CHAPTER THREE

Researching technical subjects

Researching a subject in technical communication is often somewhat different than researching a subject in other areas. Your main source of information may be other people rather than books, so it may be necessary to expand your range of research skills to include such methods as interviewing and surveying. These methods seek out information that is not published anywhere, nor is it available in document form. Information that you generate that has not been published before is called "primary research." Your efforts to record the information in your technical document may be the first time this information has been committed to print. In business workplaces, the information that is needed often is so specific or proprietary that it must be created by you—there is no published research specific enough for the problem you are trying to solve.

"Secondary research" refers to information that presents the findings of previously published research; if you find articles in the library or online, you are doing secondary research, but if you interview people and report what they said you are doing primary research. Secondary research, such as literature reviews in academic documents or professional genres such as white papers, maps out what is already published about a topic. Writers of academic research projects often start by consulting the existing research (the secondary research) before planning their own research program. Once these writers identify "gaps" in the existing knowledge, they then do some primary research of their own to fill these gaps.

This chapter offers a concise review of three methods of information collection: interviewing subject matter experts, effective survey design and development, and finding and evaluating traditional print and online sources.

Primary research: Interviewing

One important source of information for technical communicators who are documenting a new product or system is often the individuals who developed it. This information is gathered through interviewing—that is, meeting these individuals with a prepared list of questions to discuss aspects of the product or system, so you will be better able to write the operation or reference manual for it. Generally, the individuals who provide information about new technical products or systems are called "subject matter experts." Often, people who develop new products have great technical expertise but less experience in translating that knowledge into documents that non-experts can use successfully. It may be your role, as a technical communicator, to be the intermediary between the subject matter experts' technical expertise and the users' relative lack of knowledge. One of the best methods for gathering the information, then, is the interview.

There are three stages to completing a successful interview:

- Preparing for it
- Conducting it
- Writing it up

PREPARING FOR THE INTERVIEW

Preparing yourself to conduct the interview is a crucial first step to increasing the chance that you create goodwill with the individual whom you interview and that you gather all or most of the information that you need. Prepare yourself in the following areas:

- Learn in advance everything that you can about the subject that you plan to discuss with the subject matter expert
- Learn in advance as much as you can about the person who is the subject matter expert
- Prepare a list of well-organized questions

Learn everything you can about the subject

Read any documentation associated with the product or system that you will discuss with the subject matter expert in the interview. The greater your own technical knowledge about it, the better are your chances of understanding what it is you still need to learn, of formulating good questions that will elicit that information from your subject matter expert, and of understanding the answers from the expert in response to your questions. If you are able to discuss the new product or system using accurate terminology, you will develop credibility with the person you plan to interview because it will be clear that you do have some knowledge of the subject matter. Your own technical knowledge will give you greater confidence as you interview the expert, as well as a concep-

tual framework that you can expand as you learn more about the subject from him or her.

Next, discover the purpose of the product or system. Why might a user purchase the product? What will it enable her or him to do? Why is it better than other similar products? If you understand what can be done with the product or system that you are documenting, you can focus your research efforts to gather the information that will help users accomplish their goals when they come to use the device.

The next step is to determine your purpose in writing the planned document. (To persuade people? To inform them? To teach them?) If your purpose is to persuade readers to buy this product, you will want to learn about and discuss during the interview the main details regarding the advantages of your product over the competition's. If you are showing readers how to use a particular application, you need to assemble specific information about the actions required to accomplish various tasks. You should also think about the reasons or motivations someone might have for reading your document. (To make a decision? To learn? To do *x*?) If you understand their possible motivations, you can more effectively respond to them in the document that you write.

In addition to reading about the item that you plan to document, you might also attend in-house training courses (if any are available) or obtain a copy of the product or system so that you can experiment with it. Throughout all of these activities, keep notes about your experiences. Are steps missing in the existing documentation about the product? What questions does your experimentation with the product raise for you that a subject matter expert might be able to answer? Use training courses as a way to make contact with individuals who know something about the product or system. Ask them whether you can contact them later with questions that they might answer.

All of these strategies will help you learn about the subject of your writing. You want to use this knowledge to be as informed as possible about the subject before you begin the interview. The higher your level of knowledge the fewer basic questions you need to ask, enabling you to ferret out more easily other important information to help you accomplish your purpose in writing the document.

Learn about the subject matter expert

Before you schedule the interview, learn as much as you can about the subject matter expert. This means doing some research on her or him to find out about interests, specialties, and personality. Check out other projects he or she may have worked on. Ask co-workers about their experiences with this individual to give you some insight

into what the individual is like to deal with one-on-one, but don't be influenced by other judgments, especially if they seem negative. You are collecting information to help you approach this person and motivate her or him to cooperate with you. Depending upon your attitude and approach, you may find him or her much more friendly and helpful than others report.

Prepare a list of organized questions

ORGANIZE AHEAD

Before you schedule the interview, prepare and organize your list of questions. That way, if the individual replies, "I'm not busy now; why don't you come right over?" you will be able to say, "I'm on my way."

CREATE A LEGIBLE, NUMBERED LIST

Your list of questions should be written down, either typed or in legible handwriting, and numbered. The numbering also helps you to keep track of your questions and cross them off as they are answered. An ordered list also helps you to control and direct the interview, since your interview subject may not always want to talk about the same topics as you do. The list helps ensure that you gain the information you need about the topics that you think are important.

STRUCTURE THE QUESTIONS TO CONTROL THE INTERVIEW

Structure your questions so that there is a recognizable shape and progression to your interview. You might order them from general to more specific; you might move from discussion of basic functions of an application to more advanced features. This approach allows you to build on earlier information as well as ask impromptu questions that occur to you based on your interviewee's responses.

Organize your questions into a logical or topical progression to help you cover all necessary aspects of the subject. Ordering your questions according to the outline of your document can also help you when you begin writing, because you won't have to reorganize everything according to a different plan.

WRITE EXTRA QUESTIONS

Write more questions than you think are needed for the interview. This way, if your subject matter expert answers the questions clearly and efficiently, you won't run out of material before the interview is scheduled to end.

Writing good questions

Good questions start with the six basic journalists' tools: who, what, where, when, why, and how. Use these to begin. As you explore the

possibilities surrounding each word, more specific questions should occur to you.

Here are a few tips to help you develop questions that will give you the answers you need:

- Don't ask questions that can be answered by "yes" or "no."
  Ask questions that require elaboration and explanation. If you were writing an operating manual for a computer application for novice users, which question would give you the most useful information?
  1. Are the program's functions represented by icons that appear on every screen?
  2. If a new user opened the program, where would he or she find information about the functions that can be performed?

  Obviously, the second version of this question is more likely to provide you with information that you don't already have (since earlier experimentation with the program—if possible—would already enable you to answer "yes").
- Ask questions that you cannot answer elsewhere.
  Once you gain access to your subject matter expert, use your time productively by asking questions that only he or she can answer. If you have conducted your research effectively into the product or system, then you should already have answered many of your own basic questions. This research should have also generated some questions and issues for you that remain unanswered at this point: use your earlier notes and observations to help you generate such questions.
- Ask about topics that you don't understand.
  Again, capitalize on the subject matter expert's knowledge by asking her or him to explain aspects of the product or system that you can't figure out.
- Include detail and background to your questions to help provide context.
  Asking a question out of the blue can confuse your interviewee. As a preamble to the question, include background information that will orient your listener to the general topic and make it faster and more efficient for her or him to formulate an answer. If it becomes clear that the background is unnecessary, you can always skip over it, as you ask the main part of the question.
- Ask what may seem to be "stupid" questions.
  Finally, don't be afraid to ask what might appear to you to be obvious or stupid questions, if you really don't know the answer. Sometimes, such questions will quickly clear up fundamental misunderstandings. Other times, these are the

IN-CLASS EXERCISE 3.1

Prepare to Interview a Classmate

Prepare a list of questions to use in interviewing a classmate. Decide what general area of life you are interested in knowing more about and write a list of at least 10 questions that you might ask. Make sure that none of them can be answered by a simple "yes" or "no." Here are some suggestions for possible areas of inquiry:

- Plans for after graduation?
- Grad school?
- Work?
- Travel?
- Family history?
- Biographical information?
- Hobbies and/or interests?

questions that your users might ask, were they able to, questions that no one else has considered because answers seem so obvious to individuals who are experts on the topic.

CONDUCTING THE INTERVIEW

Schedule an hour-long interview, if possible

Contact the subject matter expert to schedule the interview. An appropriate length of time for the interview is usually one hour. You will probably find that an hour is about the maximum that you can remain alert, engaged, and sharp. After the hour passes, both you and your interviewee can become too tired to make efficient use of the time. Aim to work efficiently and productively. You want to avoid gaining a reputation for wasting people's time because that can make it much more difficult for you to collect the information you need to do your job effectively.

If your project requires several hours of discussion with the interviewee, then set up a series of meetings over several weeks rather than trying to complete your research in one session. Only schedule additional meetings if there is significant information that you still need to collect.

Introduce yourself and explain your project

When you call to schedule the interview, introduce yourself to the subject matter expert, explain your credentials, and describe the kind of information that you need. Explain why you believe he or she is the best source of this information, if it isn't immediately obvious.

Decide whether to record the interview

To create a permanent record of the interviewee's responses, you will need to either record them or take detailed written notes (using a laptop computer or pen and paper). While an audiotape or a videotape of the interview may seem obviously useful, there are a few drawbacks to this decision, including the fact that you have to listen to or transcribe the conversation later in real time. This can be incredibly time-consuming (plan on spending about three hours transcribing one hour of conversation). It can also lead to a false sense of security during the interview, when you believe that you are capturing all of the important details, only to find out later that the recording machine has malfunctioned or the building's ventilation system drowns out the human voices. Also, some people object to having interviews that they give recorded, so make sure you have your interviewee's permission before you begin to record.

Of course, there are also advantages to recording: the interview can proceed more smoothly and naturally because the speaker doesn't have to wait for you to scribble the key points frantically

before proceeding with his or her explanation. You can maintain eye contact and think about the next question or decide that a follow-up question is needed. If the information is recorded accurately, then you can review specific points the speaker made later to clarify your understanding.

Even if you do decide to record the interview, you should also take notes so that you can record the context of the speaker's comments as well as your impressions as the discussion continues. This way you also have a list of the major topics and points in case your recorder malfunctions.

If you decide to take notes exclusively, then, after the interview ends, you should go back over your notes as soon as you can and add details and impressions that you remember from the interview but did not have time to record.

Be an active listener

As you conduct the interview, use active listening to respond to your interviewee's answers. Active listening is the practice of checking your understanding of the speaker's comments by rephrasing them to state what you think you heard. This type of rephrasing enables the interviewee to verify that you have understood his or her point accurately and to correct any misperceptions. In addition to ensuring accuracy, this technique also communicates that you are engaged and interested in what the interviewee is saying.

Also, be conscious of the nonverbal cues that you give your speaker as he or she talks. Try to make eye contact, even if you are taking notes, and smile and nod encouragingly to show that the information is helpful. Mannerisms that indicate positive interest will motivate your speaker to continue to talk, which is your goal.

Control the interview

Sometimes, you may find your subject matter expert getting bogged down in minute technical details, which he or she finds fascinating but which do not help you to accomplish the task of showing a beginner how to use the device. In this case, you need to tactfully bring the speaker back to talking about the information that you can use. For example, you might point out that, while this particular explanation is fascinating, you would appreciate it if the speaker could also explain how it might tie into the information that the user needs to know.

Working with those for whom English is a second language

Sometimes your subject matter expert will not have a good grasp of English, which makes your job a little more challenging. If he or she does not understand a question, then try rephrasing it to locate

IN-CLASS EXERCISE 3.2

Interview a Classmate

Using the questions that you developed in Exercise 3.1, interview a classmate. Your purpose in interviewing this person is to gather enough information to write a short news story or biographical sketch. Take notes as you talk so that you can refer to them later for details during the write-up.

Then, write up the results of the interview as a short news story, personal profile, or biographical sketch.

vocabulary that is familiar and will help clarify your point. You might also consider drawing pictures to illustrate the point or using the technology while the interviewee observes you and comments on your actions. These interactions require patience and ingenuity, but you can usually gather the information that you need if you accept responsibility for making the communication work.

Closing the interview

When your information is complete or the time scheduled for your interview has passed, wrap up the discussion. If you have unanswered questions, you may need to schedule another interview. Thank your interviewee for talking with you, and make it clear that his or her answers have provided you with valuable information. If interviewees understand that you consider the time well spent, they will be more willing to talk with you again about later aspects of this project or another one. Also, arrange to have your subject expert answer any follow-up questions that might arise when you review your notes or convert responses into written text.

As soon as you can, review your notes and fill in any gaps that you see with details that you can remember. Assess how well the answers you received will work to provide you with the information that you need. Schedule a follow-up interview, if you haven't already, and begin drafting your document based on the information collected from the first interview.

Primary research: Conducting surveys

You have probably participated in a survey as recently as the end of your last course: student evaluations generally take the form of surveys. Your experience in filling out those forms may have given you some insight into the limitations and advantages of survey methods: do the questions sometimes direct you to answer in a certain way? Is there enough time given to express your thoughts about the course and the instructor? Are you confident that the results will be kept confidential until after the grades for the course have been turned in? Confidentiality, time limits, and loaded questions are just some of the limitations that may affect survey results. In this section of the chapter, we'll point out some ways that you can avoid these problems while benefiting from the advantages of surveys: a large number of people can be consulted, the same questions are asked of each participant, and results can be quantified and compared to those from other surveys.

Survey methodology turns up in a wide range of communication activities, everything from texting a vote to election polling; you may also have been asked by telemarketers to participate in survey

research projects, and some may even have offered to pay you for the time it takes to participate in the survey. Not every research project has a budget to pay participants, though, and many good projects depend on the goodwill of participants to succeed. Cancer survivors and their relatives, for example, often are more likely to contribute the time needed to answer an extensive survey for cancer research—they have an intrinsic interest in the research. If you choose to do survey research or need to do survey research as part of your writing project, one of the things you'll need to do is determine what would motivate people to participate in your survey.

Survey research can help you at two stages in your writing project: before you begin writing and as part of usability testing (revising). In the initial stages of a writing project, you could do surveys to find out what users are looking for in a manual: what are the tasks they do most often? What tasks confuse them the most? What are their most frequently used methods of solving a problem when they are using the software or device you are writing about? The answers to these kinds of questions could save you an enormous amount of time and effort if you get good information before you begin drafting your document. Not every survey has to be extensive, and not every survey needs to be formal. With a few pointers on how to get started, you should find that you can use this method to improve the quality of your writing.

ASKING GOOD QUESTIONS

Survey research is a method of generating information by asking questions of a large group of people. The quality of your survey, however, is directly related to your skill at asking good questions. There are two main types of questions to ask: closed-ended and open-ended. Closed-ended questions have the range of possible answers printed below the question itself; these questions are said to be closed because the range of answers is predetermined.

Kind of Question	Example
Closed-ended	How often did you contact your academic advisor when you were a student? 1. Never 2. Once or twice 3. Each academic term
Open-ended	What was the best advice you got from your academic advisor while you were a student?

FIGURE 3.1
Examples of open-ended and closed-ended survey questions.

Let's start with open-ended questions. These questions allow respondents to answer in their own words and to give some insight into why they think the way they do. They allow for unanticipated responses—and sometimes that is the most valuable information you can obtain from a survey! For example, you could ask a respondent "Why do you take/not take public transportation to school?" The range of possible answers could be quite wide, and the unanticipated answers could lead to innovative responses that would improve services. This wide range of answers constitutes the biggest disadvantage to open-ended questions: the data are difficult to group into categories because the answers vary so much.

Closed-ended questions are more efficient for respondents: they can answer these questions quickly because the answers are right there for them.

What is the single most important reason that you avoid buying books at the campus bookstore?

1. High prices
2. Long lines
3. No used copies are stocked
4. Other (please specify) _____

FIGURE 3.2
Example of a closed-ended question.

The data generated by closed-ended questions are more reliable (that is, the same question asked of the same person will almost always give the same resulting answer) and easier to code and compile into tables and statistics. These advantages may also cause problems: the predetermined categories for the answers might force respondents to choose an answer that does not accurately reflect what they think (that is, the answers may not be valid or an accurate measure of what respondents think). There may be a combination of reasons for avoiding the campus bookstore that the question in Figure 3.2 does not capture.

One final consideration involves the time it takes to complete a survey. In general, the longer it takes for respondents to complete a survey the more likely it is that they will not finish it or return it to you. Open-ended questions take longer to answer than closed-ended ones, so limit your use of open-ended questions. Use open-ended questions to uncover the most important information you want to know.

GUIDELINES FOR ASKING GOOD QUESTIONS

Once you have decided which kinds of questions you want to ask, use the following guidelines to write the questions themselves:

- Rephrase jargon and technical language into plain language
- Ask specific questions
- Avoid loaded questions
- Break compound questions into individual questions

Rephrase jargon and technical language into plain language

BEFORE:

Which database systems provide a variety of tools that allow specialized interfaces for tasks such as order entry and report generation to be constructed quickly?

BETTER:

Which databases provide specialized interfaces to quickly enter information and generate reports?

Ask specific questions

BEFORE:

What do you do when you cannot determine where to click?

BETTER:

When you are in the Build section of the WebCT/Vista interface, where do you click to return to the screen that shows how to enter student grades?

Avoid loaded questions

BEFORE:

Has your undergraduate advisor ever given you even a single piece of good advice?

BETTER:

How would you characterize the quality of the advice that your undergraduate advisor has provided to you?

Break compound questions into individual questions

BEFORE:

Should the undergraduate student council sponsor more social events or lower the fees that they charge you?

BETTER:

- Should the undergraduate student council sponsor more social events?
- Should the undergraduate student council lower the fees that they charge you?

CHOOSING APPROPRIATE RESPONSES

Asking good questions is only one half of the challenge when you write questions. The other half is creating appropriate responses. Open-ended questions, of course, do not provide a structured

response by the very nature of these questions. Responses to closed-ended questions can take one of the following forms:

- Yes/no answers
- Rating scales
- Comparative rating scales
- Category scales

YES/NO answers are, well, self-evident. Respondents can answer yes or no. The trick with these questions is to make sure that the situation you are asking about is really this black and white. Yes/no questions can also be organized into a list so that you can obtain quite a bit of information from one question:

1. Which of the following software applications have you used in the past year:
   ___ WordPerfect®
   ___ MS® Word
   ___ Excel®
   ___ Photoshop®
   ___ Dreamweaver®

RATING SCALES ask respondents to answer a question with a number that represents a response. The number they assign can vary; the following list offers some options:

- Pick one of the listed numerical responses
- Assign a number to the responses listed
- Choose among a range of numbers
- Select a number aligned with a word or phrase that describes the response each number corresponds to

The Likert scale (named after its inventor, Rensis Likert) is one such scale, though there are many others. The traditional one uses a five-point interval, though seven- and nine-point intervals are also used. These intervals can be represented either as a list or more graphically

Computer support in your workgroup is adequate:

1. STRONGLY DISAGREE
2. DISAGREE
3. NEITHER AGREE NOR DISAGREE
4. AGREE
5. STRONGLY AGREE

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE

FIGURE 3.3
Two examples of a Likert scale using five-point intervals. The first one provides a numbered list, the second a graphic representation with a numbered line.

along a line with numbers. Figure 3.3 shows a Likert scale using a numbered list or a numbered line.

COMPARATIVE RATING scales differ by asking respondents to rank each of the responses in relation to the other ones. In one survey sent with a power tool, respondents were asked this question:

Using the numbers in the above list, indicate your three most important activities:

___ Golf
___ Camping
___ Avid book reading
___ Wines
___ Wildlife
___ Gambling

Apparently, the idea was to generate a comparative ranking in an attempt to determine whether any of these activities had a connection to buying power tools.

The last kind of response you could structure establishes **categories** that respondents select. Instead of individual selections, you provide CATEGORIES or ranges for respondents. Many people, if asked, could not say how many times in the past month they used a particular software application, but they could reliably put themselves into a category that allowed them some margin of error: "frequently," "sometimes," or "almost never" are three categories that are often used to structure these answers.

PREPARING THE SURVEY FORM

Surveys can be done on paper, via the Internet, and through phone conversations. Whatever delivery method you choose, you must take care to prepare the survey form so that it is clear and easy to read; it should encourage respondents to finish. Even telephone surveys need to have clearly written and well-designed forms for the person making the call to read out to the person answering the survey. But when paper or a computer screen is all the respondent will see, the time you spend designing your form will be a crucial factor in your success or failure to obtain completed survey forms.

Follow these guidelines as you prepare the survey form:

- Put a title on the page
- Write a short introduction to motivate the respondent to complete the survey
- Order the questions: start with easy or factual answers to create a sense that the survey won't take too long to complete
- Leave plenty of space for respondents to write answers to open-ended questions

- Edit the survey; keep only the questions that you really need the answers to
- Leave lots of white space

REPORTING SURVEY DATA

Once you have produced your survey, you need to distribute it. If you are doing an informal, fast survey, you will probably distribute it to a wide range of people, perhaps even leaving some forms in a public place for respondents to pick up and fill in. If you are doing more serious work, you need to decide what group of people you are surveying and how many of those people you can afford to contact. You then track how many of the people that you selected to survey actually filled in and returned the survey form: this is called the response rate (the percentage of people who responded). The higher the response rate, the stronger your data will be.

MAJOR PROJECT 3.1

CREATE A SURVEY FORM

- Create a survey form on computer lab usage to give to students who use the public labs on campus. Use the information in this section of the chapter to help you generate survey questions that tell you what you want to know about computer lab usage.
- Distribute the finished survey form, and collect your data. You should get as many responses as you can (aim for 20 to 30 completed surveys).
- Tabulate and analyse your data. Create two or three visuals from the data that you could use in a written document summarizing the results of your survey.
- Write a memo or report that summarizes the data. Direct this report or memo to the administrators at your institution who would be interested in the responses of student users of the computer labs. If your goal is to argue for improved lab service (or maintenance or equipment up-dates), use the data to make an argument as to how the administration should respond to your survey.

Your memo or report should include at least one data table and one other type of visual that summarizes interesting points about your data. (See Chapter 6 for more information about using visuals.)

While the quality of your data is important, it is also important to determine what type of data you've collected. Open-ended questions result in qualitative data: data that cannot be counted easily but that can describe the qualities or details of an answer well. If you get repetitive answers to an open-ended question, those answers are then seen as quantitative and reported as numbers. As you read through the words that respondents have written, look for patterns among the responses and group similar responses together. Are there any surprising responses? Qualitative data is important because it provides context for understanding the numeric patterns that emerge

from quantitative data. You will use qualitative data (quotations from the open-ended questions) in your report to help explain the meaning of the numeric data. In your thinking about how to write a manual, these open-ended questions may give you key insights into how users will actually use the manual, insights that might not come up in responses to closed-ended questions.

Closed-ended questions will give you answers to count: QUANTITATIVE data. For example, in answer to the question "What year of university study are you in?" students could have responded this way:

- First year: 2
- Second year: 11
- Third year: 7
- Fourth year: 4
- Other (please explain): 1 (student at large)

You would total these results on an unfilled-out copy of the survey, but, in your report based on this research, you might want to present the data in a table:

Year of student	Number of responses	Percentage
First year	2	8
Second year	11	44
Third year	7	28
Fourth year	4	16
Other	1	4

FIGURE 3.4
In a report, present data in a table for easy reference for readers.

In the text of your report, you might want to combine some of these data: 72 per cent of the students in this class are second- or third-year students, and very few first-year students enrol in it. What you are doing here is looking for patterns in the data in an attempt to generalize about what you are finding.

When collected in the initial stages of your project, survey findings can answer questions about the usefulness of the direction you plan to take. Based on the responses from your survey population, you can make adjustments early on or rest assured that your project is on track to provide the best document for your user group. When considered as part of usability testing, survey findings can reveal areas of the document that need revision, improved visuals, clarification of a key point, or perhaps they can even highlight that the level of detail is too basic for your target user group. Direct feedback from real people can be immensely helpful as you evaluate the effectiveness of your work at different stages in its development.

Secondary research: Finding print and online sources

Depending upon what type of technical document you are writing, you may need to do some traditional library or print research on your subject. Especially if you are writing a laboratory report based on a series of experiments, you may need to investigate further research on aspects related to the topic of your experiments. If you are creating a software manual to fill a market niche, you might examine recently published existing manuals to pick up some strategies or tips about what to do or not to do. Or if you are writing a white paper on a new electronic device, you might visit the Internet to search for competitors' products that you can use as a comparison with your company's device, examples of well-written white papers about similar devices that might work as models, or consumer chat sites that evaluate and comment on similar products that might give you useful perspectives on what your readers may like or dislike about such items. A wealth of information is now available online, which facilitates thorough research efforts.

At the same time, libraries are better stocked with useful sources and information than ever before. Many schools have excellent library websites where you can conduct your search for print materials from one of the terminals in the building or through your own Internet connection at home. If you are at a larger educational institution, you may find it has more than one library. If you attend a multi-campus school, you may find that the technical communication journals and books are housed at a different location than where you attend classes. Some libraries allow you to order the books and have them shipped to your location to make it easier for you to research the subjects you are studying. In a day to two, you can visit the library nearest you and pick up your books.

Many of the technical communication journals now have their issues available online, and many educational libraries carry these subscriptions. You can search for a full-text article from your computer and download a PDF to read on screen or to print off a paper copy. As long as you print only one copy for your own personal and educational use, you do not have to worry about violating copyright laws.

Here is a list of the journals that publish articles and reports about research on technical communication:

- *Canadian Journal for Studies in Discourse and Writing* (publication of Canadian Association for the Study of Discourse in Writing with articles in both English and French): see http://www.cs.umanitoba.ca/~casdw/en/about_casdw.htm
- *Technical Communication Quarterly* (publication of the [American] Association of Teachers of Technical Writing)

- *Technical Communication* (publication of the Society for Technical Communication)
- *Transactions of the IEEE* (publication of the Institute of Electrical and Electronics Engineers)
- *Journal of Business and Technical Communication*

You should also identify a list of journals related to the subject area in which you are working so that you can keep current with the recent developments related to the content of your documents.

CONDUCTING AN EFFECTIVE SEARCH FOR SOURCES: LIBRARY AND INTERNET

When you have determined that you need to find some sources, you want to find the sources most relevant and useful to your topic. Finding the most useful information depends largely on the keywords that you select to use in your search. If you don't use the appropriate technical terms, then your search won't locate appropriate publications.

To improve the chances that you will name your subject matter correctly in the search, generate a list of words that you associate with the topic. Then, list as many synonyms for each word as you can think of. If your list is a bit short, you could also consult web search site subject directories (e.g., Yahoo!® Directory, Google Directory, or INFOMINE). A subject directory can help you think of subcategories related to your broader topic. You can also browse or use keyword searches at the library. Browsing allows you to search by author, title, or assigned library subject heading when you already know some of the main sources to use. Keyword searches allow you to access related information from databases. You can also mine some of the sources that your initial searches turn up for additional keywords related to your subject. Other options are to consult a specialized dictionary on your topic or the Library of Congress subject headings (for example, authorities.loc.gov), since most educational libraries use the Library of Congress Subject Headings to organize their holdings.

Once you have generated a respectable list of keywords, you will find that, if you enter just one word, the sources that you locate will be too diffuse and general for actual usefulness. To narrow your search, you may need to combine two or three key words (using AND) to focus and qualify the sources that show up on your screen. You may also be able to narrow your search by specifying what you don't want (e.g., NOT crystalline semiconductors). Some search engines simplify this process by allowing you to use a plus or minus in front of the term to indicate combining and excluding (e.g., +amorphous

semiconductors –crystalline semiconductors). Others provide access to advanced search options such as this on a separate page.

When you have located several useful sources, you can also study their reference sections to locate additional information relevant to your topic. Often, a useful article will contain references to other useful articles on the same or a related subject.

If you are having difficulty finding useful sources from your own search efforts, an efficient alternative is to visit the library and get a reference librarian to help you out. Librarians can shortcut your search time by directing you to the right subject headings, and they can also point out the location of various types of sources in the building. They can help you get your hands on some useful material in a relatively short time.

ASSESSING THE CREDIBILITY OF YOUR SOURCES

Once you locate what look like relevant and useful books, articles, and websites, the next step is to assess the reliability and credibility of your sources. Especially for website-based information, the credibility of the source must be sound. Anyone can put up a website, and no one polices the accuracy or legitimacy of the information posted. Some websites even pretend to credibility and distinction by imitating the look of respected websites posted by well-known organizations or governments. Look closely at the URL and other details to make sure you are visiting the legitimate site.

Here is a list of the criteria that librarians use to assess printed material:

1. PUBLISHER: Who published the document? Scholarly books and journal articles are reviewed by experts in the area before they are published. If the source of the document is a scholarly one, it is likely fairly reliable: it has been screened for accuracy and reliability. If it appears in a popular magazine or book, it may be less reliable because the selection criteria in such sources are based more on interest and entertainment than accuracy or thoroughness.
2. AUTHOR: Who wrote the document? What are this person's qualifications in this area? Does the author have a professional degree or connection with the subject matter that is legitimate and sanctioned by related professional organizations?
3. CURRENCY: How recent is the document? If the topic is a hot one, such as genetic research, then it matters how recently the source was published. An article or book that is several years old may be out of date since developments in genetic research are ongoing, and the field changes rapidly in a very short time.
4. EVIDENCE: What is the basis of the information presented? Did the author conduct interviews, experiments, observations, etc. to

gather the evidence he or she uses to support the claims? Does the author cite relevant and current research and provide proper documentation, so you can find this material yourself? Is enough evidence presented to support the claims?

5. SLANT: Can you figure out areas where the writer seems biased in the opinions expressed? To what extent might these biases affect the information presented?

Depending upon how you answer the questions posed in the list above, you can evaluate the credibility of a particular print source on a scale from useful and relevant to biased and unsupported. Then you can decide whether to include the information in your document or continue to search for other material with more trustworthy content.

The criteria that you can use to evaluate the credibility of an Internet or website source are similar to those useful for evaluating print sources, but some of the criteria will be impossible to verify on the website. In this case, you should probably keep searching for a source that you can verify as accurate and reputable rather than use a source that may be unreliable. Here are some questions that will help you evaluate a website's credibility:

1. WEBSITE SPONSOR: What type of URL does the site use? Is it a government site (ending in .gov or .gc.ca)? Is it a commercial site (ending in .com)? Is it a non-profit site (ending in .org)? Is it a university or college-sponsored site (ending in .edu, sometimes, or sometimes just .ca in Canada)? The final tag on the website URL can give you some indication of whether or not the site is sponsored by a reputable organization. Government and educational websites tend to sponsor information that is more reliable and accurate than many commercial websites, which have as their goal selling a service or product.
2. AUTHOR: Who has written the information that you want to use? Often websites don't identify authors beyond giving their email address. Without at least a name, you may have difficulty assessing the qualifications of the writer, and therefore the validity of the opinions or information that he or she has published.
3. CURRENCY: Does the website have a date and time when the information was posted or last updated? Many websites do provide this detail, but others do not. If you cannot verify the currency of the posting, then you should keep searching for a source that you know is current, especially if timeliness of information is a goal.
4. EVIDENCE: Many websites do not clarify the source of their information, so you may have difficulty verifying their level of accuracy. Look for some idea of who or what organization is sponsoring the website. You can evaluate the accuracy and reliability of its content based on who is affiliated with the website.

If the site does not have an obvious reputable sponsor, nor does it identify the sources for the information it presents, you should probably stay away because you cannot verify its reliability.

5. SLANT: While some websites are overtly political or slanted in their views, others cloak their bias by sounding reasonable and scientific. They may cite statistics as evidence of their claims, but unless you can evaluate the origin of their data, you cannot really tell whether information is legitimate or fabricated.

6. ADVERTISING: Watch for sites whose main purpose is to sell you a service or product. Many sites exist solely to promote the sale of something, and any information they contain will be as reliable as any advertising.

When you have located enough reliable and useful sources, you can begin using them to develop your own document. Reputable sources and statistics can help you build a watertight case for the argument you want to make or help you feel confident about the quality of the technical information that you are presenting. The main challenge of integrating research sources into your text is ensuring that you paraphrase or cite them properly. The next section briefly reviews the difference between quoting and paraphrasing and reviews how to highlight the original source to keep your readers informed as to where you obtained the research materials that you are using.

In the 1970s electrostatics was a field based largely on experimental evidence and requiring the understanding of three basic facts. The first fact was the "existence of electric charge itself" (Schey 1973).

H.M. Schey describes the second fact as follows:

> The second fact is called Coulomb's law, after the French physicist who discovered it. This law states that the electrostatic force between two charged particles (a) is inversely proportional to the product of their charges, (b) is inversely proportional to the square of the distance between them, and (c) acts along the line joining them. (1973)

In this passage, Schey both introduces the law and defines it for his reader, connecting the fact to the equation used to find it. He notes the third fact to be "the principle of superposition" (1973), and he goes on to define it through an equation also. More than thirty years later, the field of electrostatics has ...

FIGURE 3.5
Passage from a report that illustrates how to cite direct quotations using Council of Science Editors (CSE) parenthetical style.

In its earliest years, the field of electrostatics relied primarily on knowledge derived from experiments. Work proceeded on the assumption that electrical charges existed and obeyed Coulombic forces; furthermore, the concept of "superimposition" was integral to work in electrostatics.[1]

FIGURE 3.6
A source paraphrased and cited correctly, using CSE numbering style.

Citing and paraphrasing researched sources

When you encounter a phrase, sentence, or paragraph written by someone else that states so perfectly what you would like to say that you want to repeat it exactly, you should quote it. Quotation means that you copy the passage word for word, and place it between quotation marks, or, if it is longer than about four lines, set it off in a block quotation, as in the example in Figure 3.5.

Note that the long passage is indented to the right and the shorter phrases are contained in quotation marks. Note also that it is important to cite your sources, to tell where a quotation came from.

There are many different ways of doing this. The example uses parenthetical documentation, which puts information about the source in parentheses. The year of the publication appears in parentheses at the end of the quotation. In the first citation, because the author is not identified outside of the parentheses, his or her name appears before the year of publication inside the parentheses.

If you find yourself quoting several passages, re-examine your work to figure out which ones you can paraphrase. If you use too many quotations, your text tends to be taken over by your sources, and the words of your sources overshadow your own ideas. Save direct quotation for only those passages that succinctly express an idea that is critical to the point you are making. If you find yourself relying too heavily on one or two sources, you may need to create some distance between your text and the sources. Put the sources away for a day or so and try writing out what you want to say in your own words. Later you can insert quotations from the sources to support your ideas, but try not to rely too much on others' ideas.

If the writer of the passage in Figure 3.5 had not wanted to quote Schey's words exactly, but rather summarize them to shorten the reference, he or she would have paraphrased his words while still noting the origins of the idea. Figure 3.6 shows how to paraphrase and cite the same information.

Note that, when the writer uses a technical term quoted from the source, he or she places that term (superposition) in quotation marks to highlight the fact that the original source's wording is being used here. The writer has also attempted to substitute synonyms, where possible, for the exact phrasing used by Schey. In this case, paraphrasing is tricky because the passage requires a limited technical vocabulary that cannot easily be replaced while still retaining the precise meaning. For this reason, it is critical to cite the original source to clarify that you are borrowing Schey's ideas here and to avoid any appearance of plagiarism (presenting someone's ideas/words as if they were your own). When you are locating your sources, don't forget to record all of the publication data carefully so that you can cite all sources accurately and completely, should you decide to use them.

How do you know when you should cite sources? Here is a list of types of information that you should always document:

- Statements of opinion
- Claims that can be argued
- Sources for statistics
- Research findings
- Examples

IN-CLASS EXERCISE 3.3

Which Item Needs a Source Cited?

1. The definition of a technical term, for example, "Coulomb's law"
2. An equation to solve a physics problem
3. The year that Isaac Newton published *Opticks*
4. A sentence from Newton's *Opticks*
5. The sketch Newton used to show how he bent light to reveal the spectrum
6. The letter he sent to the Royal Society to secure his claim for primacy about his experiments with light

- Graphs
- Charts
- Illustrations

One type of information that you don't have to cite is facts, if they are widely known and readily available in general reference works such as an encyclopaedia. For example, you would not need to document the fact that 0 degrees C is equal to 32 degrees F.

IN-CLASS EXERCISE 3.4

Which Paraphrase Is Legitimate and Which Is Too Close to the Original?

Read the two paraphrases on this page. Which one is an accurate paraphrase? Explain what makes it a good paraphrase. Explain why the other passage might be considered plagiarism.

The original paragraph:
"Misogyny accounts for Pygmalion's contribution to the history of artificial intelligences. He creates Galatea in ivory because of his disgust with flesh-and-blood women; seeing his completed work, he falls in love with it—though whether what he feels is love or vanity about his own creation is hard to say. We will see that same confusion weaving endlessly through the history of men and their self-imitations (and also its opposite, as creators recoil from what they have made). In any case, Aphrodite obliges Pygmalion by breathing life into Galatea, and the two seem to have lived happily every after."

Source: P. McCorduck, Machines Who Think *(San Francisco: Freeman & Co., 1979), 5.*

Paraphrase 1:
McCorduck attributes Pygmalion's motivation for creating Galatea to misogyny. She says he was disgusted with flesh-and-blood women, so he made his own out of ivory. She questions whether he really loves Galatea or whether he is just vain about his own creation. McCorduck notes that other people in Pygmalion's position have either loved or hated their self-imitations. She concludes that after Aphrodite gave life to Galatea, she and Pygmalion lived happily ever after.

Paraphrase 2:
In her introductory chapter, McCorduck summarizes a number of historical and fictional figures who have created living beings from inanimate materials. She argues that Pygmalion, a Greek sculptor who created an ideal woman out of ivory, was motivated primarily by prejudice against women. She notes that, while he fell in love with his creation, other similar individuals have repudiated their finished works. She concludes with the observation that Pygmalion and Galatea, when Aphrodite gives her life, end up happily living out their lives together.