



Writing a Science Research Paper 2019

PRESENTERS

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Characteristics of Science Research Papers

- Style – Tense & Person
- Organized into a standard format
- Abstract
- Key Words
- Literature Citations within text
- Table of Contents (longer texts only)
- Formatting requirements of Publisher

TECHNICAL WRITING PRACTICES

- New Mexico Junior Academy of Science and National Junior Science & Humanities Symposium use standard technical writing practices
- Writers of science papers generally follow the guidelines of their Publisher
- Specifics will be given for: margins, font, citations, title page, captioning, numbering sections
- Writers often choose a Style Manual in their science discipline

Tense

- Past tense—used for stating what was done

“Application of the dye restricted the growth.....

- Present tense—used for statements of fact

“Rate constants of many reactions are available...

- Future tense – used to suggest further studies or applications

Tips on Tense

- Be clear....use the appropriate tense in each section
- Is the research complete already.....use past tense
- When stating a fact that is widely accepted the present tense is appropriate
- If you will do research in the future... use future tense

Person

- Use first person when it helps to keep your meaning clear and to express a purpose
“Jones reported rising temperatures but I found.....”
- Do not use “we” unless partners or colleagues have been identified
“We present here a detailed study.....”
- Generally third person is preferred
“The cell membrane was ruptured by

Standard Format

- Separates the paper into sections
- Is a visible pattern of how the paper is organized
- Basically logical
- Parallels the scientific method of deductive reasoning

Standard Format

Title Page

ABSTRACT

Body of the paper

- INTRODUCTION
- METHODS
- RESULTS
- DISCUSSION
- CONCLUSIONS (includes recommendations)

ACKNOWLEDGMENT

REFERENCES

Appendices

Table of Contents - Longer Papers

- A. Title Page (page numbers)
- B. List of Figures
- C. List of Tables
- D. Table of Contents
- D. Abstract
- E. Introduction
- F. Methods
- G. Results
- H. Discussion
- I. Conclusion
- J. Acknowledgements
- J. Appendix
 - 1. Raw Data
 - 2. References

Innovations in concrete technology: Interaction between research, codes and applications

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Abstract

For all new applications there is an area of tension between research, code work and practice. For a new technology practice always asks for guidelines, while on the other hand for writing codes or guidelines there is always the demand for experience from practice. Being active in practice as well as in research, while also contributing to code writing and research committees, the author is active in the described area of tension. In the paper several processes for introducing new developments are discussed and illustrated with some examples.

Keywords: Innovations, applications, recycled aggregates, CFRP, GFRP.

1. Introduction

From 1985 till 1990 the author performed a PhD study (Hordijk 1991) at Delft University of Technology under supervision of Prof. Reinhardt. That investigation into fracture mechanics and fatigue behavior of concrete was very actual at that time and valuable for understanding various mechanisms of concrete behavior. However, it was fundamental research and the distance to real practice was rather large. In the two subsequent jobs the author gradually moved in the direction of daily construction practice with firstly performing applied research at a research institute (TNO Building and Construction Research) and subsequently being active in a consulting office. In both two latter professions the author dealt with the introduction of several innovations in concrete technology in the Neth-

Captioning in Science Papers uses fonts, outlining, and indents to show definite sections and organization of the paper.

Title

- The title should be brief, accurate and able to stand alone
- The title serves two main purposes
 - To attract a potential audience
 - To aid retrieval and indexing
- Choose terms that are specific
- Spell out all terms in the title
- Determine the title after the text is written

ABSTRACT

- One or two paragraph summary
- Between 80-200 words
- Briefly states the problem, indicates the experimental plan, summarizes principal findings and points out major conclusions
- Keywords are added in a separate line following the paragraph
- Use verb tense based on that of the text

Tips on Abstracts

- Write abstract after the paper is complete
- Briefly state the problem, indicate the research plan, summarize findings and point out conclusions
- The abstract must be complete enough to appear separately in abstract publications
- Do not cite references, tables, figures or sections in the abstract

INTRODUCTION

- A clear statement of the problem and the reasons from studying it
- Background, previous work, limiting factors, significance and scope
- Cite pertinent literature—not a general survey
- Relevance of the research—how is your work related or different

Tips on Introduction

- Should be a clear statement of problem
- Reasons for studying it
- Outline what has been done before by citing pertinent literature
- State how your work is related or differs from previously published work
- Demonstrate the continuity from previous work to yours

METHODS

- Describe the procedures used unless they are established and standard
- If using a standard method cite the appropriate literature
- Give details only when necessary
- Give sufficient detail so that others can repeat the work

Tips on Methods

- Write steps in groups with common title such as
 - Sources of Materials
 - Inoculation Methods
 - Statistical Methods
- Don't over use first person..it can become very boring. Generally use third person
 - “I inoculated the medium for each drug...”
 - “I treated all samples with”

RESULTS

- Summarize the data and their treatment
- Analyze data and present in a figure or table
- Describe the relationships from the data analysis
- Use appendices for all raw data
- Use past tense since the experiment is complete

Tips on Results

- Do NOT draw conclusions in this section
- Explain what occurred during a test
- Do NOT repeat procedures in this section
- Present data in a table or figure, but only one type per data set
- Any table or figure must be mentioned in the text.
 1. Study area covers the upper Pecos River (Fig. 2).
 2. Results of the partitioning study are presented in Table 5 and 6.

Tables and Figures

Figures can be drawings, photos, maps or graphs

Figures and tables should be numbered consecutively, separately and be titled

- Figure (or Fig.) 1. Location of upper Pecos River area.
- Table 1. Description of sampling sites along Pecos River

Graphs should have all axes clearly labeled and tables should have columns clear labeled

DISCUSSION

- Interpret and compare results
- Explain all observations
- Briefly state the implications
- Relate your research to current knowledge
- Suggest further study or applications if warranted

Table 1. Comparison of some constituents in ground waters with varying arsenic levels.

	Type 1	Type 2	Type 3
As	~40 ppb	~25 ppb	2-12 ppb
TDS	~260 ppm	~700 ppm	300-1800 ppm
Hardness	~150 ppm	~200 ppm	200-700 ppm
Fe	<5 ppb	~100 ppb	30-3000 ppb
Mn	<5 ppb	~100 ppb	2-3000 ppb

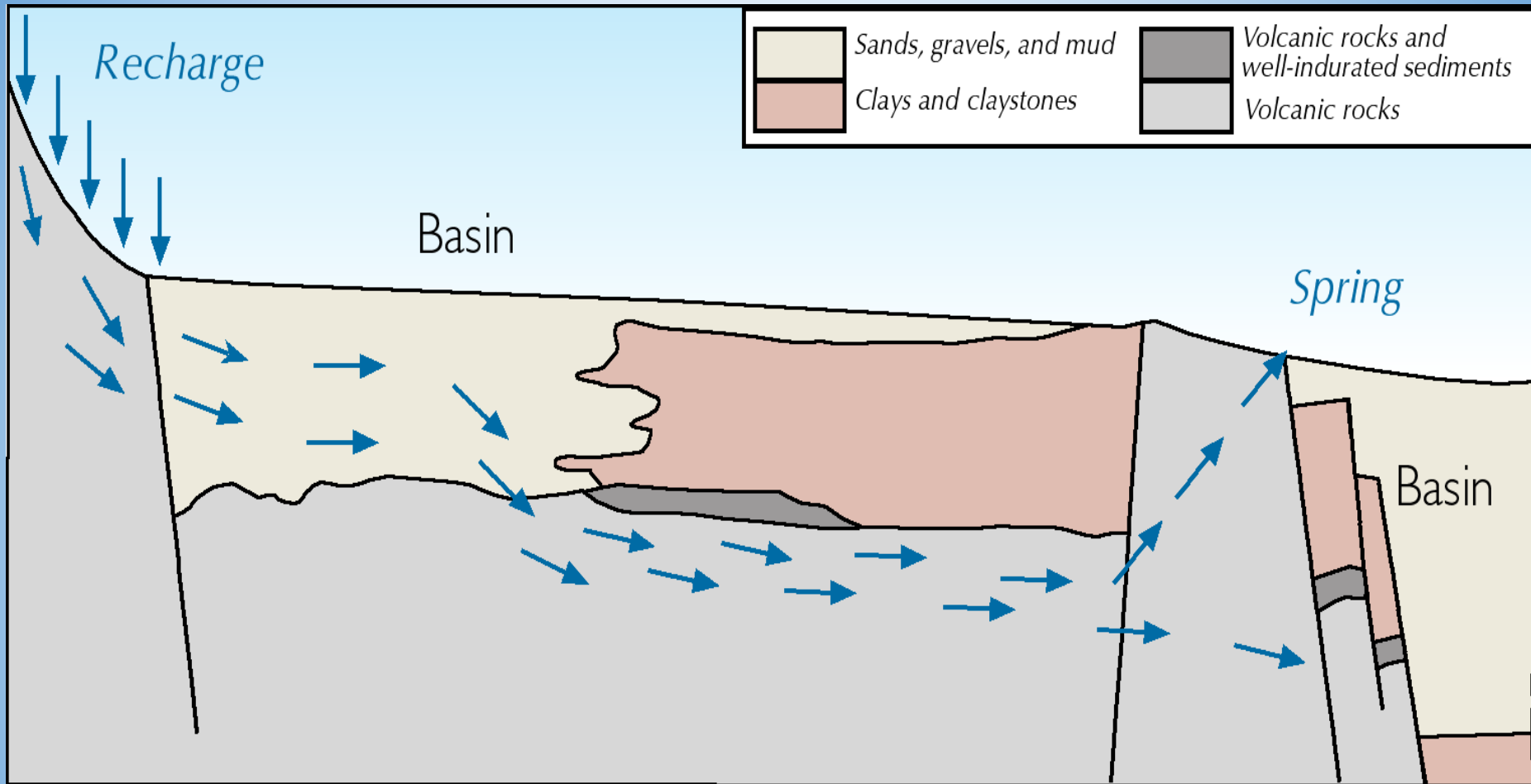


Figure 1. Recharge from Magdalena Mountains under Socorro Mountains to discharge at Socorro Springs.

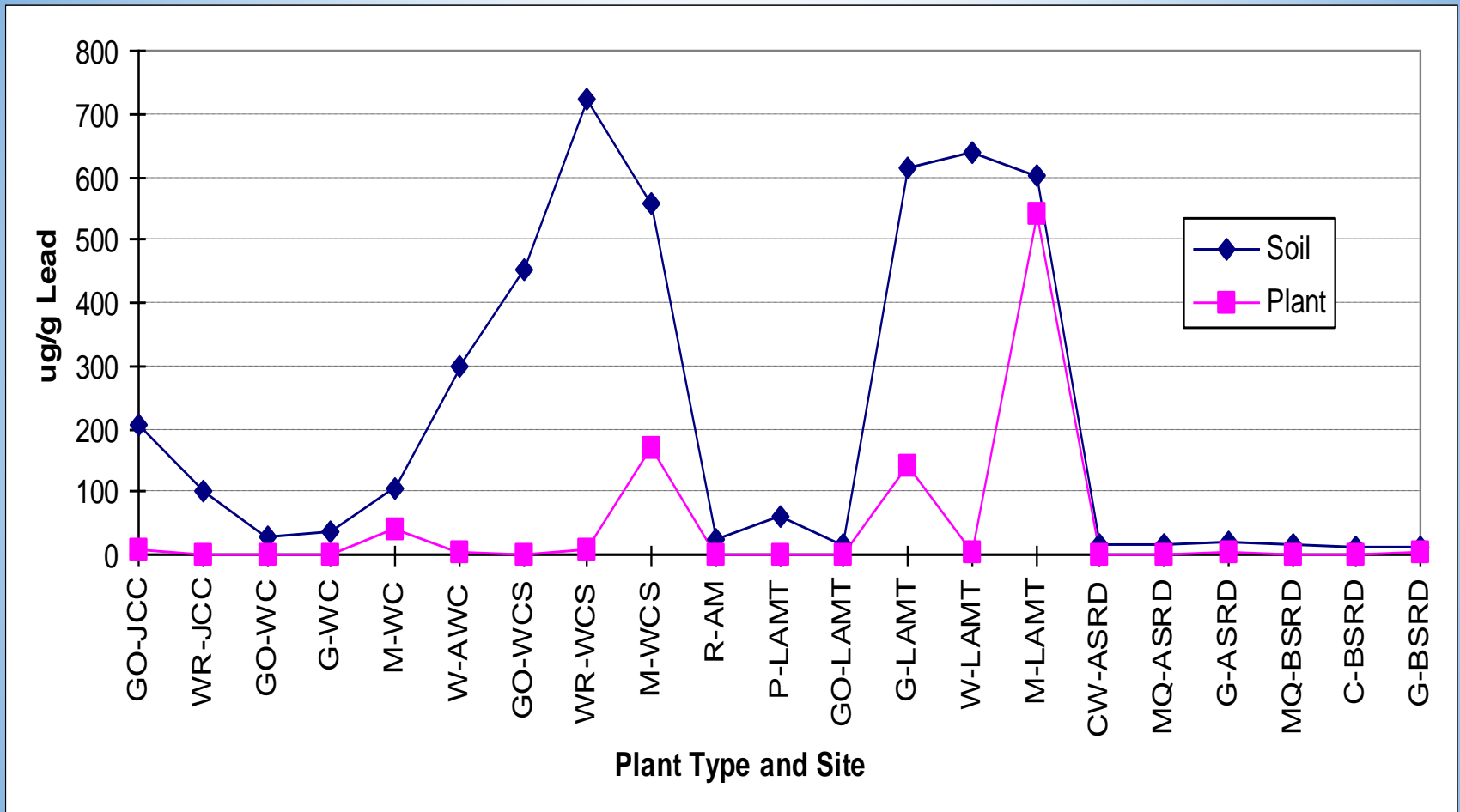


Figure 2. Comparison of lead in soil to lead in plants.

CONCLUSION

- Put the interpretation into the context of original problem
- Do not repeat discussion points
- Conclusions should be based on evidence presented

Literature Citations

- In the text within the sentence or at the end of a sentence
- Include author and date of publication (Smith, 1980)
- List all citations alphabetically in “References” section

Literature Citations within the text

- Smith (1990) compared the reactions of....
- Recent studies (Smith, 1990) showed.....
-as was shown (Smith, 1990).
- In 1990, Smith compared the reaction of...
- Multiple citations should appear in increasing order (Smith, 2006; Jones, 2009)
- Publications by the same author in the same year (Smith, 2015a, 2015b)

REFERENCES

- List the complete information about the references
- All references cited in the text must appear here and all references in the list must appear in the text
- List references alphabetically by first author
- Use initials rather than given names for authors

References

Ehrsson, H. H. "Touching a Rubber Hand: Feeling of Body Ownership Is Associated with Activity in Multisensory Brain Areas." *Journal of Neuroscience*, vol. 25, no. 45, 2005, pp. 10564-10573. Journal

Membrillo, Michelle. "The Importance of Proprioception!" *OTFC*, occupationaltherapychildren.com.au/the-importance-of-proprioception/. Webpage, 2/2017

Niedernhuber, Maria, et al. "Prostheses as extensions of the body: Progress and challenges." *Neuroscience & Biobehavioral Reviews*, vol. 92, 2018, pp. 1-6. Journal

Ramakumar, Hari, et al. "The rubber hand illusion and its application to clinical neuroscience." *Journal of Clinical Neuroscience*, vol. 18, no. 12, 2011, pp. 1596-1601.

"The Rubber Hand Illusion - Horizon: Is Seeing Believing? - BBC Two." *YouTube*, 15 Oct. 2010, www.youtube.com/watch?v=sxwn1w7MJvk.

Sample, Ian. "'Rubber Hand Illusion' Reveals How the Brain Understands the Body." *The Guardian*, 14 Feb. 2018, www.theguardian.com/science/2016/oct/20/rubber-hand-illusion-reveals-how-the-brain-understands-the-body.

Smith, Gwenn S. "Aging, Neuroplasticity and Neuro Rehabilitation." *Journal of Aging Science*, vol. 02, no. 01, 2014.

Reference Examples

- For scientific papers: Monod, J. 1949. The growth of bacterial cultures. *Annu. Rev. Microbiol.* 3:371-394.
- For a book: Neidhardt, F.C., Ingraham, J. L. and Schaechter, M. 1990. *Physiology of the Bacterial Cell*. Sinauer Associates, Sunderland, MA.
- For a newspaper article: McKay, D. 2000. Arsenic: how much is safe? *Albuquerque Journal*. July 30, 2000 p. A1.

More Reference Examples

- For a web site: National Research Council, 1999. Arsenic in drinking water. Subcommittee on Arsenic in Drinking Water. <http://www.nationalacademies.org/news.nsf/isbn/030906337??OpenDocument>
- For a personal communication: Sanchez, R. 1993. City of Socorro, Water Utilities Division, Socorro, NM. Personal communication.

Format for Typing

- **Publisher's guidelines:** margins, font, citations, title page, captioning, numbering sections
- **Style Manual**
 1. Science discipline
 2. Technical writing: Chicago Style Manual, American Psychological Association or American Chemical Society Style Guide
 3. Use source of formulas, tables, graphs, statistics

General Guidelines

- Use proper grammar
- Correct spelling
- Subject and verb agreement
- Avoid slang or jargon
- Define new terms in the text. Don't use a Glossary
- Be watchful for “affect” and “effect”
- Don't start a sentence with a number, write the number in full

Formatting for NMJAS

- Papers should be submitted preferably as MS Word documents, single spaced, paginated, left aligned with one-inch margins and a Times New Roman 12 point font.
- Paper should include the following: Cover page, Title page, Abstract, Main Body, Acknowledgements and References.
- Cover page: Title of paper, student's name, grade, school name, school address, student's home address and email address and the name, address, and email address of the teacher or sponsor. Both the author and the teacher should sign this page.

Formatting for NMJAS continued

- The body of the paper should be continuous. Don't start a section on a new page
- Page numbers should appear centered in the bottom margin
- Except for the Acknowledgments which should follow the body of the paper, the paper should be written in third person.
- Tables, figures, etc. should be in place, labeled and captioned

Teaching Paper Writing in the Classroom

Use an experiment performed by all students.

Assign a small portion of the paper writing task to a small group of students. Include:

- **ABSTRACT**
- **Body of the paper**
 - **INTRODUCTION METHODS**
 - **RESULTS DISCUSSION**
 - **CONCLUSIONS (with recommendations)**
- **ACKNOWLEDGMENT REFERENCES**



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