Technical Research

Differences between research in school and research in the workplace.

Features	Writing prompt	Purpose	Audience	Sources	Publication format
Academic writing	General topic assigned by the teacher	Communicating what the student knows about the topic, to earn a high grade	The teacher who assigned the project	Secondary sources, for the most part	Academic papers Presentations and posters at academic conferences
Workplace writing	Specific workplace situation, question, or problem raised by the writer or by a supervisor	Providing information needed to answer a question or make a decision	Often several people with differing professional backgrounds	Secondary sources serve as foundation for primary research	Reports Proposals Workplace presentations Presentations and posters at professional conferences

Before starting your research, you ask yourself the following questions, to give direction to your work:

- What questions must be answered during the research phase?
- What information might be most useful?
- What print and electronic sources would be most appropriate?
- What format must be used to document material borrowed from sources?

Secondary Sources:

Secondary sources are materials like books, articles, videos, or presentations that provide background information on a topic. They help researchers and readers understand the context and details of a problem or issue from a professional perspective.

Locations for secondary sources include the following:

- The public library
- Corporate library
- The university library
- The World Wide Web

Using Resources:

- What are the author's academic or professional qualifications?
- Who is the publisher, and what is its reputation?
- What are the scope and content of the work?
- How does this information fit in with what you know about this topic?
- What are the trends in information on this topic, and how does this book, article, journal, or Web site fit in?
- How current is this information?

Library Resources:

- **Books**
- **Periodicals** (magazines, journals)
- **Newspapers**
- **Company Directories**
- **Dictionaries, Encyclopedias, and Other General References**

Web Resources:

1. **Directories** of people, businesses, and organizations
2. **Advertising and Marketing Materials** like product catalogs
3. **Government Documents**
4. **Periodicals, Newspapers, and Magazines**
5. **Books** (many available online)
6. **Conference Proceedings and Reports**
7. **Reference Tools** (e.g., guides, periodical indexes, dictionaries)
8. **Subscription-Based Resources** (specialized databases and journals)
9. **Sound and Video Clips** (audio-visual resources)
10. **Images**

Conducting Primary Research:

Data collected by the researcher through methods such as **interviews**, **focus groups**, **surveys**, **laboratory experiments**, or **field observations**. Primary sources also include **original documents** like diaries, company reports, and correspondence, as well as materials analyzed directly, such as user manuals and websites.

Methods of Conducting Primary Research:

Primary research can be divided into two main approaches: **quantitative** and **qualitative** research. Each approach gathers unique types of data and is used for specific purposes in technical research.

1. Quantitative Research

Quantitative research involves collecting data that can be represented in **numbers**. This approach is commonly used to answer questions about the amount or frequency of specific actions. For example, in technical communication, it might involve tracking how long it takes to perform a task or counting the number of clicks needed to locate information in a help file.

Quantitative research is evaluated based on:

- **Validity**: The research is valid if it measures what it is intended to measure.
- **Reliability**: The research is reliable if it can be repeated with consistent results.

Information Gathered Through:

- Surveys
- Questionnaires

2. Qualitative Research

Qualitative research focuses on **non-numeric** data such as words, images, and processes, which help researchers gain a deeper understanding of complex topics. Common qualitative research methods include:

1. **Interviews**: Used to gather insights from subject matter experts (SMEs) or users to document products or improve usability.
2. **Focus Groups**: Involves discussions with small groups to gain feedback on products, websites, or documentation design.
3. **Field Observations**: Researchers observe how clients use equipment or software to better understand their needs and challenges.
4. **Document Analysis**: Researchers examine documents for quality, applying principles of effective communication and usability to evaluate the text.

Conducting Effective Interviews for Research:

Interviews are a valuable method of gathering primary information directly from people, often used along with questionnaires. Here's a structured guide to conducting successful interviews.

Step 1: Preparing for the Interview

Good preparation is essential for a productive interview. Follow these steps to ensure a smooth process:

1. **Set Clear Goals**: Know exactly what you want to learn from the interview.
2. **Clarify Your Purpose When Contacting the Interviewee**: When scheduling, explain why their input is valuable, what topics you'll cover, and how long the interview will take.
3. **Create an Interview Outline**:
    - Prepare a list of topics you plan to discuss in a logical order.
    - Write down specific questions you want to ask, organized to keep the conversation on track.
4. **Respect the Interviewee's Time**:
    - Arrive a few minutes early.
    - Stick to the planned time and avoid extending the interview unless the interviewee is open to it.

Step 2: Conducting the Interview

A well-structured interview helps you gather useful information. Follow these guidelines to maintain control and keep the conversation on track:

1. **Ask Open-Ended Questions**: Encourage the interviewee to provide detailed responses beyond a simple “yes” or “no.” This allows for richer insights and gives them room to explain.
2. **Use Closed-Ended Questions When Necessary**: For specific answers, such as confirming details, use closed-ended questions.
3. **Summarize Throughout the Interview**: Briefly restate responses to confirm understanding and accuracy. Summaries help the interviewee clarify their points and allow you to keep an accurate record.

Step 3: Taking Notes

Keeping good notes is important.

Results:

- Themes
- Presented in the written form (Paragraph/s)

Using Surveys for Research:

Surveys are a useful tool for collecting both qualitative and quantitative data, as they provide insights into people’s opinions and experiences, often summarized through statistics or percentages.

Step 1: Preparing the Survey

To increase the chances that respondents complete and return the survey, focus on two key points:

1. **Clear Benefits for Respondents**: Ensure that respondents understand how completing the survey may benefit them personally or professionally.
2. **Ease of Completion**: Design the survey to be quick and straightforward.

Follow these guidelines to make the survey reader-friendly:

1. Write a Clear Purpose Statement

Provide a short statement of purpose to make the survey’s goals clear.

2. Limit the Number of Questions

Only include questions that are essential to your research. Avoid including unnecessary questions that might distract or tire respondents.

3. Focus on Objective Questions

Objective questions make it easy for respondents to answer and help you compile responses efficiently. Use a variety of question types:

- **Either/Or Questions**: Offer a simple choice, like “yes” or “no.”
- **Multiple-Choice Questions**: Provide several options to choose from.
- **Graded-Scale Questions**: Allow respondents to express varying levels of agreement or satisfaction.
- **Short-Answer Questions**: Useful for responses that have multiple possible answers.

<table>
<tr><th>Types of Questions</th><th>Examples</th></tr>
<tr><td>Either/Or Questions</td><td>Would you or your technical staff find it useful to receive a technical newsletter on acid rain?
a. Yes
b. No</td></tr>
<tr><td>Multiple Choice Questions</td><td>If you answered “yes” to preceding question, what publication schedule would best meet your needs:
a. Monthly
b. Quarterly
c. yearly</td></tr>
<tr><td>Grade-Scale Questions</td><td><table><tr><td colspan="4">Acid Rain is an issue that has strong impact on your day-to-day business:</td></tr><tr><td>Strongly Agree</td><td>Agree</td><td>Disagree</td><td>Strongly Disagree</td></tr></table></td></tr>
<tr><td>Short-Answer Questions</td><td>List any environmental newsletters you already receive that you find helpful in business.</td></tr>
</table>

4. Write Clear, Easy-to-Answer Questions

Avoid common issues like:

- **Biased Language in phrasing**: Neutral phrasing avoids pushing respondents toward a certain answer.
- **Undefined Terms**: Use clear, commonly understood terms.
- **Mixed Variables**: Ask only one thing per question to avoid confusion.
- **Require too much homework:** Avoid questions that require too much research.

5. Provide Simple Instructions

Add clear instructions at the top of the survey, such as: "Complete all questions by checking the appropriate box or filling in the blank."

6. Use Effective Design Principles

Make sure the survey is visually appealing. Leave enough white space and use headings or lines to break up sections for easy reading.

7. Test the Survey on a Sample Group

A “test run” helps you refine the survey based on real feedback.

Step 2: Conduct the Survey

1. Choose an appropriate audience
2. Introduce questionnaire with a clear, concise cover letter
3. Encourage a quick response

Step 3: Compile the Results

- Percentages
- Statistical Tests (for significance)

Presented through:

- Tables
- Graphs

Avoiding Plagiarism

To avoid plagiarism, you need to cite all sources for information you borrow, except common knowledge. This includes quoting, paraphrasing, and summarizing content from other authors.

When to Document Sources

You should cite sources when you:

- Use facts or statistics from another author.
- Refer to ideas or summarize information from other writers.
- Include tables, charts, or graphs created by someone else.

When Documentation Is Not Required

No citation is needed for:

- Your own observations, ideas, or experiences.
- Facts commonly available in multiple reference works (referred to as "common knowledge").
- Well-known proverbs, sayings, or familiar quotes.

Components of Citations:

A citation, or reference to borrowed information, has two main components: **In-text citation** and a **Reference list**.

Types of In-Text Citations

1. **Summary or Paraphrase**: If you restate information in your own words, you still need to cite the original source, as in:
   - A trenchcoat and mask can easily disguise a few owls as a human, as shown by Smith [1].
2. **Short Quotations**: When quoting directly, use quotation marks and cite the source:
   - “The theory was first put forward in 1987 [1].”
   - Alternatively: “Several recent studies [3], [4], [15], [16] have suggested that…”
3. **Citing Multiple Authors**: For multiple authors, use “et al.” only when there are six or more authors.
   - For example: "Fan et al. [4] discuss lasers in detail."

Formatting the Reference List in IEEE Style

The reference list should appear at the end of your paper and include every source cited. Each entry in the list should:

- Be aligned to the left.
- Use single spacing within entries and double spacing between entries.
- Have the entry number in square brackets on the left margin.
- List each source's authors, with only the first six authors listed before “et al.” if necessary.

Book	**[Ref number] Author’s initials. Author’s Surname, Book Title, edition (if not first). Place of publication: Publisher, Year.** [1] I.A. Glover and P.M. Grant, Digital Communications, 3rd ed. Harlow: Prentice Hall, 2009.
Journal Article	**[Ref number] Author’s initials. Author’s Surname, “Title of article,” Title of journal abbreviated in Italics, vol. number, issue number, page numbers, Abbreviated Month Year.** [4] F. Yan, Y. Gu, Y. Wang, C. M. Wang, X. Y. Hu, H. X. Peng, et al., "Study on the interaction mechanism between laser and rock during perforation," Optics and Laser Technology, vol. 54, pp. 303-308, Dec 2013.
E-Journal Article	**[Ref number] [5] Author’s initials. Author’s Surname. (Year, Month). “Title of article.” Journal Title [type of medium]. volume number, issue number, page numbers if given. Available: URL M. Semilof. (1996, July). “Driving commerce to the web-corporate intranets and the internet: lines blur”. Communication Week [Online]. vol. 6, issue 19. Available:** http://www.techweb.com/se/directlinkcgi?CWK19960715S0005

Book

[Ref number] Author’s initials. Author’s Surname, *Book Title*, edition (if not first). Place of publication: Publisher, Year.

[1] I.A. Glover and P.M. Grant, *Digital Communications*, 3rd ed. Harlow: Prentice Hall, 2009.

Electronic Book

[Ref number] Author’s initials. Author’s Surname. (Year, Month Day). *Book Title* (edition) [Type of medium]. Available: URL

[3] W. Zeng, H. Yu, C. Lin. (2013, Dec 19). *Multimedia Security Technologies for Digital Rights Management* [Online]. Available: http://goo.gl/xQ6doi

Journal article

[Ref number] Author's initials. Author's Surname, "Title of article," *Title of journal abbreviated in Italics,* vol. number, issue number, page numbers, Abbreviated Month Year.

[4] F. Yan, Y. Gu, Y. Wang, C. M. Wang, X. Y. Hu, H. X. Peng, et al., "Study on the interaction mechanism between laser and rock during perforation," *Optics and Laser Technology,* vol. 54, pp. 303-308, Dec 2013.

Note: the above example article is from a journal which does not use issue numbers, so they are not included in the reference.

E-Journal article

PDF versions of journal articles are direct copies of the print edition, so you can cite them as print journals.

[Ref number] Author's initials. Author's Surname. (Year, Month). "Title of article." *Journal Title* [type of medium]. volume number, issue number, page numbers if given. Available: URL

[5] M. Semilof. (1996, July). "Driving commerce to the web-corporate intranets and the internet: lines blur". *Communication Week* [Online]. vol. 6, issue 19. Available: http://www.techweb.com/se/directlinkcgi?CWK19960715S0005

Websites

Note: Include as much of the key information as you can find for a given website. If a web page has no personal author, you can use a corporate author. Failing that, you can use either Anon. (for anonymous) or it is permissible to use the title of the site.

[Ref number] Author's initials. Authors Surname. (Year, Month. Day). *Title of web page* [Online]. Available: URL

[13] BBC News. (2013, Nov. 11). *Microwave signals turned into electrical power* [Online]. Available: http://www.bbc.co.uk/news/technology-24897584

[14] M. Holland. (2002). *Guide to citing internet sources* [Online]. Available: http://www.bournemouth.ac.uk/library/using/guide_to_citing_internet_sourc.html