Technical Research

ON-THE-JOB RESEARCH

Case Study

A team of civil engineers are working on a remote area which is far from main city. Their construction project requires high strength concrete which cannot be attained by using sand which is accessible in that area, so procuring sand form the main city will subsequently increase the project cost which is not under budget of client. Their director construction advises them to do research on the available sand quality so as to attain the desired strength of concrete. After research the team came to a conclusion that they add a specific chemical/admixture of specific ratio in the available sand to get required strength of concrete.

Mix design trial

2. PEC research study

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

Information about a topic that has been shared through print, recorded media, or presentations. Secondary sources provide researchers and readers with the background information they need by establishing the professional and intellectual context for an issue or problem.

Using **Web 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?

Other Sources

Library Resources

- Books
- Periodicals
- Newspapers
- Company Directories
- Dictionaries, Encyclopedias, and Other General References

Conducting **Primary Research**

- Interviews
- Focus groups
- Surveys
- Laboratory experiments, or field observations
- Original works such as diaries, company reports, and correspondence, as well as documents that are the subject of analysis, such as user's manuals and Web sites.

Quantitative Research

In technical communication, this step often involves answering questions about how long it takes to perform a task, or how many clicks it takes to find information in a Help file. Technical communicators may also collect and analyze statistics from surveys and interviews. Quantitative research is judged by validity and reliability.

- Research is valid if it measures what it was designed to measure.
- Research is reliable if it can be repeated with the same results.

Using Questionnaire and Interviews

A part of your research may include collecting firsthand information yourself, such as, questionnaires or personal interviews

Step 1: Designing a questionnaire:

1. Keepings reader's need while preparing the questionnaire

It benefits them personally of professionally/it is easy to fill out and return

2. Write a precise purpose statement

E.g. "The purpose of this survey is to find out ways in which….."

3. Limit the number of questions

Every question must serve the purpose/ resist the temptation to clutter questionnaire with irrelevant questions

4. Ask mostly objective questions

So that the questions are easy to answer and responses are easy to compile

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

Designing a questionnaire…

4. Provide clear questions that are easy to answer:

Avoid four common problems: 1. Biased in phrasing, 2. use of undefined terms, 3. use of more than one variable, 4. questions that require too much homework

5. Include precise and concise instructions at the top of the form

6. Test the questionnaire on a sample audience

Step 2: Conductions the Survey

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

Step 3: Compiling the Results

Biased questions

- “Are the federal and state government’s excessive tax credits for purchasing alternative-fueled vehicles affecting your purchasing decision?” (Words like excessive reflect a bias in the question, pushing a point of view and thus skewing the response.)
- Revised question: “Do you believe that the federal and state tax credits affected your purchasing decision?”

Undefined Terms

- Original question: “Are you familiar with the work of the PNGV on AFVs?” (Your reader may not know that PNGV is short for Partnership for a New Generation of Vehicles, or that AFV stands for Alternative Fuel Vehicle. Thus some “no” answers may be generated by confusion about terminology.)

- Revised question: “Are you familiar with the work of the Partnership for a New Generation of Vehicles on alternative-fuel vehicles?”

Mixed Variables

- Original question: “Were the dealer’s maintenance technicians prompt and thorough in their work?” (There are two questions here, one dealing with promptness and the other with thoroughness.)

- Revised question: (two separate questions): “Were the dealer’s maintenance technicians prompt?” “Were the dealer’s maintenance technicians thorough?”

Question requiring too much homework

- Question that requires too much homework:
- Original question: “What other alternative fuel vehicles has your company researched, tested, or purchased in the last 10 years?” (This question asks the readers to conduct research for an accurate answer. If they do not have the time for that research, they may leave the answer blank or provide an inaccurate guess. In either case, you are not getting valid information.)

- Revised question: “Has your company tried other alternative-fuel vehicles?”

INTERVIEWS

Besides questionnaires, interviews are another common way to gather primary research.

Step 1: Preparing for the interview

1. Develop a list of specific objectives for the interview

Know exactly what you want to accomplish

2. Make clear your main objectives when you contact for the interview

1. Stress the importance of the person's contribution, 2. put him or her at ease with your goals and general content of proposed discussion, 3. set a starting time and approximate length for the interview

3. Prepare and interview outline

It includes: 1. a sequential list of topics you want to cover, 2. specific questions you plan to ask

4. Show that you value your interviewee's time

Showing up early to begin on time/staying on track and ending on time

Step 2: Conducting the Interview

1. Ask open questions

Questions that require your respondent to say something other than “yes” or “no”

2. Ask closed-ended questions when you need to nail down an answer

3. Use summaries throughout the interview

It helps in clarification and recording the interview accurately

4. Biased questions

5. Question needing a lot of homework

6.Undefined technical terms.

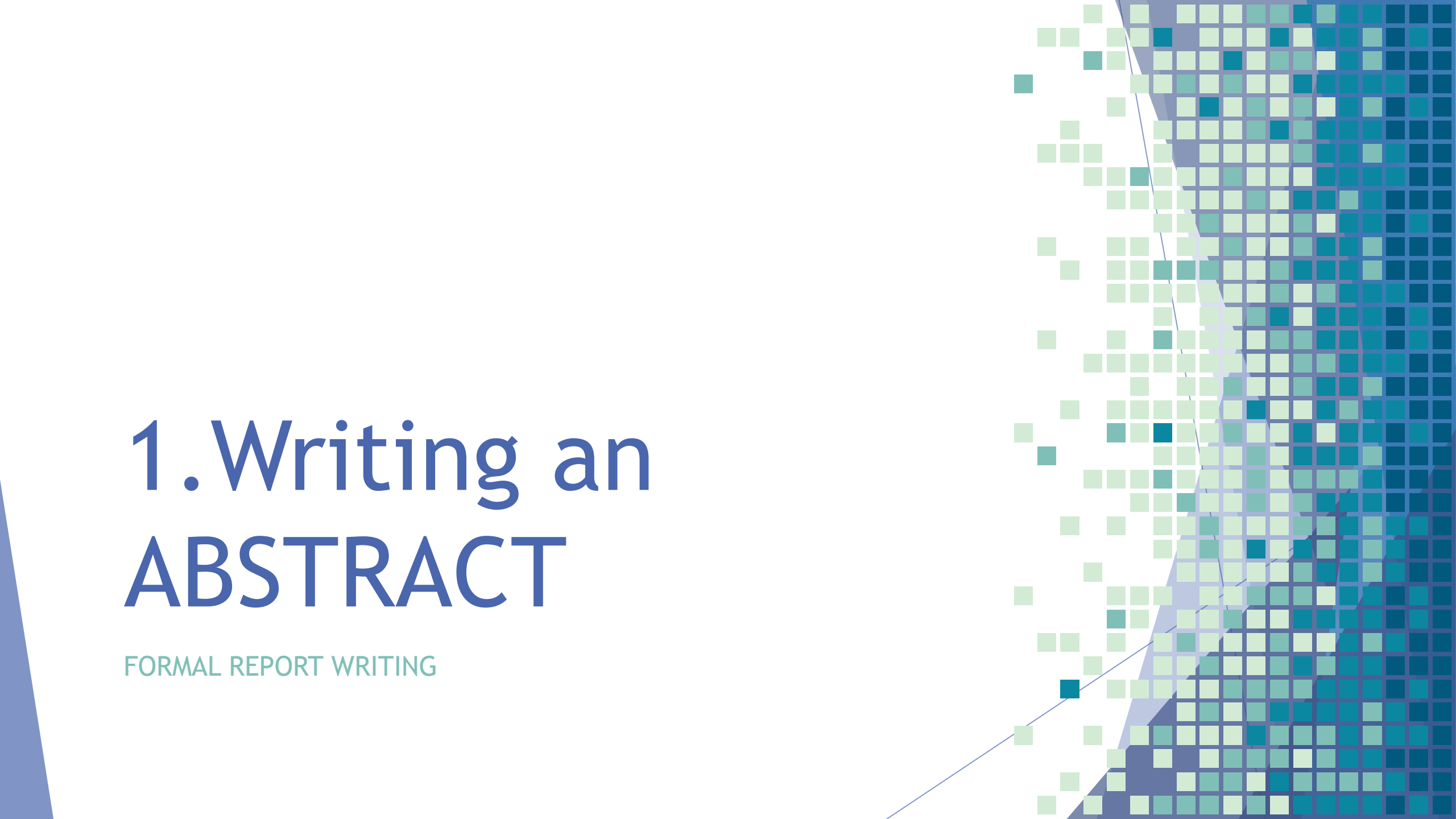
Qualitative Research

Qualitative data cannot be represented in numbers. Instead, qualitative research analyzes words, images, processes, or objects.

- **Interviews:** Often interview subject matter experts (SMEs) to learn about products or processes that they are documenting, and they should interview users to learn how to improve the usability of products or processes.
- **Focus groups:** small groups of employees or clients—to learn about issues related to the design of products, Web sites, or documentation.
- **Field observations.** Going into the field to watch clients use equipment or software on-site, so that they can learn more about who their readers are and how their readers use equipment, software interfaces, or documentation

1.Writing an ABSTRACT

FORMAL REPORT WRITING



WHY?

- You may write an abstract for various reasons.
- The two most important are selection and indexing.
- **Selection:**

After reading the abstract, one can make an informed judgment about whether the dissertation/article/report would be worthwhile to read.

- **Indexing:**

Classifying information in order to make items easier to retrieve.

WHEN

- Submitting articles to journals, especially online journals
- Applying for research grants
- Writing a book proposal
- Completing the Ph.D. dissertation, M.A. thesis or project report.
- Writing a proposal for a conference paper
- Writing a proposal for a book chapter
- Abstracts are written at the end of the project.

Qualities of a Good Abstract

paragraph which is unified, coherent, concise, and able to stand alone.

Uses an introduction/body/conclusion structure which presents the article, paper, or report's purpose, method, Results, conclusion(s), and recommendations in that order.

Follows strictly the chronology of the article, paper, or report.

Adds no new information, but simply summarizes the report.

Is understandable to a wide audience.

Any major restrictions or limitations on the results should be stated,

Types of Abstracts

Descriptive: (less than 100 words)

FORMAT ,PURPOSE,LENGTH EXAMPLE

- Indicates the type of information found in the work.
- Makes no judgments about the work, nor does it provide results or conclusions of the research.

Informative: (more than 250 words)

- The writer presents and explains all the main arguments and the important results and evidence present in the complete report/article/paper/book.
- Do not critique or evaluate a work, they do more than describe it.
- http://sana.aalto.fi/awe/style/reporting/exercises/abstract01x.html

Executive Summaries vs. Abstracts

- Executive summaries go by so many different names. Sometimes the executive summary is called an Abstract. You usually find that designation in scientific papers and academic efforts. You can also call the Executive Summary simply a Summary.

- Abstracts differ from executive summaries, because abstracts are usually written for a scientific or academic purpose.

Abstract Components (HOW)

Brief Backgound	(optional)
Reason for writing	What is the importance of the research? Why would a reader be interested in the larger work?
Problem	(Optional) What problem does this work attempt to solve? What is the scope of the project? What is the main argument/thesis/claim?
Methodology	An abstract of a scientific work may include specific models or approaches used in the larger study.
Results/ Findings/ Implementation	An abstract of a scientific work may include specific data that indicates the results of the project.
Conclusion and	What changes should be implemented as a result of

Sample Abstract

- AUTHOR: CAROL HAYEK
- Title: Portfolio Optimization and Value of Information for Catastrophe Insurance
- Quantifying losses inferred from natural catastrophes is a crucial part in our ability to understand and manage the damage caused by these catastrophic events. A significant component in reducing the uncertainty present in loss estimation can be associated with the use of better information in relation with such factors as exact building geometry, construction quality, design, and vulnerability analysis. The question remains though, how to judge whether the enhancement in the losses accuracy justifies the cost of obtaining this improved information.

  This study is an effort towards presenting a procedure for integrating, analyzing and evaluating the impact of improved losses information on insurance portfolio-related decisions. A conceptual methodology is proposed in the aim to help insurers decide on the optimal information resolution that is best-suited for the portfolio analysis. The sensitivity analysis emphasizes on the error between simulated losses obtained from default building data versus losses obtained from enhanced information and how this error translates into misleading insurance objectives predictions. For that matter, an insurance portfolio optimization problem is also suggested offering to maximize profit and control exposure risk. Here two new components are incorporated, the means to control the correlation among losses and the ability to reach a geographically and structurally resolved portfolio.

Literature Review

A lit review surveys, summarizes, and links information about a given topic. •

A good lit review assesses this information and distills it for the reader.

Literature Review

- It illuminates
  - how knowledge has evolved within the field
  - highlighting what has already been done
  - what is generally accepted
  - what is emerging
  - what is the current state of thinking on the topic.
- literature review identifies
  - a research gap (i.e. unexplored or under-researched areas)
  - articulates how a particular research project addresses this gap.

Characteristics

- Relevant and Focused
- Order/Organization
- Updated
- Critical
- Brought to a close
- Research gap should arise

Function of Literature Review

A literature review functions as a tool to:

- historical background as well as explaining recent developments in an area
- clarify areas of controversy and agreement between experts in the area as well as identify dominant views
- evaluate the previous research and identify gaps (i.e. unexplored areas)
- help justify your research by indicating how it is different from other works in the same area

Analysis and Synthesis

- Analysis involves systematically breaking down the relevant literature into its constituent parts
- Synthesis is the act of making connections between those parts identified in the analysis
- In a literature review, you will notice the synergy between analysis and synthesis as you zoom-in to closely analyse an individual source, then zoom-out to consider it in relation to the broader field.

Writing Literature Review

Writing Literature review consists of five steps:

- Selection
- Argument
- Structure
- Process
- Voice

Selection

- A useful way of thinking about the literature review is to picture it as a dinner party (Kamler & Thomson, 2006).
- You are the host, and you decide who comes and who sits where, depending on how much they can contribute to the conversation about your topic. Don't forget that you are in charge: if someone's talk becomes **irrelevant**, throw them out!
- **If you are examining several topics** (or variables) think of yourself as a film director (Rudestam & Newton, 1992). You can think of providing your audience with:
  - **long shots** to provide a solid sense of the background
  - **middle distance shots** where the key figures and elements to be examined are brought clearly into view
  - **close-up shots** where the precise focus of your work is pinpointed.

Argument

Argument will establish

- what has already been done
- what still needs to be done
- how your study contributes to meeting that need (implicit)

Structure

- For your argument about the literature to come through clearly, the review must have a structure.
- It must make connections between the works you have read, and between them and your own study.
- There is no single “correct” structure, since every review is shaped by the nature of the field being reviewed and the particular needs of the study the review is supporting.
- Some common organising patterns are (they may be used in combination):
  - Themes or concepts
  - Chronological
  - Methodological
  - Trend
  - Other

Voice

- the overall structure of the review
- the way in which you integrate and comment upon the work in the field.

- Allowing your voice to be heard equates to making your argument come through clearly.

Sample

Identity is the third element involved in the situation of the international/NESB research student, and particularly impinges on the effectiveness of any kind of support offered. Cadman (1997, p. 3) uses this term to refer to the sense of self – 'as a whole person' – that international postgraduate students bring to their writing of argumentative texts, and which can affect language performance. This sense of self is closely bound up with language; in her study of immigrant women in Canada, Peirce (1995) argued that language both constitutes and is constituted by social identity. For international postgraduate students, identity, knowledge and language are very closely connected, since what is at stake is often the student's identity as a knowledgeable person, a professional and a competent speaker/writer of English.

A study by McLellan et al. (2014) showed that all three colours are perceived by knockout mice with the human vision gene. But another study, with 25 mice, did not confirm this finding (Smith, 2012). Only two colours were consistently perceived by all knockout mice through the standard dichromatic S and M cone pigments (Myers 2015). According to Hennessy, the reason why only two colours are perceived by knockout mice is that the human vision gene does not result in the formation of L-cones (Hennessy, 2005). Trichromatic vision was, however, achieved by McLellan (2015). This new study introduced a new method of genetic modification (McLellan, 2015).

Questions:

The paragraph is about?

Does it present a clear topic sentence?

Does it present connection between one sentence and the next?

Does it present a storyline?

Although mice are naturally dichromatic, recent research has shown that their brains are able to process trichromatic vision as well (McLellan, 2015). This ability was tested by implanting mice with the human vision gene, which results in the formation of L-cones, in addition to native S and M cones. First attempts, based on flawed methods, were unsuccessful (Hennessy, 2005; Smith, 2012). However, a new method developed by George McLellan and his lab achieved an effective genetic implantation (McLellan et al, 2014; McLellan 2015).

Questions:

The paragraph is about?

Does it present a clear topic sentence?

Does it present connection between one sentence and the next?

Ethical Considerations

- Write Literature by paraphrasing the content from original source.
- Acknowledge the source by citing it in your literature review.
- Use IEEE format for citation and references.
- As shown by Brown [4], [5]; as mentioned earlier [2], [4]–[7], [9]; as presented by Wood et al. [7]
- For further details read https://pitt.libguides.com/citationhelp/ieee

Documenting Sources

- However, whenever you are using material that has been published in a book, periodical, or on another organization's Website, you should cite your sources.
- With the exception of common knowledge, you should cite sources for all borrowed information used in your final document, including quotations, paraphrases, and summaries.

Common knowledge is information generally available from basic sources in the field. In the case of Tanya's research project, common knowledge is a definition of hybrid electric vehicles. When you are uncertain whether a piece of borrowed information is common knowledge, go ahead and cite the source.

Why Document Sources?

1. **Courtesy:** You owe readers the courtesy of citing sources where they can seek additional information on the subject. Sources should be given for quotations, paraphrases, and summaries.

2. **Ethics:** You have an ethical obligation to show your reader where your ideas stop and those of another person begin; otherwise, you are parading the ideas of others as your own.

3. **Law:** You have a legal obligation to acknowledge information borrowed from a copyrighted source. In fact, you should seek written permission for the use of borrowed information that is copyrighted when you plan to publish your document or when you are using your document to bring in profit to your firm (as in a proposal or report). If you need more specific information about copyright laws or about the legalities of documentation, see a research librarian.

Sources

- https://pitt.libguides.com/citationhelp/ieee
- https://www.monash.edu/rlo/graduate-research-writing/write-the-thesis/introduction-literature-reviews
- https://www.monash.edu/rlo/graduate-research-writing/write-the-thesis/writing-a-literature-review
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- http://www.duluth.umn.edu/~hrallis/guides/researching/litreview.html
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