Chapter 6
Web-Based Content Resources

Learning Outcomes

After reading this chapter and completing the learning activities, you should be able to:

6.1 Identify strategic procedures that allow teachers and students to navigate the web efficiently to find resources to meet various educational needs. (ISTE Standards for Educators: 3—Citizen; 6—Facilitator)

6.2 Explain how learning digital citizenship skills helps teachers and students address each of the safety, security, and privacy challenges they are likely to encounter in an online environment. (ISTE Standards for Educators: 3—Citizen; 6—Facilitator)

6.3 Develop information literacy practices through targeted online search strategies and information analysis techniques. (ISTE Standards for Educators: 3—Citizen; 5—Designer; 6—Facilitator)

6.4 Locate archived, immersive, and live web content to meet various educational needs. (ISTE Standards for Educators: 4—Collaborator; 5—Designer; 6—Facilitator)

6.5 Explain the benefits and challenges of locating and using open educational resources (OER) in educational contexts. (ISTE Standards for Educators: 3—Citizen; 4—Collaborator; 5—Designer; 6—Facilitator)

6.6 Apply evaluation criteria to determine the ease or difficulty of integrating web content in instruction. (ISTE Standards for Educators: 1—Learner; 2—Leader; 5—Designer)

Technology Integration In Action: A Research Paper

GRADE LEVEL: High school

CONTENT AREA/TOPIC: Research, information literacy skills

LENGTH OF TIME: Nine weeks

PHASE 1 Analysis of Learning and Teaching Assets and Needs

Step 1: Analyze problems of practice (POPs)

Ms. Almon is the library media specialist at Werebest High School. One of her tasks is to help all teachers and students use the library and web resources effectively for student research. Over the years, she has compiled a substantial collection of handouts, lists of sources, and assessment materials, which she copied, placed in notebooks, and updated periodically. However, she and the teachers agreed that getting students to use these notebooks was difficult. Students and teachers wanted a more digital approach that allowed more simultaneous and all day, every day (24/7) guidance for the use of research resources.

Step 2: Assess technological resources of students, families, teachers, and the school

Ms. Almon recently attended a district workshop on free website development resources for the district's and schools' website. She noticed that many of the teachers were developing websites for their classes where they made announcements, posted links and homework, and even communicated with parents. The district has a bring your own device (BYOD) policy, so students bring their own devices to school to support their learning. They all had begun to navigate these emerging school websites.

Step 3: Identify technological possibilities

As she and the teachers talked about this situation, they agreed that it would be optimal to have research support materials available on a website that students could access 24/7 and could be easily updated and the research resources would be consistent across all classes. They also decided that they would use this site and a set of video tutorials to structure a series of teaching activities to help students complete upcoming research assignments. The district IT specialist agreed to help Ms. Almon design and create the site on the district web system. Ms. Almon wanted to organize the website content around the "Big6" information literacy skills (Big6 Skills Overview, n.d.).

PHASE 2 Design of the Integration Framework

Step 4: Decide on learning objectives and assessments

Ms. Almon and the teachers decided they would also structure their assessments around the Big6 information literacy skills. To make sure that all teachers structured students' learning in the same way, they agreed on objectives for each of these skill areas and created assessment methods to measure each. They also decided to measure student attitudes toward research and writing. The outcomes, objectives, and assessments they decided on included:

Big6 information skills 1–3

Outcome: Define, search for, and acquire information.

- **Objective:** Students will identify a topic for a research paper, use the library website to identify and select optimal sources for information related to the topic, and acquire the items of information.
- **Assessment:** Checklist of required tasks and products from information searches.

Big6 information skills 4–6

Outcome: Use, synthesize, and evaluate information.

- **Objective:** Students will write a summary analysis of the information in each item they locate, write a synthesis of all information, and prepare an outline of the points they will emphasize in their research papers.
- **Assessment:** Checklist of required tasks and products from information analyses; final paper.

Outcome: Write a research paper.

- **Objective:** Students will achieve a rubric score of at least 15 of 20 possible points on an assigned research paper.
- **Assessment:** Rubric on research paper content, structure, mechanics, and creativity.

(Continued)

Attitudes toward writing and research

Outcome: Demonstrate positive attitude toward research and writing.

- **Objective:** Students will demonstrate a good attitude toward the writing approach and research used in the project by reporting a rating of at least 45 of 50 possible points on an attitude survey.
- **Assessment:** Likert scale attitude survey.

Step 5: Design integration strategies and determine relative advantage

Ms. Almon and the teachers worked together to determine what they would place on the resource website and how students would use it. They organized the site by each of the six Big6 skills. For each skill area, they included:

- Short video tutorials on key aspects of the skill (e.g., how to select and narrow a research paper topic; how to use a graphic organizer to create a visual outline)
- Links to district-owned resources (e.g., library catalog, online databases, applicable software)
- Links to other helpful sites (e.g., Library of Congress)

The website and the tutorials aimed to make the teaching process more consistent across classes. They decided to recommend the following time frame for the research paper project:

Week 1: Introduce the project and identify a topic. All teachers introduce the research paper project by displaying the website to the whole class by using the interactive whiteboard. They review the steps, discuss the process (displaying some of the links at each step), show the first video tutorial, and help students select their research paper topics.

Weeks 2–3: Help students obtain information. The teachers show them how to use website links to optimally search for information related to their topic. One of the activities is deciding which type of resource to use. For resources that can best be found in the library, Ms. Almon shows students how to access them in the library media center as well as provides a video tutorial overview. Students use the website resources on their own devices, at the classroom workstation, or in the computer center.

Weeks 4–6: Help students analyze and synthesize information. The teachers help students critically review their information and make decisions on how to structure their paper and what to include in it. They show videos on graphic organizers and let students practice using these techniques.

Weeks 7–8: Write the papers. During this time, students complete most of the writing on their papers at home or in the library media center after school. Some teachers allocate class time for students to work in class and to review and give feedback on students' word-processed drafts.

Week 9: Make presentations. Students present their papers using the strategy selected by their teacher. Some prepare PowerPoint presentations to accompany their oral presentations; others create a video or a webpage.

Relative Advantage

After designing the new website and integration approach, Ms. Almon and her teaching colleagues determined the relative advantage by RATifying the research paper assignment with the new research website. See Figure 6.1 for the aspects of instruction, student learning, and curriculum that the teachers felt would be impacted by students using the research website and its resources. They recognized that the curricular goal of writing a research paper remained the same but identified how the website would amplify resource access for students and teachers. They felt there was relative advantage in creating the website and completing the lesson.

Figure 6.1 Ms. Almon's RATified Lesson

	Instruction	Learning	Curriculum
Replacement Technology is a different means to same end.			• Research paper assigned to students
Amplification Technology increases or intensifies efficiency, productivity, access, capabilities, etc., but the tasks stay fundamentally the same.	• Research resources easily updatable • All teachers and students can obtain similar research experience	• Students access research resources 24/7	• More awareness of available information sources for research
Transformation Technology redefines, restructures, reorganizes, changes, and creates novel solutions.			

Step 6: Prepare the instructional environment and implement lesson

The main preparation task for the project was creating the website and video tutorials and deciding what to include in each. However, Ms. Almon also had to coordinate the students' trips to the library media center. Preparation tasks included:

- **Creation of website content**—Ms. Almon and the teachers searched for the best resources to include, made a Bookmarks/Favorites file of the sites they found, and wrote the content of each of the six Big6 sections on the site. Ms. Almon compiled the materials into a website with the district IT specialist's help.
- **Video development**—The teachers also decided on six initial brief video tutorials to align with each Big6 stage: how to select a research paper topic, how to identify and use optimal library media center resources, how to create search queries, how to critically analyze information, how to create a graphic organizer, and the strategies for presenting a research paper. For most of these, they identified already existing videos that were licensed for reuse. They worked with the district to create one video specifically about their library resources. All the videos were embedded on the website.
- **PDF handout**—To make sure that students understand the assignment and have access to all resources, Ms. Almon created a PDF document that all teachers could give their students digitally. She also posted this handout on the website so that students could download it whenever they wished.
- **Library media center and computer lab scheduling**—Before students began work on the projects, the teachers scheduled time for their students in the lab and in the library media center.

PHASE 3 Post-Instruction Analysis and Revisions

Step 7: Analyze lesson results and impact

After all students completed their research papers, the teachers met to review the data they had collected. Students did moderately well on both sets of information skills. Student attitudes toward the writing process were moderate: About 75% of students rated it 20 points or more. Comments volunteered by students on their surveys indicated they would like more in-class time to revise their writing and more individual assistance with the revision process. Rubric scores on research papers were also generally good with noticeable improvement in the areas of structure and content. Scores on mechanics were lowest.

Step 8: Make revisions based on results

The teachers decided to create a set of writing exercises to give students more concentrated practice on critical analysis and synthesis skills before having them write summaries. The teachers also decided to target one or two mechanics skills for special practice with word-processed exercises. All the teachers agreed that the website and video tutorials had been critical focal points in making instruction across classes more consistent and easier to follow. They planned to add more resources and supports to increase students' information literacy skills even more.

Step 9: Share lessons, revisions, and outcomes with other peer teachers

Ms. Almon met with the librarians from the elementary and middle schools in the district to share her resources and explain the lesson's outcomes. The district decided to duplicate the resources for each library, and Ms. Almon was hired to lead a summer workshop for the librarians and some teachers on how to identify key research resources matched to their students' developmental needs.

Based on concepts from "So You Have to Do a Research Project?" from East Greenwich Public Schools.

Introduction

Most of us cannot remember a time when cell phones and social media were not the norm, when we couldn't "Google" something we did not know or had forgotten, or when communicating with mobile devices was not a daily activity. Even in the rapid environment of technological evolution, remarkable changes in communications have come about with incredible speed. Some resources have gone from possible to pervasive in only a few years. These changes are not slowing down.

The primary reason for this breathtaking revolution in communications is society's recognition of the importance of ready access to people and resources. If "knowledge is power," as Francis Bacon said, then communication is freedom—freedom for people to reach information they need in order to acquire knowledge that can empower them. This

heady freedom permeates the atmosphere of a 21st-century information and knowledge society. The development that made this revolution possible is the emergence of an online, web-based environment. This chapter, the first of three that focus on how affordances of the Internet's web have contributed to the development of resources and activities that support blended and online learning, reviews how the online web environment emerged and how teachers and students can harness it to find and use subject area content.

Introduction to the Web

We inherited our online world from a U.S. Department of Defense (DOD) project that developed the first version of the Internet during the 1970s. Its purpose was to allow quick communication among researchers working on DOD projects in about 30 locations. The DOD also saw it as a way to continue communications among these important defense sites in the event of a worldwide catastrophe such as a nuclear attack. Because these projects were funded by the DOD's Advanced Research Projects Agency (ARPA), the network was originally called **ARPANET**.

In the 1980s, just as desktop computers were becoming common, the National Science Foundation funded a high-speed connection among university centers based on the ARPANET structure. By connecting their individual networks, universities could communicate and exchange information in the same way the DOD's projects had. However, these new connections had an additional, unexpected benefit. A person accessing a university network from home or school could also get access to any site connected to that network. This connection began to be called a gateway to all networks, and what we now call the Internet was born. Although most people think of the Internet as synonymous with the **World Wide Web (WWW)**, the latter really is a subset of the Internet system that emerged around 1993 with the development of browser software, such as America Online (AOL) and Netscape. The WWW is an Internet service that links sites around the world through **hypertext**, texts that contain links to other texts. Every day many people use a **web browser** or software, such as Firefox, Internet Explorer, Safari, and Chrome, that allows users to load websites that are connected to each other via the WWW, and in this way, they "navigate" around the Internet from site to site. Now people generally refer to the WWW simply as the *web* and web browsers as *browsers*.

The web's capabilities and characteristics in the years since invention have expanded, which can be described as follows:

- **Web 1.0**—The first iteration of the web, called the "Read only web," facilitated users reading web content that experts created. It significantly changed access to information for people with Internet access.
- **Web 2.0**—Technologies allowed any user to create content for the web through social media technologies. Thus, it became knows as the "Read/Write web" or the "social web" as users engaged in participatory, interactive activity that generated content.
- **Web 3.0**—Advancements that connect data increased knowledge sharing across platforms or devices and characterize this phase called the "semantic web" because smart systems used data to understand users' personal likes/dislikes and make in-system and across-system recommendations.
- **Internet of Things (IoT)**—Physical things became "smart objects" when information was collected by embedded processors or sensors and communicated via the Internet to other things, resources, or people. Schools have begun to examine how IoT can make schools "smarter" (Conlan, 2016).

Mobile devices have further accelerated this trend toward storing and accessing information and communicating online. Anyone with a device such as a smartphone, tablet, or wearable technology can communicate with individuals in other locations and can access course spaces from wherever they are.

Figure 6.2 Parts of a URL

1. Each web page address begins with an **http://**, which stands for Hypertext Transfer Protocol. (Secure websites begin with an **https://** to designate a secure server.) The **http://** or **https://** shows that an Internet address will follow. When typing in a URL, you do not need to type the http:// prefix into the address bar.
2. Typically, the next set of letters or numbers separated by dots (periods) reveals the owner of the site. If you look at the letters after the last period, you will find the domain designator, a suffix that tells what kind of group owns the server. This group is **.gov**, a website of the U.S. government.
3. The domain name is the designation for the computer or server to which you connect. The domain server here is called **nasa**, which shows that it belongs to the National Aeronautical and Space Administration (NASA).
4. Large organizations often have more than one server or can split a large server into subdomains. When this is done, another word preceding the domain name can reveal a subdomain. In this example, there is a separate domain for the Science topics of NASA.
5. As you move through this website, the URL will change by adding a slash (/) and more letters or numbers (typically words) that indicate the names of content pages stored on this particular server.

Using Uniform Resource Locators (URLs)

Our use of the web depends on the use of common procedures, or Internet Protocols, that allow computers to communicate with each other despite differences in programs or operating systems. One important protocol is the manner of listing website addresses. Just about every home in the world has an address so that people can find it and make deliveries of mail and other items. Each place you "visit" on the web also has an address for many of the same reasons. Each address must be entered exactly with every punctuation mark in place, or it will not work.

Internet addresses are called **uniform resource locators (URLs)**. Look at the example URL shown in a browser window in Figure 6.2. The line where the URL is entered is called the address line. The last three letters in the address line constitute what is called a **domain designator**, a suffix that typically indicates the type of content one would find at the website. The U.S. nonprofit organization that sets up domain names is the Internet Corporation for Assigned Names and Numbers (ICANN). It has expanded domain designators (e.g., .org and .edu), which accommodate more domains and more multilingual domains. This expansion also increases the need for users to examine URLs carefully to gauge the source of information.

Methods for Navigating the Web

You can move around from website to website by using many different options described in the following sections.

NAVIGATING WITH LINKS You can move through the web by clicking or tapping **links** (also known as **hot links** or hot spots), text or images that have been programmed into the website to send your browser to another location on the web either within the site or to another website. All linked text or images provide some visual (or auditory for visually impaired users) feedback as a user moves the mouse over it, such as change

of color or a drop-down menu appearing. Use the following techniques to keep track of valuable site links:

- **Adding a Bookmark or Favorite**—You can organize website links in a browser-based list called a **Bookmarks file** (in Firefox, Safari, Chrome) or **Favorites file** (in Internet Explorer). Once at a website, go to the Bookmarks or Favorites menu at the top of the browser window and select "Bookmark/Favorite This Page."
- **Organizing Bookmarks or Favorites**—For optimal usefulness, organize your bookmarks/favorites into folders or subfolders. This can be done as you add them or at a later time.
- **Using an online organizer**—Websites such as Evernote, Bookmark Ninja, Instapaper, Historious, Delicious, Symbaloo (for early learners), Google Bookmarks, and Diigo allow users to access their favorite sites at any location by saving the website URLs online in one place.

NAVIGATING WITH BUTTONS Forward and Back buttons are available on browser menu bars. This has been the most common way to navigate back and forward to a previously viewed page.

NAVIGATING WITH BROWSER "HISTORY" Although not as common for navigation, every browser keeps a list of sites the user has visited under the "History" menu. The user can click and hold down the Back button to see the last few sites visited, scroll down to select a site name on the list, and navigate to it without having to retype a URL address into the address bar. The History menu will show you all sites visited chronologically since the last time (if ever) you cleared the history.

NAVIGATING WITH QUICK RESPONSE (QR) CODES With mobile devices, users can scan small, two-dimensional barcodelike images called **Quick Response (QR) codes** using a free QR code reader app, which immediately navigates to a website embedded in the QR code. Because of the reliance on a mobile device, QR codes are not as useful as a memorable URL. Teachers in mobile, one-to-one settings have used them to help students go quickly to online educational materials. To create QR codes, users can go to a free code-generator site such as Kaywa; QR code readers are needed to scan QR codes, and free code-reader apps can be downloaded from the Internet.

Downloading Software, Plug-Ins, and Apps

The web provides downloadable resources such as software, apps, extensions, and plug-ins or "player" programs that allow you to play interactive, multimedia websites. Some of these resources are usable with plug-ins already installed in your web browser. However, you might need to download updates to plug-ins or other resource materials.

DOWNLOADING COMPUTER SOFTWARE Most new computers come with a browser program already installed. However, browsers update frequently, adding new features, capabilities, and security protocols. Your computer or the browser often alerts you to a needed update. You should download newer versions of browsers from the Apple, Firefox, Microsoft, and Google websites.

Most computer software is now downloaded from the web and installed onto a computer instead of from media storage such as CDs. Before downloading software, be sure you are downloading content from a reputable website. Review the parts of the URL, as shown in Figure 6.2, and ensure that the domain parts are recognizable and that the website functions. Beware of URLs that are a series of numbers or resulting webpages that have spelling errors or do not have professional quality. Computer viruses are spread through software downloads and installation from nonreputable sources.

DOWNLOADING MOBILE APPS **App** is an abbreviation for application software and refers to any program specifically designed to run on mobile devices such as smartphones or tablets. Apps are designed exclusively for a given platform (e.g., Apple or Android). People use keyword or app name searches to locate apps in an app-finding program

Video Example 6.1 Using Apps in Schools

In this video, a principal describes several apps that teachers use in her school and recognizes the large app market.

on their smartphone or tablet or by using software such as Apple iTunes. Schools and districts that want their teachers to have access to apps identified as especially useful can use Apple's Volume Purchase Program (for Apple apps) and Google Play (for Android).

Once downloaded and installed, some apps interface with web-based databases to store or retrieve information about the user and the user's activity. Because apps are just programs that run primarily on handheld devices, they can fulfill many productivity or instructional software goals discussed in Chapter 4 and 5 or serve as a web-based resource as described in this and the following chapters.

DOWNLOADING PLUG-INS Web browsers enable visual, sound, and motion in web content. Special programs called **plug-ins** have been created to allow people to see and hear these multimedia features. Users should download a needed plug-in directly from the company website that created it. Five of the most commonly downloaded plug-ins are described here:

1. **Adobe Acrobat Reader**—Use this to see Portable Document Format (PDF) files. Many software programs (e.g., Word, PowerPoint, PhotoShop) allow content to be exported in PDF so that other users can view the work without the original software that created it.
2. **Java Virtual Machine (JVM)**—Some web content, such as simulations and digital manipulatives, is created as Java applets, and JVM allows them to load in a browser.
3. **Apple's QuickTime or Windows Media Player**—Videos that have been digitized and stored as movie files can be viewed through these plug-ins. QuickTime also allows viewing of 3-D virtual reality.
4. **Adobe Flash Player and Adobe Shockwave Player**—These will play animations (e.g., sliding menus, games, movies), .swf files, and some YouTube videos.
5. **Microsoft Silverlight**—This provides access to rich, interactive websites, such as some videoconferencing systems.

DOWNLOADING EXTENSIONS OR ADD-ONS **Extensions** or add-ons add functionality specifically for your web browser. Many add a menu or button in the menu area of your browser. Extensions are browser specific, so find the one for your browser. Some example extensions include:

- **Google Translate or gTranslate**—Translates web content in other languages to your primary language (a setting in the browser).

- **AdBlock Plus**—Blocks video ads, Facebook ads, banners, and more advertisements.
- **LastPass**—Manages passwords and logs-in to password-protected websites.
- **OneTab or TabCloud**—Saves and restores groups of browser window tabs as a set.
- **Grammarly**—Checks all typed content for spelling and grammar.
- **Bitly and Goo.gl**—Makes custom links with shortened URLs and QR codes, respectively.

Basic Web Troubleshooting

Like most technologies, when using the web, you could face errors and problems. Two of the most common difficulties for web users are discussed here.

PROBLEM TYPE 1: SITE CONNECTION FAILURES After entering the URL, the site won't come up on the screen; you could get an error such as "Page not found." This is the most common problem people encounter; it can occur because of URL syntax errors, problems with the local or domain server, bad links, or firewall issues. The error message for each problem indicates the cause.

- **URL syntax errors**—Each dot, punctuation mark, and letter in a URL has to be correct, or the site will not load. If the "Page not found" or "Error 404" message appears, check the URL syntax. Many URL errors occur in suffixes that follow the domain designator. Try omitting all suffixes beyond the slash and going directly to the main part of the URL. The main page could show the links you want, or the site can have a built-in site search engine you can use.
- **Local or domain server down**—If you have checked the URL syntax and are positive it is correct, it could be that the server that hosts the website is not working temporarily, could have a technical problem, or could simply be down for regular maintenance. Wait an hour or two, and try it again.
- **Server traffic**—A more rare cause of connection failures is that the server handling web traffic for the network or for users in the geographic region is not working properly. Error messages say: "Failure to resolve domain error. Try this site again later."; or "Page has no content."
- **Bad or dead links**—If a URL repeatedly fails to connect and you are sure the syntax is correct, the site could have been taken off the web. This is known as a *bad* or *dead link*. If this is the case, you could get the same error message given previously, or the site could provide a message that says: "Bad link."
- **Firewalls**—Sometimes a site will not connect because a network's firewall blocks it. If you think that your network's firewall is blocking your access to a site in error, contact your network administrator and request that this be adjusted.

PROBLEM TYPE 2: FEATURE ON THE SITE WILL NOT WORK If a website indicates that it has a special feature, such as a video or PDF that will not work, there are two possible causes:

- **Plug-in required**—If the website shows a box with a question mark in it, it could be that the computer does not have the special player program or plug-in required to play the video or see the document. Usually, if a special program such as an Adobe Acrobat PDF viewer is needed, the site will have a link to a location where you can download and install it on your computer.
- **Compatibility errors**—The web works because there are agreements in place about how to make various machines and programs "talk" to each other. However, sometimes differences exist between operating systems or versions of software that make them incompatible. One of the most recent problems is that Adobe Flash will not usually work on Apple devices such as the iPhone or iPad. This issue is the result of the lack of agreement between two companies on common standards.

Check Your Understanding 6.1

Online Safety and Digital Citizenship

Federal legislation provides some protections for students and youth in terms of their online practices. The Family Educational Rights and Privacy Act (FERPA) protects students' personally identifiable information and educational records through access rules for parents, students, and third parties (such as software companies). The Children's Online Privacy Protection Act (COPPA), established in 1998 and amended in 2012, aims to give parents control over what information is collected about children under the age of 13. Companies who collect information from children in their online or app-based software must comply with the policy. The Protection of Pupil Rights Amendment (PPRA) gives parents rights regarding the administration of surveys and data collection for marketing purposes that query several types of personal information, such as politics, sexual behavior, and religious affiliations among others. The Children's Internet Protection Act (CIPA), signed into law in 2000, is designed to ensure that libraries receiving federal e-rate funds take measures to keep children away from Internet materials that could be harmful to them, typically through web filters. In 2014, a Student Privacy Bill of Rights developed by Electronic Privacy Information Center (2014) gives students more control of their data, privacy, and security in ways that the federal legislation does not. This bill of rights focuses on allowing students (or parents) to access, amend, and limit data collection. It also expects that companies will use secure data collection practices, use data solely for educational (not marketing) purposes, provide transparent privacy policies, and hold schools and companies accountable for these rights. States are beginning to introduce and pass data privacy laws. For example, California's Student Online Personal Information Protection Act (SOPIPA), which went into effect in 2016, is being used as a model in other states. All of these laws shape policies and practices within schools in regard to safety and digital citizenship.

Online Safety and Security Issues

The web has its share of safety and security challenges, five of which are discussed here along with strategies that educators can use to make the online environment a safer place for teaching and learning.

ACCESSING SITES WITH INAPPROPRIATE MATERIALS The web has materials that parents and teachers might not want students to see either because they are inappropriate for an age level or because they contain information or images that some consider objectionable. Because online information is easily obtainable, such materials can be accessed all too easily by accident. Most schools have found that the best way to prevent access to sites with inappropriate materials is to install firewall hardware and/or filtering software on individual computers or on the school or district network that connects them to the Internet. **Firewall software** (e.g., Kaspersky or Symantec Norton 360) protects a computer from attempts by others to gain unauthorized access to it and prevents access to certain sites. **Filtering software** (e.g., Net Nanny) allows content filtering with parent controls to limit access to sites on the basis of keywords, a list of off-limit sites, or a combination of these. Although there are software and hardware to prevent students from accessing inappropriate material in schools, nothing is foolproof, so students also need to learn to self-monitor web content.

SAFETY AND SECURITY ISSUES FOR STUDENTS **Social networking sites (SNS)** are online locations that allow users to upload their own content, meet and connect with

friends from around the world, and share media and interests. Although most public SNSs are blocked in schools today, their dominance outside of school and the lack of experience that most students have can put them at special risk. For example, many pre-teens in the United States can sign up and use social network sites despite not meeting the minimum age requirement of 13 years old when they submit an older age because there are no confirmation processes for new users. Students can be impacted negatively in online social environments in many ways, and their privacy can be compromised in online educational environments. Following are some of the risk factors:

- **Online predators**—Many times young people tend to believe everything they hear and read. Therefore, in a variety of online discussion rooms or chat rooms (online locations where people can drop in and exchange messages in real time), they might not consider the possibility that a 12-year-old named "Mary" could actually be a 50-year-old man. Students should be instructed never to provide their names, addresses, or telephone numbers to any stranger they "meet" on the web, and they should report to teachers any people who try to get them to do so.
- **Marketing aimed at children**—Many websites have colorful, compelling images that entice people to act (e.g., buy things, complete surveys, sign up for newsletters). Henry Jenkins (2006) described this as the "transparency problem" in that technology users need to see how technology is not a neutral tool but influences us and the world in often invisible or taken-for-granted ways, which require critical thinking to discern. For example, some educational websites have extensive ads targeted toward children. Schools and teachers must also be sensitive to these sites and make students aware of the marketing messages implicit in them and possibly avoid their use.
- **Phishing**—Teachers and students must be vigilant to avoid offers and alerts that are **phishing** or **social engineering** attacks and emails, texts, or calls that claim to be from a legitimate organization, business, or government agency that ask for personal information that is actually used for information theft. For example, someone sends an email claiming to be from your school, saying that your account has been compromised; they send you to a site to enter and change your password. If you follow these instructions, they gain access to your password. No reputable organization asks its member to do this; all such requests should be viewed as phishing attempts and deleted. **Spear phishing** is another technique in which someone uses publically available information about a person to make it seem that the "phisher" knows that person and convinces him or her to provide private information.
- **Cyberbullying**—The practice of using technology to harass, threaten, embarrass, or target another person has become a serious problem with 20–40% of adolescents having been perpetrators or victims (Aboujaoude, Savage, Starcevic, & Salame, 2015; Kessel Schneider, O'Donnell, & Smith, 2015). **Cyberbullying** is different than face-to-face bullying because of increased incidence of individuals being both bully and victim, the ability for bullying to occur 24/7, and the permanence of online bullying activity. Several studies (Aboujaoude et al., 2015; Barlett & Coyne, 2014; Guo, 2016; Park, Na, & Kim, 2014; van Geel, Vedder, & Tanilon, 2014) indicate the following patterns:
  - Girls and sexual minorities (e.g., LGBQT) are at higher risk of being victims.
  - Bullies are more likely to be male.
  - Children with higher web activity are more likely to be involved in cyberbullying.
  - Both offline bullies and offline victims are more likely to be both online bullies *and* online victims.
  - People with serious psychological phobias, narcissism, and hostility have a high likelihood of being a bully, and negative self-beliefs are related to victimization.
  - Negative school climates influence more cyberbullying activity.
  - Cyberbullying has been linked to suicide.

Several sites, such as those sponsored by National Crime Prevention Council and Stop Bullying (U.S. Department of Health and Human Services), have been set up to document and combat this problem, but the first line of defense remains school-based programs to raise awareness among students of what constitutes bullying and cyberbullying and to teach how to respond if they observe or are a victim of this online mistreatment. Parent training, peer-support interventions, and establishment of a positive school climate are also helpful (DeSmet et al., 2015; Guo, 2016). Some schools offer students anonymous reporting tools, such as MySafeSchool and Cyber-Bully Hotline.

DATA PRIVACY ISSUES FOR STUDENTS Children must be taught how to monitor privacy policies and settings for online environments they can join, especially for "free" sites that they join outside of school with or without parent approval. They need to learn about how their personal data are being collected in various ways and can affect them in unknown ways in the future. Another privacy issue surrounds the use of **cookies**, or small text files placed on a hard drive when someone visits a website. The purpose of cookies is to provide the server with information that can help personalize web activity to the visitor's needs, but cookies also can track behavior on the web in ways that violate privacy. Students and teachers can learn how to manage cookies in ways that prevent unwanted tracking.

When teachers sign up for new online, cloud-based products, if they click "agree" without reading the legal text, they could unknowingly agree to Terms of Service and a privacy policy with an online software vendor that violates student data privacy by allowing data to flow out of the school and into these software companies (Abilock & Abilock, 2016). Therefore, if teachers independently adopt web products, they should be careful not to identify students with their names, addresses, and other personal information. Optimally, teachers should always check with their technology specialist. Both Abilock and Abilock (2016) and Smith and Mader (2014) emphasize the need for communication with and consent from parents for their children's use of online technologies. Schools can work to develop more transparent privacy policies and rationales for online software use.

ONLINE IDENTITY AND REPUTATION ISSUES The same online features that make information and media so easy to store and share also mean that they are not private, and, once shared, they have a permanent online presence. As many students, teachers, public officials, and others have learned to their distress, shared messages and media establish an online identity that, although perhaps is misleading, is difficult to change. For example, someone can post a **selfie**, or a self-taken photo, that reflects an undesirable image. A **digital footprint** is the trail that people leave behind as a result of their social media interactions (Careless, 2012). Because colleges and employers often review an individual's digital footprint before making decisions on applications, Cooper (2013) warns that students' decisions that create their digital footprint can have negative consequences for future higher education, employment, or even with the law. In light of this, teachers have to instruct students to evaluate carefully the potential impact of their digital actions on their online reputation.

COMPUTER VIRUSES AND HACKING Viruses are programs written for malicious purposes. Common ways that viruses infect your computer from the web are through email attachments and downloaded files, and computers can be hacked by others when a person connects with an insecure network.

- **Email attachments with viruses**—Email attachments can contain viruses, and when files are exchanged, many senders are not even aware that emails are being sent under their names. A virus programmed to attach itself to files on a computer can inadvertently be sent along with the file. When the person receiving the attachment opens it, the virus transfers to his or her computer.

Video Example 6.2 Digital Literacy: Creating Your Digital Footprint

Watch this video to understand how this principal and his teachers help teach students that appropriate use of technology is a 24/7 task.

- **Downloaded files and programs with viruses**—As with email attachments, viruses can attach themselves to files and programs and be received along with the item being downloaded. Download files and programs only from reputable websites. Figure 6.3 identifies strategies to address these virus problems.
- **Connecting to insecure networks**—As people move around the world with mobile devices, there is a constant stream of available **Wi-Fi** networks. Some, such as those from a school or with a payment gateway, are secured and require a password. Others are free Wi-Fi hotspots; by connecting with them, people provide access to their mobile device and data, such as everything they type or do while connected on the Wi-Fi. Recently, a fourth grader in Texas conducted a science experiment where more than 50% of people who connected to his free, mobile hot-spot accepted atrocious data use terms and conditions (Cargile, 2016). He concluded they did not read the terms, and he could have monitored all their data and use while connected.

Online Ethical and Legal Issues

Some online behaviors are risky not because they endanger students' safety or reputation but because they violate ethical and legal rules that could result in punishment. Two of these are plagiarism and piracy.

ONLINE PLAGIARISM **Online plagiarism** and **cybercheating** involve academic dishonesty in which someone uses another's work obtained from the web as her or his own. In an environment in which information is so readily available, students seldom realize that they cannot use text or images without attribution. Teaching students when and how to attribute their sources has become an essential skill for teachers to include in their instruction on how to do online research. Software such as TurnItIn is available to check students' work to ensure that they have not engaged in plagiarism. These programs can also identify essays that students purchase and reuse.

ONLINE PIRACY The free-flowing nature of online information and the ease with which students can locate it leads many students to the erroneous conclusion that everything they find online should be free. To ensure compliance with copyright laws, schools are making teachers and students aware of policies about copyright, **Creative Commons**, **acceptable usage policy (AUP)**, and guidelines for fair use of published

Figure 6.3 Strategies to Prevent Computer Viruses
Szasz-Fabian Jozsef/Shutterstock

materials. Creative Commons expands the ways that creative works can be shared and legally used through a range of licenses that vary in users' ability to copy, distribute, and remix content for various types of use. However, illegally downloading music, video, and documents remains a widespread problem. These practices are all considered **online piracy**.

Rules and Guidelines for Online Behavior: Digital Citizenship and Netiquette

In light of the safety issues, privacy challenges, and personal risks presented by online use, several standards have emerged for guiding online behavior for various situations. These fall under the general heading of fostering **digital citizenship**, or the responsible, civil, safe, and productive use of digital technologies, including communication and interactions via email, texting, social media, and the web (Young, 2014). Becoming a good digital citizen requires an array of skills, including netiquette concepts and rules of behavior in online learning environments. Because schools are increasingly asking students to use technology tools and go online, they are also tasked with teaching students all the digital citizenship concepts and skills described in this section.

TEACHING NETIQUETTE CONCEPTS The guidelines that govern civil, courteous behavior in online communications have become known as **netiquette**, a combination of *net* and *etiquette*. Netiquette is considered a subset of digital citizenship skills and covers rules of behavior for email, messaging, and discussions. Filippone and Survinsky (2016) argue for the need of email netiquette instruction and modeling for secondary students to increase positive relationships between students and teachers and to develop students' interpersonal communication skills. Furthermore, a research study by Park et al. (2014) found that children 12 to 15 years old who learned about netiquette with their parents had a negative correlation with cyberbullying activities. A summary of netiquette rules in Figure 6.4 is based on published sources (Filippone & Survinsky, 2016; Senning & Post, 2013). Roblyer (2015) has additional guidelines, the Rules for Online Learning Etiquette (the ROLE Model), to govern civil and constructive behavior in online courses, which include a rubric to guide and assess online discussions.

Figure 6.4 Netiquette: Rules for Good Manners in Digital Communications

Be courteous when using technologies to communicate:

- Silence device sounds when requested.
- Talk on phones in public only when permitted.
- When communicating with devices in public, be respectful of others by talking and texting quietly.

Include a subject line: Include a descriptive phrase in the subject line of the message header that tells the topic of the message (not just "Hi, there!").

Salutation and closing: Begin messages with a salutation including formal name: Dr. Karu, Ms. Welch. End the message with your name and possibly a signature (a footer with your identifying information).

Tone:

- Avoid sarcasm because social context clues are missing and the meaning could be misinterpreted.
- Avoid accusatory, coarse, rough, or rude tone or language.

Content:

- Keep messages as concise as possible—about one screen as a rule of thumb. Complicated questions that require lengthy responses should be asked in person or on the phone if possible.
- Observe formal grammar and spelling rules.
- Avoid using emoticons (emotion icons) or social media abbreviations (e.g., LOL) to convey meaning in emails.
- Avoid typing words or sentences in all caps, which denotes "flaming" or online "screaming."

Respect others' privacy: Do not quote or forward personal email without the original author's permission.

Acknowledge and return messages promptly: Allow up to two working days for a response from working adults.

Use carbon copy (CC) with caution: Don't copy everyone you know on each message.

Avoid spam (a.k.a. junk mail): Don't contribute worthless information on the Internet by sending or responding to mass postings of chain letters, rumors, etc.

TEACHING DIGITAL CITIZENSHIP CONCEPTS The key to promoting online safety and appropriate online behavior is instruction in digital citizenship. Common Sense Media's *Digital Compass* provides a free online curriculum on digital citizenship for middle school. It contains sets of standards and objectives, lesson plans, and assessments matched to eight topics in its scope and sequence. It also offers professional development and certification for teachers and schools. Students learn about each topic in a game set within an interactive story with decisions that affect its resolution:

- **Information literacy**—Identifying, locating, evaluating, and using information effectively; evaluating the quality, credibility, and validity of websites; and giving proper credit.
- **Privacy and security**—Managing online information and keeping it secure by creating strong passwords, avoiding scams and schemes, and analyzing privacy policies.
- **Self-image and identity**—Comparing online versus offline identity and becoming aware of how representation through different online personas affects one's sense of self, reputation, and relationships.
- **Copyright and attribution**—Addressing plagiarism, piracy, copyright, and fair use.
- **Cyberbullying**—Handling cyberbullying situations and building positive, supportive online communities.

- **Internet safety**—Optimizing Internet use by using safe strategies such as distinguishing between inappropriate contact and positive connections.
- **Relationships and communications**—Using intrapersonal and interpersonal skills to build and strengthen positive online communication and communities.
- **Digital footprint and reputation**—Protecting privacy, respecting others' privacy, and becoming aware of one's digital footprint.

Technology Integration Example 6.1 illustrates a lesson plan to use at the beginning of a school year to have students think about their digital footprint, or the kind of online presence they establish when they use social media.

Teachers can develop knowledge and instructional resources regarding digital citizenship from the following sources:

- iKeepSafe's "Privacy Curriculum Matrix K–12" provides a curriculum for K–3, 4–8, and 9–12 grades that focuses on online/offline balance, ethical use, privacy, relationships, reputation, and online security.
- In 2016, Berkman Klein Center for Internet & Society at Harvard University developed interactive curricular materials for students in grades 1–3 called "The Internet and You," which focus on digital privacy, search engines, advertising, and building positive online experiences. These are available on the Digital Literacy Resource Platform (Berkman Klein Center, n.d.), which collects tools to teach all students about online safety, privacy, creative expression, and information quality.
- The Global Digital Citizen Foundation (@glodigcit) offers many free resources for teachers, such as The Critical Thinking Workbook that offers games and activities for developing skills, Digital Citizenship Agreements for students, and The Ultimate CheatSheet for Critical Thinking that offers questions to ask when confronting new information.

Application Exercise 6.1 Strategies to Address Online Safety and Digital Citizenship

Technology Integration

Example 6.1

TITLE: Online Safety: What Would You Do?

CONTENT AREA/TOPIC: Digital literacy

GRADE LEVELS: Middle school

ISTE STANDARDS • S: Standard 2—Digital Citizen

CCSS: CSS.ELA-LITERACY.SL.6.2, CCSS.ELA-LITERACY.SL.6.3, CCSS.ELA-LITERACY.SL.7.4, CCSS.ELA-LITERACY.SL.8.1.D

DESCRIPTION: Students begin learning how to behave safely online by discussing how they know that someone on the phone is who they say they are. Then they talk about how this is different online and focus on why someone might pretend to be someone they aren't. They go over the basic rules for staying safe online. Next, the teacher divides the class into small groups and gives each a scenario about someone they "meet" online. They are to discuss and decide how they would react and why. As groups share their scenarios and responses, the class discusses them and why their response is or is not a good one. The whole class ends by generating its own list of "Online Dos and Don'ts."

SOURCE: Based on an idea from the lesson plan *Be Street Smart* at the Google Digital Literacy and Citizenship Curriculum website.

Kayla Delzer (@TopDogTeaching) promotes seven digital citizenship rules for students. The following rules could be used as classroom posters, desktop backgrounds for school computers, and simply as valuable discussion starters:

1. I am building my digital footprint every day.
2. I will make safe and appropriate choices while on my device.
3. I will keep my private information private.
4. I will be respectful of myself and others while on my device.
5. I will never share my passwords.
6. I will report any and all bullying I see while on my device.
7. I will always give credit to sources I use. (Duckworth & Delzer, 2016)

Check Your Understanding 6.2

Searching the Web for Information

There is so much information on the web that companies have developed special searching programs to help us locate items. These searching programs are called **search engines**. Some popular search engines, databases, and resource sites are described here. We also describe how to use them. Students also need to interpret the information they find; this skill is called **information literacy**.

Types of Search Engines

There are many kinds of search engines. Three commonly cited types of search engines are:

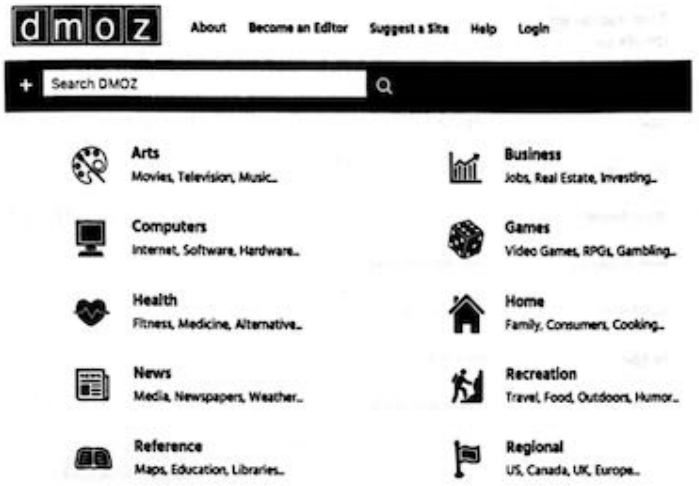
- **Crawlers**—Crawler-based search engines, such as Google, Bing, Yahoo!, AOL Search, and WebCrawler, use software called a "spider" or "bot" to crawl the web, searching for new information that it indexes in a database based on the content found on the page. When someone searches, the bot retrieves matched content with a relevancy score, which is determined based on the index terms and the user's search terms.
- **Metacrawlers**—These search engines, such as Dogpile, Kartoo, and Surfwax, work in the same way as crawlers except that they search the indexed meta information already collected by other crawler-based search engines.
- **Human-powered directory**—These search engines, such as DMOZ (see Figure 6.5), are directories of categorized information submitted, reviewed, and organized by humans.
- **Hybrid**—These search engines combine crawling and human-powered review. Search engines like Google initially crawl but if content is flagged as inappropriate, it can be reviewed manually by a human.

At most search engines, marketers and advertisers can pay for sponsored content to appear at the top of search results, which are distinguished differently across search engines. In many cases, the first few links shown are not the most relevant; they are paid advertisements.

Search Tools and Strategies

Search engines can be used in several ways, depending on how the user wants to narrow a search.

Figure 6.5 Subject Index in DMOZ Search Engine



SUBJECT INDEX SEARCHES A search engine site that provides a list of subject categories as DMOZ does, allows users to browse by clicking on links or using keyword searches.

KEYWORD OR PHRASE SEARCHES Teachers should encourage students to identify keywords rather than using whole sentences or questions to search for content. The engine will combine all keywords with "and" to conduct the search. The pages listed as results of the search are sometimes called **hits**. Searches can be strengthened by using the following strategies:

- Limit searches by including a minus sign immediately preceding a keyword you want to avoid, such as: *Christopher Columbus –Spain*.
- To search a phrase, use quotes, such as "Christopher Columbus." The engine will search for the words in the exact order within the quotes, making results more precise.

ADVANCED SEARCHES We advocate that all students use Advanced Search functions because it scaffolds the search query process, allows delimitation by language, geographic region, time, site/domain, file type, and usage rights (copyright), and provides better results. For example, in Google, a student wants to know about literary criticism of the novel *Showboat* by Edna Ferber. A keyword search with *Edna, Ferber,* and *Showboat* yields 45,200 hits on the music and the movie. However, the student wants to

Figure 6.6 Google's Advanced Search

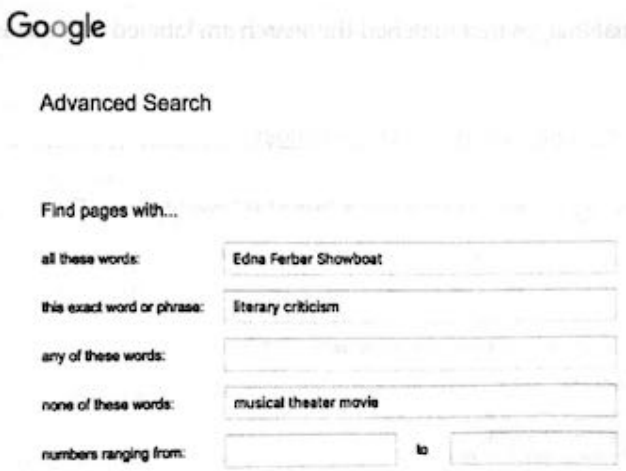


Figure 6.7 Google Advanced Search for Narrowing Results

know *only* about criticism of the book. To be more precise, the student can conduct an advanced search (see Figure 6.6) doing the following:

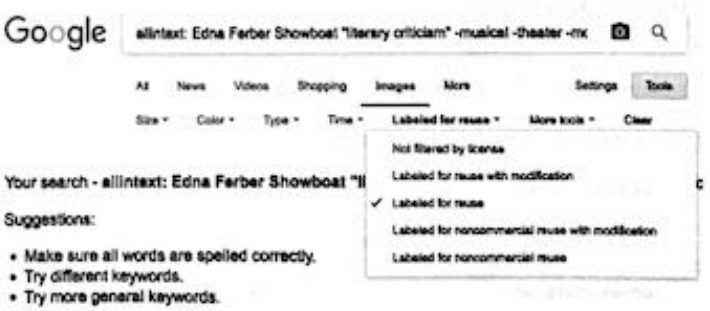
- At the Google search engine site, click on Settings and select the Advanced Search button.
- Fill in the terms *Showboat* and *Edna Ferber* in the "all these words" box.
- Fill in the terms *musical*, *theater*, and *movie* in the "none of these words" box.
- Fill in the terms *literary criticism* in the "this exact word or phrase" box.

This advanced search provides 827 results that primarily give hits on criticism of the book *Showboat*. This search, if conducted in the Search Bar, would look like this: *Edna Ferber Showboat "literary criticism" –musical –theater –movie*. Once students learn the advanced search skills, they can implement them in the search box directly.

NARROW RESULTS Teachers and students can also use the Advanced Search function to narrow results even more as in Figure 6.7. In this case, they could set the language to "English" and indicate the terms appearing as "in the text of the page" and choose the SafeSearch as "filter explicit results." These additional search choices narrow the results to 451. This advanced search removed 99% of the original 45,200 hits in the original keyword search to 451 focused hits. If students tend to use only the first page of Google results, as Maloy (2016) found, the query must be as specific as possible to make those top few results the most applicable.

To find an image related to this search, click on the Images option just above the results list. Once images appear, teachers and students can filter them for copyright usage under the menu "Labeled for reuse" as shown in Figure 6.8. In this example, none of the original images that matched the search are labeled for reuse so they cannot

Figure 6.8 Google Advanced Search for Images



be downloaded and used. Teachers and students can also set this criterion in "usage rights:" option in the Advanced Search.

Research and Reference Tools

Research and reference tools include online databases, encyclopedias, atlases and mapping tools, and dictionaries. Today's reference tools are online and usually available as apps.

ONLINE DATABASES Online databases aggregate information from a range of resources, including magazines, newspapers, encyclopedia entries, biographies, and sometimes images and video. Examples include the following:

- Kids InfoBits (Gale)
- Primary Search (EBSCO)
- MAS Ultra—School Edition (EBSCO)
- Opposing Viewpoints in Context (Gale)
- Science in Context (Gale, Cengage)
- Biography in Context (Gale, Cengage)
- Pebble GoNext (Capstone)

Online databases can be accessed through school libraries. Librarians can identify which databases are available. Imagine Easy Solutions and EasyBib (2014) found that over 60% of K–12 librarians reported that their students "very often" used the open web, such as Google, instead of subscription library resources. Yet these library databases can yield manageable and pertinent resource results for students. Barack (2014) summarized how students as early as ninth grade have increased success in higher education if they have explicit, modeled research experiences using online databases with teachers and librarians, repeated research trainings, and practice researching.

ONLINE ENCYCLOPEDIAS Digital encyclopedias help learners research topics by locating specific content or all reference materials on a given topic, and they usually offer multimedia formats that include sound and/or film clips as well as hypertext links to related information on any topic. Prominent encyclopedias include:

- Encyclopedia Britannica Online
- Encyclopedia.com
- Wikipedia

Wikipedia is an online, open encyclopedia that anyone can edit. Okoli, Mehdi, Mesgari, Nielsen, and Lanamäki's (2014) review of research indicates that Wikipedia has been one of the top visited websites in the world and the top reference resource. Many studies encourage librarians, teachers, and students to use Wikipedia as an opportunity to teach about information literacy skills, collaborative information sources, and its use as a gateway to more advanced research skills (Okoli et al, 2014; Polk, Johnston, & Evers, 2015). Despite widespread use of Wikipedia, many studies indicate that scholars and users rate it as less trustworthy than other encyclopedias and use caution when using it (Hilles, 2014; Okoli et al., 2014). Many librarians encourage its use for building background information on a topic, and facts should be triangulated as accurate through other sources.

DIGITAL ATLASES AND MAPPING TOOLS Atlases and mapping tools help students learn about and use local, national, world, and extraterrestrial geography. They summarize geographic and demographic information ranging from population statistics to national products and often are interactive. Students can either see information on a specific country or city or gather information on all countries or cities that meet certain criteria. Some atlases even play national songs. Mapping sites such as MapQuest also

help teach geographic concepts by showing distances between points. Following are common tools:

- Google Maps
- Google Earth
- Worldatlas
- Rand McNally
- Mapquest
- The National Map from United States Geological Survey (USGS)
- U.S. Atlas
- Digital Universe (American Museum of Natural History)

DIGITAL DICTIONARIES (WORD ATLASES) Sometimes called **word atlases**, digital dictionaries and thesauruses give pronunciations, definitions, example uses, synonyms, and antonyms for each word entry. They also offer many search and multimedia features similar to those of encyclopedias and atlases. Many digital dictionaries can play an audio clip of the pronunciation of any desired word, which helps young users and others who cannot read diacritical marks.

- Wordsmyth
- Merriam-Webster
- Dictionary.com

Information Literacy Skill Development

Locating and using information from online sources for learning purposes has become a key part of classroom learning. Growth in digital information requires that students have opportunities to learn to use web resources to locate information they need efficiently, what Rieh, Collins-Thompson, Hansen, and Lee (2016) refer to as "learning to search," also referred to as information literacy.

The 2016 presidential election and the new administration in 2017 referred to claims of "fake news," and researchers indicated that the web and SNS enabled "powerful entities to directly and quickly spread false or misleading information far and wide" (Herold, 2016). In a large study of young people's reasoning about web-based information, results were "bleak" (Stanford History Education Group, 2016), indicating low information literacy skills. In another study, school librarians indicated that 75%, 61%, and 50% of elementary, middle, and high school students, respectively, have rudimentary understandings of website evaluation, and 58% of students reported using Google or open web resources instead of online databases (Imagine Easy Solutions and EasyBib, 2014). Researchers have found that learners have difficulty in building appropriate search queries, evaluating resulting information, and focusing on the task through completion (Barack, 2014; van Deursen & van Diepen, 2013). Critical thinking about information is key in making more thoughtful information consumers.

An essential skill that students must acquire is the ability to evaluate information critically and look for indications that content is accurate and reliable. Numerous rubrics and checklists are available for evaluating website content; one of the most popular sites for rubrics is in Kathy Schrock's Guide to Everything (Schrock, n.d.). These can be used to teach students important information evaluation strategies. The Web Content Quality Checklist shown in Figure 6.9 is a compilation of many checklists and formatted for use in reviews of web content.

Teachers also must facilitate students' abilities for **searching to learn** (Rieh et al., 2016), which emphasizes the inquiry task that involves information searching, knowledge development, and sense making. Kingsley and Tancock (2014) provide a teacher-friendly approach to developing the following four crucial competencies

Figure 6.9 Website Content Quality Checklist

Site Name:_____ **Topic:** _____

Site Purpose (check one):

_____ Business _____ Entertainment _____ Instructional _____ News _____ Personal _____ Political _____ Other

URL: _____

Criteria	Yes	No
Site Authors and Sponsors		
Site author(s) and/or sponsorship are/is clearly identified.		
Author(s) is/are clearly qualified to present reliable information on the topic.		
Contact is provided so site users can ask questions and get further information.		
Comments Related to Site Author/Sponsor:		
Content		
All information is the most current and up-to-date available.		
All information is factually accurate.		
The site is complete (i.e., no "under construction" signs).		
The site has a creation and/or revision date.		
Sufficient information on the topic is provided; it is not missing key elements.		
Appropriate helpful links to other related sites are provided.		
Content is free from typos and misspellings and from punctuation and grammatical errors.		
Content is free from ethnic, slang, or rude names or words; information is presented in a professional manner.		
Content sources (including sources of graphics) are properly referenced.		
In informational sites, content is free from bias.		
In persuasive sites, author bias is clearly stated.		
Comments Related to Content:		

that support searching to learn. Teacher or librarian modeling within all the activities is critical:

1. **Generate high-quality inquiry topics**—Students identify a topic and learn to generate key questions to investigate in their information searches.
2. **Search for effective and efficient information**—The teachers model generating keywords and search techniques as described earlier. Students learn that searching and understanding is a recursive process that takes time. Teachers must ensure that enough time is provided for effective searching and learning to occur. Students must consider what their final product from learning will be; if it is multimedia focused, search techniques could be different than if the product is data or text focused.
3. **Critically evaluate web resources**—Teachers model evaluation strategies, such as triangulating information with other sources, author credentials, bias of website, and timeliness of information. Researcher Don Leu suggests that teachers require students to include short descriptive rationales explaining why online sources in their reference lists were chosen and are credible (Herold, 2016).
4. **Connect ideas across resources**—Students must synthesize two or more sources of information, find connections and meaningfulness, and communicate new knowledge.

Software such as NoodleTools supports the process that Kingsley and Tancock (2014) describe in the preceding list with an online environment that scaffolds research-based inquiry with tools for citing, annotating, and archiving source materials; note taking, organizing, and outlining content; and collaborating and sharing with peers and instructors.

Check Your Understanding 6.3

Shared Writing 6.1: Using Information Literacy Skills

Online Educational Content

Transformative, technology-supported teaching and learning cannot occur only with technological infrastructure, such as Internet access and computing devices; it requires accurate subject area content that supports learning. As more districts adopt one-to-one computing, some abandon print and digital textbooks in favor of online educational content. This typically transfers a significant responsibility to teachers to identify online content and develop curriculum using it, sometimes without the provision of additional time or curriculum development preparation (Hughes, Boklage, & Ok, 2016; McShane, 2017; Molnar, 2016b; Ok, Hughes, & Boklage, 2017). However, many teachers see opportunities to use online content as supporting the professionalization of teaching by allowing them more control and design of teaching (Kimmons, 2016). The following sections introduce three types of online educational content: archived, immersive, and live.

Archived Online Content

Archived content remains fairly static and often resides in online archives from governmental agencies or on organization websites, such as universities. No master list of online content exists, so teachers must use strategic searching techniques or their knowledge of organizations that might offer accurate content applicable to the curriculum and learning levels of students being served. Such archived online content tends to be oriented toward consumption by which learners read, watch, listen, or view the content. Yet learners can also synthesize and develop meaning across multiple sources as described as a culminating step of information literacy or searching to learn.

Teachers use archived content as content representations to illustrate content concepts for instruction. Some archived content examples include:

- **Library of Congress (LOC)**—The largest library in the world with 162 million holdings, the LOC offers a rich array of its resources available online in its Digital Collections. For example, a collection "African-American Band Music and Recordings, 1883–1923" highlights historical documents that represent experiences of African-American musicians.
- **The Wayback Machine**—November (2016) describes how The Internet Archive, a nonprofit, has been archiving the web since 1996. He suggests that teachers can use this to engage students in temporal online research by examining websites as events occurred, such as the September 11 attacks (by examining archived news sites on that day).
- **HippoCampus**—This is an archive of more than 5,000 free videos across mathematics, natural science, social studies, and humanities.

Video Example 6.3 Using Video Content to Support Learning

In this video, a principal talks about how video clips are used within lessons across the curriculum that help students stay engaged in learning.

- **Teachinghistory**—The Center for History and New Media is funded by the U.S. Department of Education to gather content, resources, and materials for teaching U.S. history.
- **NASA PubSpace**—NASA provides this public archive of all peer-reviewed research generated from NASA-funded research. This resource is an example of archives that require teachers to review the content prior to student use because much of the content could require high level of scientific background.

The Technology Integration Example 6.2 exemplifies how students access archived historical material to develop an understanding of westward expansion.

Interactive or Immersive Web Content

Web content can also have interactive or immersive qualities that typically involve the user in some actions, such as making choices, moving, or involving multiple senses. Simulations; virtual fieldtrips; and virtual, augmented, and mixed reality environments have interactive and immersive characteristics. Although some of this web content is available online via web browsers, some is available only via mobile apps that must be downloaded from the Internet and could require Wi-Fi for full functionality.

SIMULATIONS A **simulation** is a computerized model of a real or theoretical system designed to teach how the system works (see Chapter 5). As instructional software, simulations contain sequenced content designed for learning. Learners using simulations usually must choose the tasks to do and the order in which to do them to explore how changing input variables impacts outcomes within the simulated system. The simulations can represent physical things or processes, can slow down or speed up events that are difficult to understand in real time, can teach procedures or sequences of steps, and can be situational problem-solving tasks. Some online simulations include:

- **The National Gallery of Art**—Offers the NGAkids Art Zone with several art-making simulation tools that situate learners in art history, such as drawing portraits or creating a still life painting.
- **Web-based Inquiry Science Environment (WISE)**—Provides interactive simulations and models as one feature of its learning environment.

Technology Integration

Example 6.2

TITLE: Westward Expansion

CONTENT AREA/TOPIC: Social studies, history

GRADE LEVELS: 7–12

ISTE STANDARDS • S: Standard 1—Empowered Learner; Standard 3—Knowledge Constructor; Standard 5—Computational Thinker; Standard 6—Creative Communicator; Standard 7—Global Collaborator

CCSS: CCSS.ELA-LITERACY.RH.6-8.1, CCSS.ELA-LITERACY.RH.6-8.5, CCSS.ELA-LITERACY, RH.9-10.2, CCSS.ELA-LITERACY.RH.9-10.8, CCSS.ELA-LITERACY.RH.9-10.9, CCSS.ELA-LITERACY.RH.11-12.6

NCSS THEMES: 2 – Time, Continuity, and Change; 3 – People, Places, and Environments; 4 – Individual, Groups, Institutions; Disciplinary Standards: 1 – History, 2 – Geography, 4 – Economics

DESCRIPTION: Begin by asking the class to hypothesize why Americans might have wanted to move west in the middle of the 19th century.

- Discuss general reasons why humans leave one place to move to another and what the cultural and political climate of the United States was during this era.
- Have students work in pairs researching, examining, and discussing primary documents and images from this time period available online through the National Archives.
- Using tools available at the National Archives Docs Teach website or a collaborative online tool such as Google Docs or Google Sites, students then choose 5–10 documents to share with the class and place their documents in chronological sequence, compiling a list of possible reasons why Americans moved westward during this era.
- Have groups share their findings with the class.

SOURCE: Based on ideas from the lesson Reasons for Westward Expansion at the National Archives Experience Docs Teach website.

- **PhET Interactive Simulations**—Developed by Nobel Laureate Carl Wieman, this site offers free interactive simulations for science and math.
- **Falstad.com**—Features a range of simulations for math and physics about oscillations, waves, signal processing, electricity, magnetism and more.

VIRTUAL FIELD TRIPS A **virtual field trip** allows a virtual visit to a real place or a historically accurate representation without physically leaving a learning space. Virtual field trips eliminate travel expenses and extensive travel time and increase global perspectives (Zwickert, 2017). These activities explore unique locations around the world, sometimes involve learners at remote sites, and can explore experiences rather than places, such as women describing their careers and showing what kinds of work they do (Ravipati, 2017). Stoddard (2009) provided a conceptual model of elements necessary for successful virtual field trips, which include the following:

- Clear objectives for the field trip
- Logical and timely connections to the curriculum
- Substantive conversations between students and field experts
- Inquiry or problem-based instruction to support higher order thinking
- Site-provided teacher materials
- Media that enhance the curriculum
- Requirement that students prepare for the field trip and debrief afterward to build knowledge
- Teacher collaboration with field trip site personnel to enhance student learning

When virtual field trips do not offer all these elements, especially access to experts, field site personnel, or teacher materials, teachers must supplement and adapt them to ensure an effective learning experience for students.

Technology Integration

Example 6.3

TITLE: Immerse Yourself in the Smithsonian

CONTENT AREA/TOPIC: History and geology

GRADE LEVELS: All grades

ISTE STANDARDS • S: Standard 1—Empowered Learner; Standard 3—Knowledge Constructor; Standard 6—Creative Communicator

CCSS: CCSS.ELA-LITERACY.RI.3.3, CCSS.ELA-LITERACY.SL.8.5, CCSS.ELA-LITERACY.RI.11-12.4, CCSS.ELA-LITERACY.RI.11-12.7

DESCRIPTION: Students take a tour through the Smithsonian Museum in a 3-D environment made up of panoramic pictures of actual exhibits. They use their computer mouse to "walk" through the museum room by room as camera icons throughout the museum show them hot spots where they can come close to an exhibit panel. Exhibits include the ocean hall, ancient seas, dinosaurs, early life, fossils, plants, mammals, African cultures, the Ice Age, Western cultures, reptiles, insects, butterflies, bones, geology, gems, and minerals. The teacher forms small groups of two or three students, each of which is assigned an exhibit to explore. The groups become the experts on their exhibit, acting as a tour guide for the class as their exhibit is projected on an interactive whiteboard or screen.

SOURCE: Based on a concept from the Teaching Community virtual field trip lesson plans website. http://teaching.monster.com/education/articles/8847-5-best-virtual-field-trips

Stansbury (2013) recommended "10 of the best virtual field trips" that range from a tour of the Louvre Museum in Paris to panoramas around the world. Other notable field trips include:

- **Google Expeditions**—Presents virtual tours into women's STEM career lives and workplaces. These tours are created by a NASA and Google Expeditions collaboration (Ravipati, 2017).
- **Skype in the Classroom**—Offers hundreds of virtual fieldtrips, such as visiting an elephant sanctuary or a tour of the Tinker Swiss Cottage (Rockford, IL).
- **Smithsonian National Museum of Natural History**—Offers room-by-room virtual tours of the museum. A teacher can likely use just one part to connect with a lesson topic. Read about a lesson using this Smithsonian resource in Technology Integration Example 6.3.
- **Visit the Moon**—Provides visits to the moon via Google Earth as described in the accompanying video. Field trips include viewing historical geological maps, 3-D models of spacecraft left on the moon, videos and photographs taken on the moon, and narrated tours by astronauts Buzz Aldrin from Apollo 11 and Harrison (Jack) Schmitt from Apollo 17 missions.
- **U. S. White House**—Allows students to join a virtual tour of the White House (Stracqualursi, 2017).

VIRTUAL, AUGMENTED, AND MIXED REALITY ENVIRONMENTS In 1989, Jaron Lanier coined the term *virtual reality*, but only recently has the potential for virtual and augmented reality in education grown in science (Chen et al., 2016; Civelek, 2014), social studies (Lisichenko, 2015), and foreign languages (Solak & Erdem, 2015). Yaakov (2017) described the differences between these digital modalities as follows:

- **Virtual reality (VR)** shuts out the real world, typically with a physical **head-mounted display (HMD)**, and the user enters another reality, such as traveling inside a human cell.

Video Example 6.4 The Moon on Google Earth

Watch the video to see how you and your students can go to the moon with the astronauts.
https://youtu.be/zHJ77RsnFXI

- **Augmented reality (AR)** involves a layer of virtual entities often accessed with a mobile app that are set atop the real world, such as physical coloring pages that come to life with the virtual layer.
- **Mixed reality (MR)** involves augmented entities in interaction with the real world, such as playing/building within an augmented representation of Minecraft in the middle of one's living room.

Yaakov (2017) emphasized that these virtual modalities move the Internet of information to an Internet of experience, and such experience is shaped deeply by feelings of presence/copresence, embodiment, agency, and empathy. *Presence* is a feeling of being there, and *copresence* is being there together (Fowler, 2015). *Embodiment*, a representation of the user in the world, can occur naturally in immersive VR or through an **avatar** in virtual worlds. *Agency*, a desire to take action, and *empathy*, an understanding of another's perspective, are facilitated within VR, though competition can undermine perspective-taking (Herrera, 2017). Yaakov and Herrera (2017) found that as virtual environments mature, there will be a need for more educational content and more social aspects within the environments.

Virtual Reality Environments. In 3-D **full immersion systems**, the user places a headset, such as Google Cardboard, Samsung Gear VR, HTC Vive, or Oculus Rift, over her or his eyes. Known as a head-mounted display (HMD), this headset is the channel through which the wearer experiences the virtual environment, which can represent real or simulated worlds. The headset fills the mind with views of the virtual environment, and whole-body senses create the illusion that the wearer is actually in the environment that the system displays. See Figure 6.10 for the photo of a boy wearing an HMD who is engaged in a VR activity. Other devices for full immersion systems include sound and tactile or **haptic interfaces** such as a data glove.

Figure 6.10 Example of a Virtual Reality Immersion
Leah-Anne Thompson/Shutterstock

Educational content for virtual reality exists and is expanding rapidly. Following are prominent resources with content available for PK–12 teachers:

- Google Earth VR
- Google Expeditions
- Google Arts & Culture App Cardboard VR tours of art museums and cultural locations
- Apollo 11 VR Experience
- New York Times VR
- Discovery VR
- YouTube 360 videos

To use these, teachers need access to HMDs and mobile devices if they are using Google Cardboard or Samsung Gear VR. Google Cardboard is the most economical cardboard viewer, and Google also offers instructions for making a viewer with everyday items. A current challenge is the lack of learner interaction with objects or other people

within virtual reality environments because many experiences are photos or videospheres in which the viewer is passive except for being able to view in 360 degrees of direction (Fowler, 2015; Yaakov, 2017).

Semi-immersive virtual environments are not whole-body immersive (Fowler, 2015) but allow users' avatars to meet in web-based, 3-D VR environments on a computer screen as in **multi-user virtual environments (MUVEs).** In them, users create an avatar to represent their digital presence; then they explore the digital world to connect and collaborate with others. Educational MUVEs include Quest Atlantis where students from various physical locations use their avatars to solve various problems posed in educational scenarios (see Figure 6.11). EcoMUVE is a virtual environment in which students learn about ecosystems. Chen et al. (2016) found that middle school students' interest in science increased with use of EcoMUVE.

Augmented Reality Environments. **Augmented reality** refers to a combined hardware and software platform that creates a computer-generated environment in which a real-life scene is overlaid with information that enhances its uses. Students can use an app called Aurasma to hover their tablet cursors over images of famous paintings, which calls up audio and text with features and notes about the artist's techniques. Other augmented reality apps include Layar, which is used to enhance print materials and colAR, which works with coloring book pages. The National Science Foundation (NSF) has funded a project in which students will engage in AR with their mobile devices to inquire into local historical sites in present-day and different time periods and from different social perspectives as well as another project, EcoMOBILE, that allows students to examine the ecological aspects of a local pond using phones and AR technology. A NASA mobile app, SpaceCraft 3D, uses augmented reality for learners to explore spacecraft, including rockets and robots, that explore our solar system.

Mixed Reality Environments. **Mixed reality** allows people to engage with complete virtual objects or worlds while functioning within the real world. For example, AR and VR can be overlaid in wearable technologies like eyeglasses to allow access to augmented, virtual content. Other developers are using HMDs to access holograms, such as Microsoft's HoloLens or Meta's Meta 2. The latter allows tactile interaction with virtual objects.

Sophisticated software enables **3-D models** to represent three-dimensional (3-D) replicas of objects or locations. The products are then viewed on a flat-screen computer (as opposed to an immersive environment). A **virtual manipulative**, or replica of real manipulatives accessed via the Internet (Li & Ma, 2010), is one of the most popular types of 3-D models. The National Center for Virtual Manipulatives at Utah State University

Figure 6.11 Opening Page from the Quest Atlantis MUVE

has a large collection of these tools to support math and science topics with instructions for teachers on how to use them. Wang, Kenzie, McGuire, and Pan (2010) found that virtual manipulatives support inquiry learning by allowing children to "manipulate representations by flipping, turning, or rotating objects (e.g., geometric shapes), helpful for reinforcing critical mathematics skills, such as numbers and operations, algebra, geometry, and measurement" (p. 385).

The major advantages of interactive and immersive educational content are experiential learning, problem solving and inquiry, and spatial understandings. However, some virtual environments involve significant preparation for students to learn to do simple tasks such as walking around or designing their avatar. Some virtual environments, such as those with virtual and mixed reality technologies, require expensive hardware.

Live Web Content

Another source for online educational content are live-sourced experiences. Obviously, live content is more difficult to use because of timing constraints, but some live content can eventually become archived. In this section, we describe how videoconferencing, adventure learning, and citizen science all leverage live content for learning.

VIDEOCONFERENCING This form of two-way interactive communication allows those involved to see and hear each other. Each person must have a camera, an audio input device such as a noise-canceling microphone, an output device such as speakers, and a videoconferencing app, such as Skype, Google Hangouts, Webinato, and Adobe Connect. Many apps offer areas for video, visuals (e.g., presentations or graphics), a list of participants, and questions. Lawrence and Chang (2011) remind potential users that successful use of videoconferencing requires familiarity with the technology, clear teaching and learning objectives, and pedagogical strategies appropriate for the medium. Videoconferences work well in one-computer classrooms with a projector. Some educational examples include:

- Students can speak and listen in languages they are learning with peers in other countries. ePals is a source for finding language partners for classrooms.
- Book authors or guest speakers can speak on curricular topics. Two environmental science teachers host the annual National BioDiversity Teach-In in February when experts offer webinars on topics related to ecology and biodiversity. The webinars are archived in their YouTube channel. In addition, Skype in the Classroom facilitates finding volunteer guest speakers.
- ARISS is a program that allows students to talk directly with the crew of the International Space Station.

Technology Integration Example 6.4 is a lesson that could involve videoconferencing through ARISS.

ADVENTURE LEARNING **Adventure learning (AL)** is a pedagogical approach that harnesses real-world experiences for learning. One approach uses live data, such as interviews, videos, photographs, and scientific information, collected from explorers on expeditions to be immediately integrated into online learning activities available to students and classes that follow the expedition. Go North! Adventure Learning and Earthducation are examples of AL (Doering & Henrickson, 2015). Another variation, referred to as AL@, capitalizes on students' capacities to engage in locally based exploration and inquiry related to a broader AL expedition (Hougham, Eitel, & Miller, 2015). For example, AL@GL took place in Greenland, and AL@MOSS was situated within the McCall Outdoor Science School in Idaho. Miller, Hougham, & Eitel (2013) provide

Technology Integration

Example 6.4

TITLE: Connecting Science Students with NASA Resources

CONTENT AREA/TOPIC: Earth science

GRADE LEVELS: All grades

ISTE STANDARDS • S: Standard 1—Empowered Learner; Standard 3—Knowledge Constructor; Standard 5—Computational Thinker; Standard 6—Creative Communicator

NSTA: 2-ESS1-1, 2-ESS2-3, 4-ESS2-2, 5-ESS2-2, 5-ESS3-1, MS-ESS1-1, HS-ESS2-2, HS-ESS2-3, HS-ESS2-5, HS-ESS2-6, HS-ESS2-7

DESCRIPTION: The project begins by having students learn how to analyze photographic detail. They then obtain related images taken from the International Space Station's Window Observational Research Facility (WORF) or from NASA apps such as Eyes on Earth, Spaces Images, or Images of Change. Students analyze the related images and document their findings. Each student develops five questions to ask in a videoconference or online session with NASA experts. Each class involved in the project forwards its best 10 questions, which the experts address in a live NASA Expert Virtual Visit.

SOURCE: Adapted from an idea from Peterson, R., Starr, B., & Anderson, S. (2003). Real NASA inspiration in virtual space. *Learning and Leading with Technology, 31*(1), 14–19.

practitioners help in answering "where will you AL@?" by encouraging local, place-based education.

CITIZEN SCIENCE **Citizen science** is a form of **crowdsourcing** in which the public can participate in scientific research activities. The scientific research is authentic, not a simulation, so the data collected and submitted by citizens become part of the project's analysis and findings. The following citizen science projects offer K–12 educator resources to support classroom learner participants:

- Galaxy Zoo
- Project Noah
- Rocks Around the World
- iNaturalist

Cohnstaedt, Ladner, Campbell, Busch and Barrera (2016) describe a citizen science mosquito lesson plan that involves collecting mosquito eggs and rearing them to adulthood for identification. Data can be submitted to a national mosquito species study, which is then available to all mosquito submitters. See Technology Integration Example 6.5 for a lesson that gathers carbon footprint data.

Citizen science projects situate learners in inquiry-based science, data analysis, and use of evidence to support claims. Various research studies show positive outcomes from participating in citizen science, some of which include increases in science content knowledge, understanding of the scientific method, scientific thinking, scientific analysis, scientific observation skills, and motivation and interest in science (Haywood, 2014; Hiller & Kitsantas, 2014). Barron, Martin, Mertl, and Yassine (2016) caution that teachers need to prepare students in scientific data collection procedures and should move beyond the data collection stage to support optimal learning.Lamb (2016a, 2016b) provides a comprehensive list of citizen science projects applicable for classrooms.

Technology Integration

Example 6.5

TITLE: OF2—Our Footprints, Our Future

CONTENT AREA/TOPIC: Environmental science

GRADE LEVELS: All grades

ISTE STANDARDS • S: Standard 5—Computational Thinker; Standard 6—Creative Communicator

NSTA: MS-PS1-4, MS-ESS3-5, HS-LS1-6 –LS2-5 HS-ESS2-6

DESCRIPTION: OF2—Our Footprints, Our Future is an international initiative that encourages individuals younger than 19 from around the world to use online tools and resources to measure their carbon footprint and develop ways to reduce their carbon usage. The goal of OF2 is to encourage students, their families, schools, and communities to reduce their total global carbon footprints. Students input data based on their lifestyles into an online carbon footprint calculator to estimate their annual contribution (e.g., see the Zerofootprint Youth calculator for younger students or the What's Your Carbon Footprint? calculator at the Nature Conservancy website for older students). Because the tool has been adapted to recognize different cultural and socio-economic settings, housing, modes of transportation, and food consumption, students will be able to find a close estimate to their own situations. Once students receive their results, they can blog or discuss in groups how their lifestyle affects climate changes around the world.

SOURCE: Based on an idea from the Our Footprints, Our Future lesson at the iEARN website.

Check Your Understanding 6.4

Open Educational Resources

A subset of web-based educational resources are referred to as **open educational resources (OER)**. These are educational materials in the public domain or aligned with copyright provisions that allow for the 5Rs:

1. Retaining (keep a copy)
2. Reusing (use in multiple ways)
3. Revising (modify a resource)
4. Remixing (combine multiple resources)
5. Redistributing (share again with others)

The 5Rs are provided through licensing such as Creative Commons (CC). Popular types of OER include videos, e-textbooks, images, assessments, tests, infographics, games, lectures, lesson plans, podcasts, and full or parts of courses (de los Arcos, Farrow, Pitt, Weller, & McAndrew, 2016). Open educational resources are free, but not all free resources offer the license for the 5Rs. Table 6.1 summarizes some of the differences between open-licensed, free, and proprietary educational resources (U.S. Department of Education, 2017).

In 2015, the U. S. Department of Education began a #GoOpen campaign aimed at school districts and states to innovate teaching and learning with the use of open educational resources by (1) developing a learning registry for OER, (2) encouraging districts to create and adopt OER, and (3) requiring resources created with federal grant support to be licensed as OER. McShane (2017), however, argues that federal support of OER is premature, the learning registry is not targeted for teachers and is overwhelming, and requiring all federal resources to be open could undermine the federally sponsored research-based practices (e.g., new curriculum) when it is open to revision or remixing (which eliminates the research-based findings' applicability)

Table 6.1 Open versus Free versus Proprietary Learning Resources

Type	Cost	License	Flexibility	Example
Openly licensed educational resources	Free or minimal cost (i.e., non-electronic print costs)	Open license (Creative Commons or other similar)	Yes, generally licensed to allow free use and repurposing by others (some restrictions and exceptions apply)	OER Commons
Free digital learning resources	Free	Copyright restricted	Varies; limited ability to use and repurpose without permission from owner/creator	Smithsonian Education
Proprietary textbooks	Variable costs	Copyright restricted	No, owner has the right to control the copying and dissemination of an original work	Holt McDougal Environmental Science Student Edition eTextbook

Attribution: OpenVersus Free table by OET, used under CC-BY-3.0/ Modified https://creativecommons.org/licenses/by/3.0/us/ Report is in public domain

*Report is in public domain (U.S. Department of Education, 2017.*https://tech.ed.gov/files/2017/01/GoOpenLaunchPacket_v1_2.pdf

and then redistributed. Nonetheless, many districts or schools are committing to replacing traditional textbooks with OER.

Locating OER

When schools and districts begin building OER into their curriculum, they tend to use three sources for locating OER: online searches, OER repositories, and curated OER content.

ONLINE SEARCHES FOR OER As described in earlier sections of this chapter, teachers can use search engines to search for subject-specific content and use filtering tools within advanced search options to identify content that is open licensed (review Figures 6.7 and 6.8).

OER REPOSITORIES Educational agencies, schools, states, and nonprofit organizations are building OER repositories. There is no limit to the amount of content in them, and they typically have filtering tools to search by grade level, subject area or topic, curricular standards, and other items. Repositories differ in who adds content and whether content is reviewed or vetted. For example, Wisconsin, a #GoOpen state, developed the WISELearn educator portal where teachers can explore resources, professionally learn, and share successes and strategies with other teachers.

The following examples include repositories that predominantly offer individual content bits, not curricularly sequenced OER content. Some of these, such as YouTube and TED Talks, were identified as most used by surveyed teachers from 72 countries (de los Arcos et al., 2016). Not all content in the following repositories is openly licensed.

Video Example 6.5 Open Educational Resources in the Columbus Municipal School District

In this video, the superintendent of the Columbus, Mississippi school district describes how their urgency to offer highly-quality, 22nd Century instruction to their students led to the combined use of new technology infrastructure, OER, and professional learning opportunities.
https://youtu.be/l6LPE3a43nA

Video Example 6.6 What is WISELearn?

The accompanying video shows how teachers play a crucial role in adding, rating, and curating resources in WISELearn.
https://youtu.be/9NvFwwSu9ks

Therefore, it is always incumbent on the user to check the licensing on all resources or filter by Creative Commons licenses.

- **YouTube, YouTubeEdu, YouTube School**—Offers video content, video sharing, and video editing tools.
- **TED talks**—Offers video content.
- **iTunes, iTunesU**—Offers educational and video files from universities, schools, public media organizations, and museums.
- **Khan Academy**—Offers access to instructional videos and interactive exercises.
- **Creative Commons**—Offers definitions of various open licenses and a CC search tool to find open content.
- **CK–12**—Offers various OER resources, such as simulations and flexbooks, and various instructional tools for teachers and study tools for students.
- **Learning Registry**—Offers digital learning resources browsed by subject or standard, but has the primary purpose of pooling resources across constituents and supporting app development from these resources.
- **Better Lesson**—A repository of more than 16,000 teacher-shared lessons open for reuse.
- **Share My Lesson**—Offers more than 420,000 lessons and activities.
- **The National Science Digital Library**—Offers searchable access to science, technology, engineering, and mathematics content contributed by educational, nonprofit, and government providers, such as USGS and the Smithsonian.
- **OER Commons**—Offers a searchable OER repository and tools to create OER by building lessons, collections, or libraries individually or collaboratively with others.
- **International Music Score Library Project**—Offers a library of sheet music and scores.
- **Wikimedia Commons**—Offers more than 37 million media (images, sounds, videos) files.

Some of these repository resources, such as The National Science Digital Library and OER Commons, also offer collections of materials curated by digital librarians from the organization. However, these tend to be resources collected about a topic and still lack instructional and pedagogical framing for the resources.

McShane (2017) argues that repositories of individual open educational content, such as lessons, images, or videos, can number in the thousands (even when using a subject-area filter) and quickly become overwhelming because an individual piece of content still requires (a) quality assessment, (b) integration into or development of a lesson aligned with curricular standards, (c) learner activities, and (d) teacher resources for instruction.

CURATED CURRICULAR OER CONTENT Because of the effort to find OER content, districts, schools, and teachers seek curated OER content. As opposed to collections of resources by topic or subject area, curated curricular OER is created by individuals with content and pedagogical expertise who sequence OER to build a curriculum aligned to standards and supported with teacher resources, such as assessments, lecture supports, and learning activities, all of which take time to create and is a type of intellectual property. Teachers, curriculum developers, nonprofits, and for-profit companies, some of which expect compensation (McShane, 2017), are participating in curating OER content into sequenced curriculum. McShane (2017) points out although open resources are free to use, curated curricular content is not created for free because it requires human expertise and significant time and resources. The following list includes sources of curated curricular content:

- **Utah's Open Textbook Projects**—Part of the Utah Education Network, experts have developed open textbooks, often circulated through the CK–12 foundation, such as third, fourth, and fifth grade science, chemistry, and secondary English language arts textbooks.
- **EngageNY curricula**—The New York State Department of Education has developed year-long curriculum for mathematics and English language arts for grades K–12. According to McShane (2017), the curriculum has been downloaded 45 million times.
- **Open Up Resources**—This nonprofit offers full-course curricula authored by experts and checked by teachers.
- **Saylor Foundation**—This nonprofit foundation focuses on identifying free educational resources and assembling open texts (most at college level).

These examples tend to offer full-year curricula or textbooks as an open resource; the degree to which they include multimedia-based OER within the curriculum greatly varies.

Other online platforms allow teachers to curate customized learning units from OER or from already existing lessons by remixing or revising. Examples of these platforms include:

- **Gooru**—A nonprofit online platform where teachers can assess students to identify learning needs and search for and remix open, multimedia content, such as websites, videos, games, images, into learning assignments that students pursue at their own pace.
- **OpenEd**—This is a resource library of assessments, homework, videos, and lesson plans that can target learning needs. Teachers can create classes or integrate OpenEd resources within a school-based **learning management system (LMS)**. The site uses machine learning to curate content by content standards confirmed by subject matter experts.
- **CK–12**—This nonprofit foundation has developed many free tools to support collecting online resources, create online textbooks (i.e., flexbooks), simulation apps, content practice apps, and collaboration capabilities.

States, school districts, and teachers who build curated curricular content engage in a lengthy process summarized in the #GoOpen District Launch Packet (U.S. Department of Education, 2017) that involves:

- Setting goals and selecting a strategy
- Selecting and organizing an implementation team
- Putting in place a robust infrastructure for learning
- Ensuring accurate and effective learning resources
- Designing professional learning opportunities

Video Example 6.7 CK–12 In Action: Chris Perkins' Classroom

In this video, classroom teacher Chris Perkins talks about how his use of CK–12 has allowed him to meet a wider range of learner needs without stress and how he's excited to teach each day.
https://youtu.be/q-S24Y9PdPw

For example, North Kansas City Public Schools worked toward districtwide, one-to-one device ubiquity and used CK–12 platform and Diigo for content curation. A Blackboard LMS facilitated online and blended learning with OER and copyrighted materials (U.S. Department of Education, 2017).

Benefits of OER

The following range of benefits of using OER in education was generated from teachers who participated in professional development of OER (Kimmons, 2016):

- **Meet students' learning needs**—By adapting, remixing, or revising OER, teachers can supplement or remove content, simplify difficult reading using software such as Rewordify, translate content into other languages, and make content more culturally responsive to students in their geographic areas.
- **Engage teachers in digital information literacy**—Teachers can identify problems of practice and engage in the information literacy activities described earlier in the chapter to identify, cull, and adopt OER to tackle identified problems.
- **Improve access to resources without budget constraints**—OER typically does not require accounts or paid subscriptions to use resources. Some subject areas, such as science, technology, and social studies, change so much that teachers believe that print textbooks are not up-to-date.
- **Increase educational equity**—Inequity in resources across schools, districts, and states can be reduced with OER. Teachers can use the same resources as anyone else in the world with Internet access.
- **Share lessons and curated materials**—Teachers express delight in working with colleagues, such as in a Professional Learning Community (PLC), to develop OER-based lessons and to immediately share their work back out to the profession to be used by other teachers.
- **Increase teachers' awareness of and adherence to copyright laws**—Use of OER increases teachers' knowledge of fair use and open-licensed resources and can serve as models for their students.
- **Save money**—Many argue that OER reduces costs by eliminating expensive textbooks.

Challenges of Using OER

The following challenges have been reported by school districts and teachers (de los Arcos et al., 2016; Kimmons, 2016; McShane, 2017):

- **Difficulty finding or knowing where to search for current OER for specific subject area and local context**—Teachers require professional development to support the integration of OER.
- **Lack of time to search for OER or experiment with OER**—Teachers' low pay, high long working hours, and new standards reduce some teachers' inclination to investigate OER. Teachers indicate that there are no legislated incentives to support adoption and development of OER.
- **Technical difficulties in downloading or using OER**—Teachers mention lack of Internet bandwidth, use of old devices, and lack of technical support or training as preventing their abilities devoted to OER adoption.
- **Lack of knowledge of reuse/adaptation rules for OER**—Teachers require knowledge of copyright and open licensing to adopt educational resources legally.
- **Lack of alignment of OER to academic standards**—McShane (2017) points out that schools and teachers need OER that support meeting goals specified by standards and/or school improvement plans, which reduces flexibility or "openness" of choice.

- **Lack of adoption or support for OER among colleagues or school leaders**—Administrators must buy in to OERs and provide time and support for planning and collaboration.
- **Lack of OER adherence with privacy laws and equal access under IDEA**—Schools and teachers must ensure that no educational resources used within the classroom violate federal policies regarding privacy of student information and that they meet accessibility requirements for students with disabilities.
- **Increased costs**—As districts commit to OER, they must also invest financial resources to support time for teacher research and professional development and/or district-sponsored curricular development processes to ensure quality and effectiveness of OER.

Check Your Understanding 6.5

Evaluation and Integration of Web Content for Instruction

This section introduces an evaluation framework that teachers can use to consider the challenges that web content might introduce if adopted. The framework suggests instructional design options that can either reduce or increase the ease of use of web content. It also introduces integration strategies for web content in the classroom.

Evaluation Framework for Web Content

When web content is not evaluated by other trusted entities, teachers must decide whether it is applicable for their teaching purposes. Wallace (2004) identified five affordances of web resources: boundaries, authority, stability, pedagogical context, and disciplinary context. When taken into account, these affordances can assist teachers in analyzing the usefulness of resources and identifying any supplementary design work that a teacher might need to do to make the web content usable. As teachers design activities with web content, these five affordances will vary on a spectrum from not available to maximally available. It is more challenging to use web content when the affordances are not available, but teachers can make design decisions that increase the affordance's availability. This section describes these five affordances and discusses how teachers can make instructional design decisions in relation to these affordances.

BOUNDARIES *Boundaries* are the intellectual and physical boundaries or scope of web content. Print textbooks provide maximal intellectual and physical boundaries. On the web, students physically access web content on digital devices, in web browsers, and in apps, and different access could show web content differently. Students' intellectual web work could occur on any website or web-based app. To set more physical and intellectual boundaries, teachers can assign specific devices through which to access specific web content. Teachers can increase intellectual boundaries by assigning content topics versus student-generated topics, but this approach can still lead to massive content. Teachers can introduce intellectual boundaries by limiting sources for information, such as using K–12-oriented library databases, so the resulting content will be at student's reading and intellectual levels.

AUTHORITY *Authority* is the relevance and accuracy of the web content. Unlike textbooks that are developed and authorized for classroom use, content on the web typically is not. Teachers and students must take critical stances on establishing relevancy

and accuracy of web content. Some teachers engage in such critical analysis and provide a set of "vetted," known, authoritative content sites for students to use. Other teachers have students find and evaluate information, but in doing so, teachers must ensure that students have deep information literacy skills.

STABILITY *Stability* relates to whether the web content will change or disappear within the timeframe for use. Some teachers ignore issues of instability by allowing students to search all websites, but this approach introduces the need for students to determine authority of the content. Most teachers find that the most stable web content emerges from websites sponsored by reputable, professional organizations, such as governments and universities.

PEDAGOGICAL CONTEXT *Pedagogical context* is the existence of built-in framing for teaching and learning in web content. Framing could include online materials to support teacher scaffolding, instruction, and assessment as well as to support students' learning processes. If web content has no built-in pedagogical context, teachers could have a difficult time knowing what and how students are learning. For example, students doing open web research on any website might need scaffolding to capture their learning processes and knowledge development, such as using NoodleTools software. When web content provides pedagogical context, teachers should consider using it if deemed appropriate. For example, Google Expeditions provides narrative descriptions that can be read to the class, the ability to mark aspects in the field to be examined in more detail, and assessment questions.

DISCIPLINARY CONTEXT *Disciplinary context* is the existence of carefully sequenced subject-area curricular content (e.g., mathematics, science, English language arts disciplines) that is age and developmentally appropriate. Unlike textbooks, most web content has not been created with subject area curriculum and learner needs in mind. In most cases, teachers must decide and design how web content will fit within their subject area curriculum. Some teachers design web content to replace exactly what they have done in the past (replacement), expand content resources (amplification), or enable completely new experiences (transformation). In other cases, teachers use web content as an add-on to textbook-based instruction. If students do not see coherence with other activities, the web content could be peripheral to real learning.

Application Exercise 6.2 A Teacher's Approach to Finding Web Resources

Wallace (2004) argues that web content activities that make all affordances maximally available could inhibit students from critical thinking or synthesis. On the other hand, web content activities that make affordances unavailable will be unsuccessful because students will be overwhelmed with content and/or teachers will need to do significant design work to focus the learning activity. Teachers must work within these affordances to design more successful use of web content. For example, a teacher can identify a battery simulation (the web content) on the CK–12 website, which is tagged with curricular topics and standards that the simulation meets (high disciplinary context). CK–12 Foundation is a reputable, nonprofit in existence since 2007 (high stability) with science experts as authors of the content (high authority). The battery simulation is focused on electrochemical concept (high intellectual boundary) and is accessible

via any web device or browser (low physical boundary). CK–12 does not provide any pedagogical context for its use (no pedagogical context). The affordances of this web content are more available, but the teacher is called on to design how to pedagogically use the simulation within her teaching to support learning.

Integration Strategies for Web Content

Once teachers have identified subject area web content, they can consider the following strategies that address a variety of learning and teaching needs; it is this match of activity types with needs that defines and shapes integration strategies. The web content and lessons described previously can be used with more than one of the integration strategies discussed next.

STUDENT RESEARCH AND INFORMATION LITERACY SKILL DEVELOPMENT Students frequently use web content to gain insights into topics they are studying and to locate information from online sources for research papers and presentations. Growth in students' digital literacy skills requires that they have opportunities to learn how to use web resources to locate the content that they need efficiently. Possible activities include individual and cooperative research projects.

VISUAL LEARNING WITH PROBLEMS, MODELS, AND SOLUTIONS The real-world data, images, animations, and videos available online can help students better understand complex problems and visualize possible solutions. Currently, 3-D modeling is experiencing increased use in education as a way to help students visualize mathematics and science concepts. Activities that work for this strategy include teacher demonstrations, individual or cooperative research, and problem-based learning.

MULTICULTURAL, GLOBAL AWARENESS Much web content can broaden students' perspectives on their own culture and that of others in addition to providing insights into how their culture relates to others in the world. For example, teachers use virtual field trips to locations or experiences not accessible to students. Archived content from museums and government organizations provide historical artifacts from across the globe.

IMMERSIVE EXPLORATION, COLLABORATION, AND PROBLEM SOLVING In education, immersive and semi-immersive 3-D worlds, such as virtual reality and MUVEs, are expanding in K–12 education. Virtual reality is emergent with some K–12 content, such as that offered through Google Expeditions. MUVEs can be used to conduct constructivist lessons to allow students to work together to explore content and solve problems. For example, the Quest Atlantis MUVE positions students as scientist avatars who must solve a water quality problem in a park. Semi-immersive 3-D worlds have capacity for multi-user collaboration whereas virtual reality needs to expand its social capabilities in the future.

Check Your Understanding 6.6

Chapter 6 Summary

The following is a summary of the main points covered in this chapter.

1. **Introduction to the web**
   - The Internet began as a U.S. Department of Defense (DOD) project called ARPANET. Today's online environment, referred to as "the web," came about in 1993 with the development of Internet browser software.
   - Internet addresses are called *uniform resource locators*, or URLs. There are parts of a URL that determine its address. Uses of URLs include locating them and reading them.
   - Methods of navigating the web include navigating with links, buttons, browser history, and QR codes. Links can be organized using bookmarks, favorites, and online organizers.
   - The web provides the ability to download computer software, mobile apps, web extensions, and plug-ins. These resources often need to be updated to ensure optimal functionality for and security against new threats.
   - Basic Internet troubleshooting includes solving two kinds of problems: site connection failures and features on the site that will not work.
2. **Online safety and digital citizenship**
   - Many federal laws govern policies and practices within schools regarding online safety and digital citizenship.
   - Online safety and security issues for teachers and students include accessing sites with inappropriate materials, safety and security issues for students, data privacy issues for students, online identity and reputation issues, and computer viruses and hacking.
   - Online ethical and legal issues for teachers and students include online plagiarism and online piracy.
   - Digital citizenship concepts include information literacy, privacy and security, self-image and identity, copyright and attribution, cyberbullying, Internet safety, relationships and communications, and digital footprint and reputation. Netiquette, a subset of digital citizenship, covers rules of behavior for email, messaging, and online discussions.
3. **Searching the web for information**
   - Search engines are online programs that allow keyword searches to locate websites. Types include crawlers, metacrawlers, human-powered directories, and hybrids.
   - Search strategies include subject index searches, keyword or phrase searches, advanced searches, and narrowing results.
   - Research and reference tools let students look up information in online databases, encyclopedias, atlases and mapping tools, and dictionaries for research projects and other learning activities.
   - Information literacy involves building appropriate search queries, evaluating resulting information critically, and connecting ideas across resources to build knowledge.
4. **Online educational content**
   - Archived content remains fairly static and often resides in online archives from governmental agencies or on organizations' websites. Teachers and students must use strategic searching techniques or their knowledge of organizations to find archived web content.
   - Four types of web content with interactive or immersive qualities include simulations; virtual field trips; virtual, augmented, and mixed reality environments; and 3-D models.
   - Live web content occurs in real time and includes videoconferencing, adventure learning, and citizen science.
5. **Open educational resources**
   - Open educational resources (OER) are web resources either in the public domain or licensed to allow the 5Rs: retain, reuse, revise, remix, and redistribute.
   - Educators use three sources for OER content: online searches for open-licensed content, OER repositories, and curated OER content.
   - Teachers have identified many benefits of using OER, including meeting students' learning needs, engaging in digital information literacy, improving access to accurate OER, increased educational equity, sharing curated lessons, increased awareness of copyright, and saving money.
   - Teachers have identified several challenges in using OER, including difficulty finding OER, lack of time to search or experiment with OER, technical difficulties in using OER, lack of knowledge about OER, lack of curricular alignment with OER, lack of support for using OER, lack of adherence to laws regarding privacy and equal access, increased costs for professional development, and curricular development.

6. **Evaluation and integration of web content for instruction**
   - Teachers should evaluate web content in terms of the availability of five affordances: boundaries, authority, stability, pedagogical context, and disciplinary context. Teachers can make design decisions in how they use the web content that can reduce or increase the availability of these affordances, which can impact the success of web content use in teaching and learning.
   - Integration strategies that leverage archived, interactive, immersive, or live web content include student research and development of information literacy skills; visual learning with problems, models, and solutions; multicultural, global awareness; and immersive exploration, collaboration, and problem solving.

Technology Integration Workshop

1. Apply What You Learned

In this chapter, you learned about finding web-based content resources. Now apply your understanding of these concepts by completing the following activities:

- Re-read Ms. Almon's *A Research Paper* lesson at the beginning of this chapter. Pay close attention to Step 3 of her TTIPP where she identifies the technological possibilities for her problem of practice: getting students to learn about and use research resources. Using your knowledge about finding web-based content resources introduced in this chapter (navigating the web, online safety and digital citizenship, searching the web, online educational content, open educational resources, and evaluating web content for instruction and integration), generate at least one new technological possibility for targeting Ms. Almon's problem of practice.
- Review how Ms. Almon and her colleagues RATified the lesson in Step 5 of her TTIPP as represented in Figure 6.1. Use the RAT Matrix to analyze the role(s) and relative advantage that your new technological possibilities (identified in the last step) would have in the lesson. You must reflect on the roles that your identified technological possibilities play as replacement, amplification, and/or transformation of instruction, student learning, and/or curriculum. Do you feel that your proposed technology would provide relative advantage?

2. Technology Integration Lesson Planning: Evaluating Lesson Plans

Complete the following exercise using the sample Technology Integration Examples 6.1–6.5, any lesson plan you find on the web, or one provided by your instructor.

a. Locate lesson ideas—Identify three lesson plans that focus on any of the web-based content resources you learned about in this chapter. For example:
   - Archived web content
   - Simulations
   - Virtual field trips
   - Virtual, augmented, or mixed reality environments
   - 3-D models
   - Videoconferencing
   - Adventure learning
   - Citizen science

b. Evaluate the lessons—Use the **Technology Lesson Plan Evaluation Checklist** and the **RAT Matrix** to evaluate each of the lessons you found. Based on the evaluation and your RATification of the lessons, would you adopt these lessons in the future? Why or why not?

3. Technology Integration Lesson Planning: Creating Lesson Plans with the TTIPP Model

Review how to implement the TTIPP Model (see Figure 2.6) for technology integration planning and use Ms. Almon's lesson *A Research Paper* in this chapter as a model. Create your own technology-supported lesson that uses web-based content by completing the following activities:

a. Describe Phase 1—Analysis of Learning and Teaching Assets and Needs:
   - What is the problem of practice or main content topic in your lesson?
   - What are the technology resources that your students, their families, you, and your school could bring as assets to the lesson?
   - What are the technological possibilities for helping to solve the identified problem of practice? Identify the technology(ies) you will integrate into the lesson to ensure that you have the skills and resources you need to solve the problem.

b. Describe Phase 2—Design of the Integration Framework:
- What are the objectives of the lesson plan?
- How will you assess your students' accomplishment of the objectives?
- What integration strategies will you use in this lesson plan?
- What is the relative advantage of using the technology(ies) in this lesson?
- How would you prepare the learning environment?

c. Describe Phase 3—Post-Instruction Analysis and Revision:
- What strategies and/or instruments would you use to evaluate the success of this lesson in your classroom, in order to determine any needed revision?
- Create descriptors for your new lesson (e.g., grade level, content and topic areas, technologies used, ISTE standards, 21st-century learning standards).
- Save your lesson plan with all its descriptors and TTIPP Model notes and share with your peers, teacher, and others.

When you use your new lesson with students, be sure to assess it using the **Technology Impact Checklist**.