study was conducted again with the same patients, but this time using personal computers (PC) as the gaming platform. The rationale for testing the VR experience on a PC was to determine whether it would be simpler or more convenient than the console-based model.

7 The results of the two-part study proved to be significant. Playing VR games not only improved the patients' endurance and physical movement, but also gave the patients a sense of motivation that they had not experienced before. Patients who had little to no knowledge of computer technology were able to learn and use the VR games quickly and with little effort. Moreover, the games did not cause the patients any added discomfort or pain, and helped them maintain a sense of **independence**. In the second part of the study, patients played PC-based VR games and completed a similar questionnaire. The results mirrored those of the console-based study except for the fact that the desktop PC was easier to operate or transport, whereas the console-based games were stationary.

WHILE YOU READ 2

Reread the beginning of the paragraph. Highlight evidence that supports the claim in the first sentence.

V. Case Study 2: Using VR in Education

8 Imagine students all over the world, sitting in front of computers wearing VR headsets and taking a class at the same time. This desktop-based method of VR enables the learner to have a certain amount of autonomy in that each person can take the class from the comfort of home. Online learning has changed how educators think about the classroom and has afforded instructors an easy-access way to teach without having to be in the same room with their students. Yet for all its apparent contradictions, online learning also seems like the natural, next step in the evolution of **education**. The MOOC (Massive Open Online Course) is one way of making a class available to more than 100 students at a time. This takes place via a desktop-based platform and affords the students the convenience of not having to travel or change time zones: a student in Canada can easily attend a course in the U.K.

WHILE YOU READ 3

Highlight an example in the paragraph that supports the claim in this sentence.

9 Developed by Linden Lab in 2003, the VR program *Second Life* allows people all over the world to join and interact in a wide variety of ways. Within the computer program, teachers are able to set up their own classrooms. Each student who wishes to join the class can design an avatar to

[8] *spinal cord:* the set of nerves inside the spine that connect the brain to other parts of the body

[9] *sustain:* to experience damage or loss

represent him- or herself. The instructor, in turn, creates a "virtual" classroom where the students' avatars enter the room, sit in class, and chat with one another. The instructor can lecture and give on-screen presentations, such as PowerPoint, and teach a class that simulates the real world. Though the technology is a bit more complicated than playing a video game on a console, the environment is vibrant and provides real-life experience for anyone who wants to study subjects like English online.

10 VR can also be useful in the physical classroom setting. Using an immersive 3D program called Chaotic Moon, students wear a VR headset and use a motion controller to experience the subjects they are studying. They can take a walk through the Amazon jungle and interact with its plants and animals, or even the people who live there. According to Chaotic Moon's CEO Ben Lamm, this is "i-learning" – immersive learning. Lamm claims that people remember 90 percent of what they do, but only half of what they hear, and 10 percent of what they **read**.

11 If what Lamm says is true, there will be countless opportunities for patients and learners to achieve their goals by playing VR games. Whether VR is used for rehabilitative or educational purposes, it is obvious that VR's practical applications expand far beyond entertainment. These "gamification" cases barely scratch the surface of the possibilities for virtual worlds in the **future**.

WHILE YOU READ 4

Highlight any signal verbs or phrases in paragraph 10 that introduce claims or evidence.

WHILE YOU READ 5

Reread paragraph 11. Highlight the claims the author makes about the future of VR games.

A student avatar in a virtual classroom

Main Idea Check

Match the main ideas below to five of the paragraphs in Reading 2. Write the number of the paragraph on the blank line.

_____ **A** Being completely involved in a 3D game helps the user engage all of their senses.

_____ **B** Online courses enable instructors to teach greater numbers of students without a physical classroom.

_____ **C** Games can have uses beyond simple entertainment.

_____ **D** Use of VR in a regular classroom can help expand student's abilities to retain information.

_____ **E** Therapists are helping people heal by using VR and video games.

A Closer Look

Look back at Reading 2 to answer the following questions.

1 Why is Daniel playing Ping Pong with Angela?
- **a** He wants to play against an avatar.
- **b** He needs to play for health reasons.
- **c** He's taking part in an experiment.
- **d** He's playing for educational purposes.

2 What is special about the VR headset?
- **a** It improves the vision of the player.
- **b** It is just like what was used in sci-fi movies.
- **c** It changes the user's perception of the real world.
- **d** It enables the player to have a three-dimensional experience.

3 In the CAVE, a user experiences a world that looks and feels real. **True or False?**

4 The writer describes different types of games for rehabilitation. Choose all that apply.
- **a** Games that are used from a device connected to a computer
- **b** Games that make users experience and interact in a movie
- **c** Interactive games that are played with controllers
- **d** Games that can be played via the Internet

5 Teaching classes online is an interesting concept, but one that is unlikely to change traditional education. **True or False?**

6 What is true about using Second Life for teaching online classes? Choose all that apply.
- **a** Users can interact with each other and the instructor in a realistic environment.
- **b** Students can have a learning experience online similar to that of a physical classroom.
- **c** Online classes are usually more complicated than regular classes.
- **d** Teachers are still able to make presentations and talk to students.

7 What is true about the effect of immersive learning (i-learning) on individuals?

a It enables students to be fully engaged and interact with what they are learning instead of just reading.
b Immersive learning helps students stay focused on what they are learning.
c Children can play games while they learn in order to remember more.
d Students will enjoy walking in nature more if they are wearing a headset.

8 What is the writer's prediction about the future of VR?

a It will be suitable for people who enjoy game playing when they learn.
b We have not even begun to explore the possibilities it has for educational purposes.
c It is likely that most people who use it will begin to remember things better.
d It does not matter whether VR is used for educational goals or not; people will like it.

Skill Review

In Skills and Strategies 1, you learned that writers make and support claims by providing evidence in a text. Writers use signal verbs and phrases to introduce claims.

A Reread the following paragraph from Reading 2. Choose the claim that is supported by evidence in the paragraph. Then highlight the evidence that supports this claim.

In the first part of the two-part study, occupational therapists interviewed ten male patients with spinal cord injuries, ranging in age from their mid-twenties to mid-fifties. Three to six months after these participants had sustained their injuries, the patients began a course of treatment using console-based VR games. At the end of this period, interviews were conducted with each patient via a 45-point questionnaire. The therapists were also required to complete a special survey regarding their experiences using VR with patients. Then in the second part, the study was conducted again with the same patients, but this time using personal computers (PC) as the gaming platform. The rationale for testing the VR experience on a PC was to determine whether it would be simpler or more convenient than the console-based model.

a Most patients lose interest in playing games after six months.
b Male patients between the ages of 25 to 55 are more likely to play video games.
c It is important for patients who participate in such studies to begin within a fairly short time after they are injured.
d Whether patients who are undergoing occupational therapy play games on their own computers or a VR console does not affect them.

B Compare your answers with a partner's.

Definitions

Find the words in Reading 2 that are similar to the definitions below.

1 a situation or description of possible events (*n*) Par. 1
2 existing or firmly attached within something (*adj*) Par. 1
3 to change gradually in appearance or form (*v*) Par. 2
4 to change or develop gradually (*v*) Par. 2
5 uses, particularly computer-related (*n pl*) Par. 2
6 the process of returning someone to a healthy or normal condition (*n*) Par. 3
7 a model of a real activity, created for training purposes (*n*) Par. 4
8 complete involvement in an activity (*n*) Par. 4
9 a device used for studying movements (*n*) Par. 5
10 the ability to make all parts of the body work together (*n*) Par. 5
11 expressed or happening in the same way many times (*adj*) Par. 5
12 pain, usually not severe (*n*) Par. 7
13 to make available or provide naturally (*v*) Par. 8
14 things that are opposite of what is said or done (*n pl*) Par. 8
15 to deal with only a superficial part of a subject of problem (*idiom*) Par 11

Synonyms

A Complete the sentences with words from Reading 2 in the box below. These words replace the words or phrases in parentheses, which are similar in meaning.

countless	echoes	mirrored	practical	stationary
drawn	heightened	platform	rationale	virtual

1 The bicycle remains (in place) _____, but the rider experiences the sensation of cycling through Ireland.
2 People can play video games on any type of gaming (hardware and software) _____.
3 During a VR experience, a user's sense of sight is usually (increased) _____.
4 There are (numerous) _____ texts and instant messages sent every day.
5 At the electronics store, the sound of six TVs playing at once (repeats) _____ through the showroom.
6 There are many (useful) _____ applications for using VR.

7 When a student's classroom experience is (almost real) _____, she will still be engaged and interested in learning.

8 One of the most interesting things about using VR is that the player feels as if he has been (pulled) _____ into the game.

9 When an instructor uses VR activities in a lab, what is on her computer is (reproduced) _____ on the screen in the class.

10 The (justification) _____ for teaching online is to make classes available to more people all over the world.

Academic Word List

You have already studied the words in the box in Vocabulary Development exercises in Readings 1 and 2 of this unit. These are particularly important words to study because they come from the Academic Word List – a list of words that frequently appear in academic texts. Use these words to complete the sentences. (For more on the Academic Word List, see page 299.)

attributed (*v*)	guidelines (*n*)	innovations (*n*)	scenario (*n*)	transmission (*n*)
evolve (*v*)	impact (*n*)	networks (*n*)	simulations (*n*)	undertaking (*n*)

1 The success of most technological _____ is often due to the efforts of an R&D team.

2 Managing online classes via the Internet is a serious _____ for any teacher.

3 NASA astronauts practice flight _____ before heading into space.

4 The invention of the world wide web (www) is _____ to Tim Berners-Lee.

5 To beta test new products, technologists follow certain _____ to ensure that data is objective.

6 The number of mobile _____ worldwide is not increasing as fast as the number of cell phone users.

7 It is not hard to envision a / an _____ where viewers can interact with TV programs and commercials.

8 Cell and mobile towers are responsible for the _____ of signals to a phone.

9 The "ripple effect" implies that ideas, designs, and products _____ over time because one influences the other.

10 The usefulness of VR and its educational purposes are likely to have a / an _____ on future generations.

Critical Thinking

Reading 1 presents perspectives about how we have perceived the development of technology and different points of view about inventors, inventions, and the places where ideas come to life. In Reading 2, you discovered innovative applications of Virtual Reality and gaming.

Based on what you read in this unit and your own knowledge, answer the questions below. Discuss with a partner.

SYNTHESIZING

Critical thinking includes connecting new information to information you learned in previous readings.

1 How has technology shaped the way we learn, find restaurants, get directions, and shop?

2 Can you think of other ways to make use of technology such as apps, gaming, or virtual reality?

3 Do you think brain hubs might influence how quickly new devices and games get created? Why or why not?

Research

Investigate new developments or innovations in technology and how they are used for more than entertainment purposes. These can be mobile apps, devices, or computer software programs.

- Who developed or created the innovations?
- How do they work?
- Who do you think will benefit the most from them? Why?

Writing

Your assignment is to write a short essay on innovations in technology. Discuss who came up with a new way to use an app or gaming for more than entertainment and describe how these innovations change the way we work, manage our health care, exercise, or learn.

A Preparing to Write

1 Look over your notes from your online research.

2 Review Readings 1 and 2. Highlight any information you think you would like to include in your report.

3 Organize your notes from your research and any information from Readings 1 and 2.

B Writing

1 Write an introductory paragraph about an innovation and include background information on its inventor.

2 Explain how you think this new technology might be used and who will benefit from it.

3 Include examples and evidence or arguments from your research to support your arguments.

4 Conclude with the supporting evidence and a restatement of your perspective about the innovation.

5 When you have finished your report, check it for grammar and spelling errors.

Improving Your Reading Speed

Good readers read quickly and still understand most of what they read.

A Read the instructions and strategies for Improving Your Reading Speed in Appendix 3 on page 316.

B Choose one of the readings in this unit. Read it without stopping. Time how long it takes you to finish the text in minutes and seconds. Enter the time in the chart on page 317. Then calculate your reading speed in number of words per minute.