RESEARCH METHODOLOGY

Unit-04:
Report and Scientific Article Writing

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Research Methodology

REPORT and SCIENTIFIC ARTICLE WRITING

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Interpretation

- Collecting, analyzing data -> drawing inference -> report writing
- To be done very carefully.
- It is only through the interpretation the researcher can expose relation and processes that underlie his findings.
- Analytical information and inferences may be communicated through a research report

Meaning of Interpretation

- Task of drawing inference from collected fact after experimental study.
- Interpretation is concerned with relationship within data collected and study beyond data collected.
- Two major aspects of interpretation:
  1) Establish continuity in research
  2) Establish exploratory concept

Interpretation continued..

- It is basic concept of research because of following:
  - Continuity in research can be maintained.
  - Establishment of explanatory concepts.
  - Researcher appreciates real significance of his findings.
  - Interpretation of finding often result in hypothesis for experimental research.

Techniques of Interpretation

- Involves following steps:
  1)Researcher must explain how generalization is done and concepts are formulated.
  2)Extraneous information must be considered while interpreting the final results.
  3)It is advisable to consult someone having insight into the study who is frank, honest and will not hesitate to point out errors in logical argumentation.
  4)Accomplish task of interpretation only after considering all relevant factors affecting the problem and avoid false generalization.

Report Writing

- Significance of Report Writing
- Structure/Layout of Reports
- Preparation
- Types of Reports.

What is a report?

Report

"A report is a **statement of collected** and considered **facts,** so drawn-up as to give **clear and Concise-information** to persons who are not ready in possession of the full facts of the subject matter of the report" .

A research report is:

A **written document** or **oral presentation** based on a written document that **communicates the purpose, scope, objective(s), hypotheses, methodology, findings, limitations** and finally **recommendations** of a research project to others.

What is a report?

A report is written for a specific audience; it must always be accurate and objective.

Types of reports include memos, meeting minutes, expense reports, audit reports, closure reports, progress reports, justification reports, compliance reports, annual reports, and feasibility reports.

Categories – Formal and Informal

Formal reports are meticulously structured. They focus on objectivity and organization, contain deeper detail, and the writer must write them in a style

Informal reports are usually short messages with free-flowing, casual use of language.

Categories – Formal and Informal

A technical report is simply defined as formal and organized documentation of the process that was performed which is created to communicate to a certain audience important information about the work.

Technical reports **describe the process, progress, or results of technical or scientific research**. Include in-depth experimental details, data, and results.

The steps in preparing a report:

1.Decide on terms of reference.
2.Conduct your research.
3.Write an outline.
4.Write a first draft.
5.Analyze data and record findings.
6.Recommend a course of action.
7.Edit and distribute/ publish

Characteristics of Research Report

1)Accuracy
2)Simplicity
3)Conciseness or Brevity (shortness) & appearance
4)Comprehensibility & readability
5)Reliability & economy
6)Timelines
7)Logical content
8)Completeness

Research Methodology

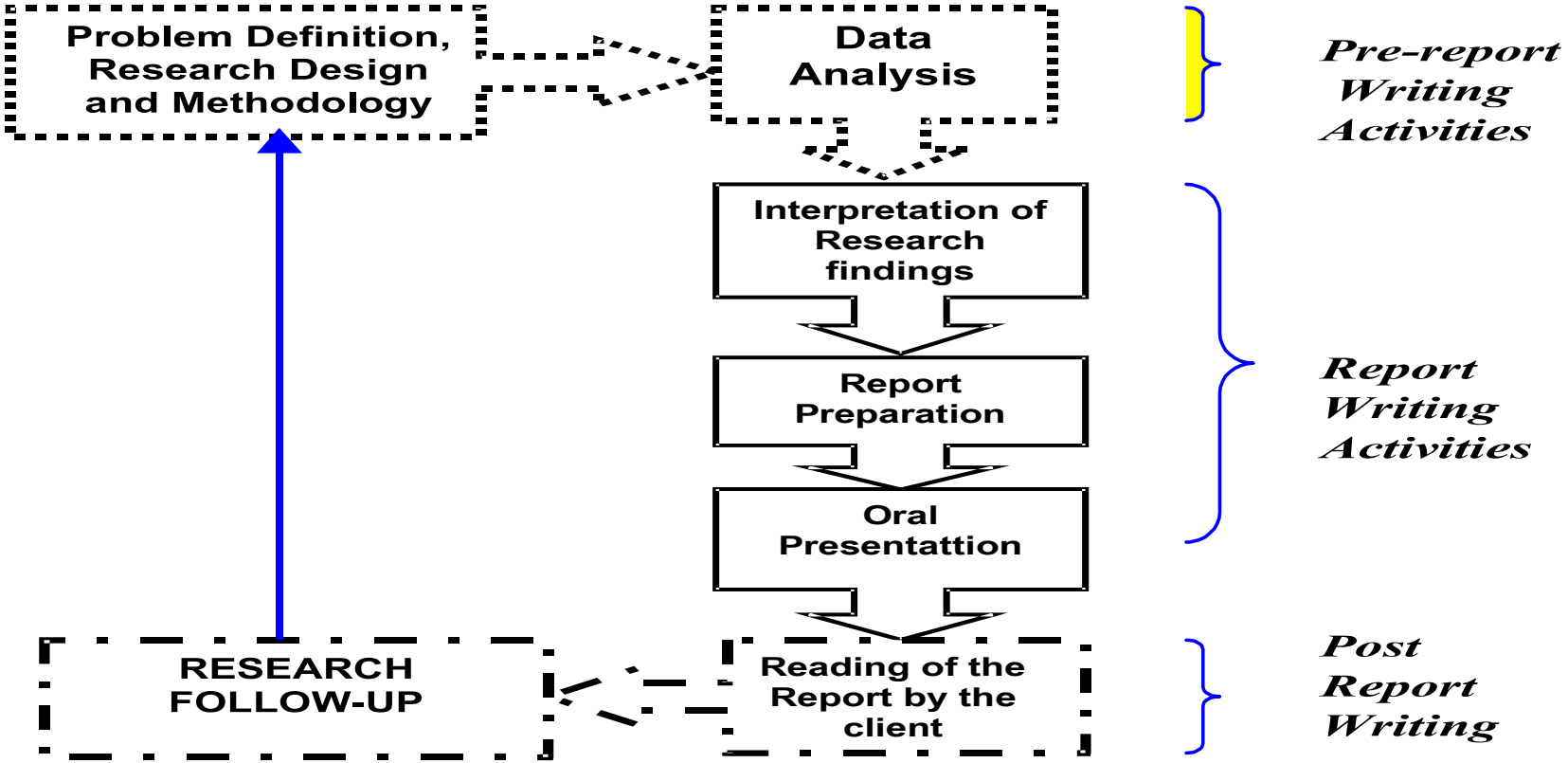
Report Writing

- Report should **show originality**
- It must provide **ready availability of the findings**.
- The **layout** must be **appropriate** and accordance with the objective.
- Report should be free from **grammatical mistakes**.
- Report must present the **logical analysis** of the subject matter.
- **Index** must be prepared and **appended** at the end.
- Report must be **attractive in appearance, neat & clear** whether typed or printed.

Guidelines for writing Research Report

- Be **objective**
- **Minimize** the use of **technical language**
- Use **present tense** and **active voice**
- Treat the data confidentially
- Revise and rewrite
- Use visual aids

REPORT PREPARATION AND PRESENTATION PROCESS



TYPES OF RESEARCH REPORTS

Technical Report

Algorithmic Research Report

Popular Report

Types of Research Reports

Summary Report

Interim report

1. Technical Report:

A technical report (also: scientific report) is a document that describes the process, progress, or results of technical or scientific research or the state of a technical or scientific research problem.

It includes:

1) Summary of results
2) Nature of the study
3) Research methodology
4) Details of data
5) Analysis of data & preparation of findings
6) Conclusions
7) Bibliography
8) Technical appendices
9) Index

2. Popular Report

It gives emphasis **on simplicity and attractiveness.** The simplification should be sought through clear **writing, minimization of technical, particularly mathematical**, details and **liberal use of charts and diagrams**.

Attractive layout along with **large print**, many **subheadings**, even an **occasional cartoon now** and then is another characteristics feature of the popular report.

Example :
RBI presents the report based on nature of economy for every year.

General outline of popular report:

- Findings and their implications
- Recommendations for their follow-up
- Objective of the study
- Methods employed
- Results
- Technical appendices.

3. Interim report

In projects, an **interim** report is often compiled to **analyze how the project is proceeding**, before its **final completion**.

This **short report** may contain either the first results of the analysis of some aspects completely analyzed.

- It facilitates the sponsoring agency to take action without waiting for the full report.
- It helps to keep **alive the agency's interest** in the **study and prevent misunderstandings about the delay**.
- This report also enables the researcher to find the appropriate style of reporting.
- Interim analysis is important in medical trials, to ensure that the patients are not exposed to unnecessary danger during the trial.

4. Summary report

➢ Summary report usually contains **a brief statement** of the problem or proposal covered in the major document(s), **background information, concise analysis and main conclusions.**

➢It is intended as an **aid to decision-making** by managers and has been described as possibly the most important part of a business plan.

➢They must be **short** and to the point.

4. Summary report

- It just contains a brief **reference to the objective of the study, its major findings and their implications**.

- It **size is so limited** as to be **suitable for publication in daily newspaper**.

5. Algorithmic research report

An algorithm is a well defined sequence of steps to solve a problem in industry, business and government.

There are problems, viz., production scheduling, supply chain management, line balancing, layout design, portfolio management, etc., which exists in reality.

The solution for the above problems can be obtained through algorithms.

Report Structure

Abstract

Introduction

Method
- Participants
- Design
- Apparatus/Materials
- Procedure

Results

Discussion & Conclusion

References

Report Structure or Layout of the Research Report

Preliminary Pages

Main Text

End Matter

(A) Preliminary Pages Include

These must be title of the research topic and data. There must be preface of foreword to the research work. It should be followed by table of contents. The list of tables, maps should be given.

➢ **Introductory pages**

- Title page
- Acknowledgments
- Abstract
- Table of contents
- List of tables
- List of charts/figures

(B) Main text

It provides the complete outline of research report along with all details. The title page is reported in the main text. Details of text are given continuously as divided in different chapters.

(1)Introduction
(2)Statement of the problem
(3)Literature review
(4)Objectives of the study
(5)Limitations of the study
(6)Research methodology
(7)Data Analysis
(8)Conclusions
(9)Bibliography
(10)Appendices

Successful Report Writing

- Start writing early
- Remember
- Read
- Reflect

Report : *General Style*

- Reports should be double-spaced.(Varies according to the requirements)
- Each major section (Abstract, Introduction, Method, Results and Discussion) should start on a new page with the title of the section in bold.
- All pages should be numbered.
- The last section is the Appendices and includes raw data, Ethics Approval Form and other relevant information.

Most research reports include the following elements:

I. Title page
II. Letter of transmittal
III. Table of contents
IV. List of tables
V. List of graphs
VI. List of appendices
VII. List of exhibits
VIII. Executive summary
a. Major findings
b. Conclusions
c. Recommendations
IX. Introduction
a. Background to the problem
b. Statement of the problem
X. Approach to the problem
XI. Research design
a. Type of research design
b. Information needs
c. Data collection from secondary sources
d. Data collection from primary sources
e. Scaling techniques
f. Questionnaire development and pretesting
g. Sampling techniques
h. Field work
XII. Data analysis
a. Methodology
b. Plan of data analysis
XIII. Results
XIV. Limitations
XV. Conclusions and recommendations
XVI. Appendix

Main Source

How to Write and Publish a Scientific Paper, 6th edition, by Robert A. Day and Barbara Gastel (Greenwood Press/Cambridge University Press, 2006)

Overview

- Definition of a scientific paper
- The IMRAD format (IMRaD)
- Front matter: title, author(s), abstract
- Core of the paper: introduction, methods, results, discussion
- Tables and figures
- End matter: acknowledgments, references
- A suggestion
- Sources of further guidance

Definition of a Scientific Paper

(Council of Biology Editors, as adapted by Day)

- The first publication of original research results
- In a form whereby peers of the author can repeat the experiments and test the conclusions
- In a journal or other source document readily available in the scientific community

Significance of Scientific Writing

From the Author's Perspective

- Make know the research finding to others.
- Effective communication is very important..
- Typically it's the last step..

From Reader/Reviews perspective

- Read about the project's aims, methods and findings
- Assess the quality of the project
- Provide feedback to the project's researchers on what they like or dislike about the project
- Incorporate aspects of the project's methods or findings into their own work or thinking.

- Summarized as 4 A's (Aim, Awareness, Audience, Articulation)

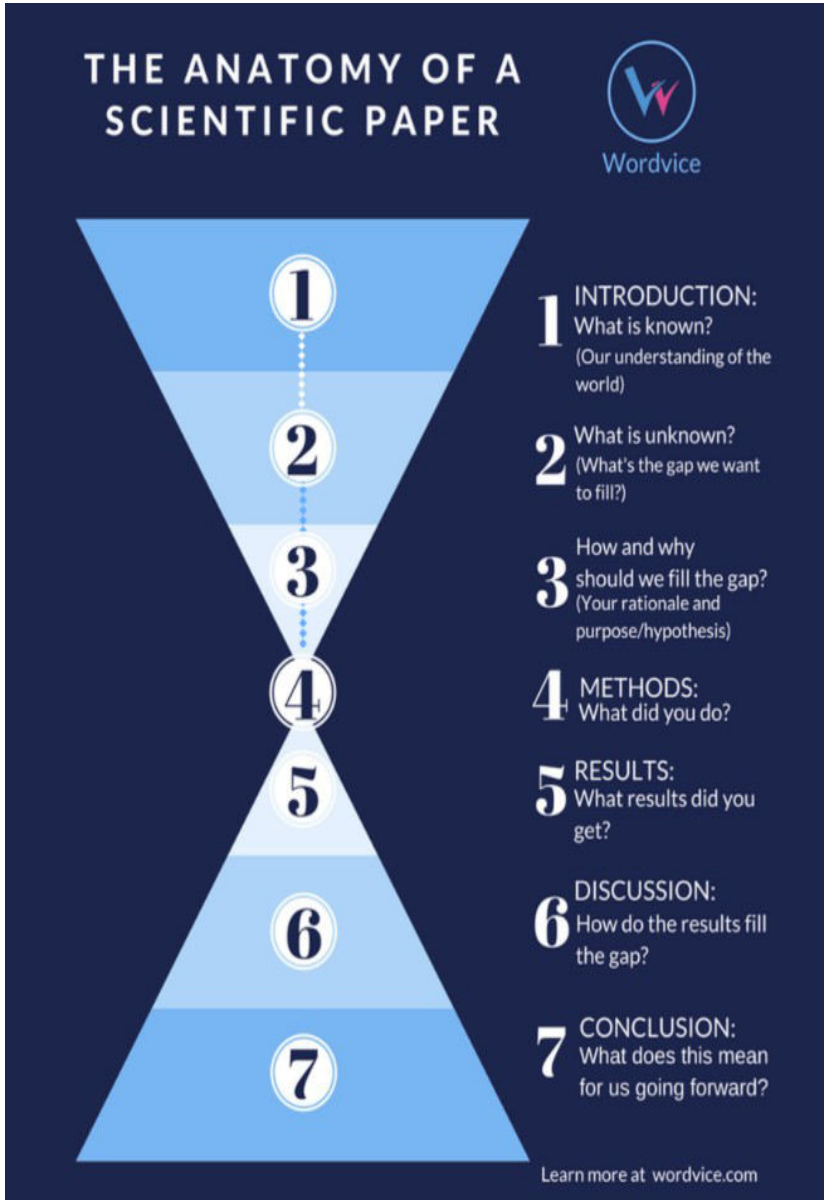
Some Types of Journal Content (Other Than Scientific Papers)

- Review articles (summarize the literature on a topic)
- Case reports
- Editorials
- Book reviews
- Essays
- Letters to the editor

The IMRAD Format for Scientific Papers

- **I**ntroduction: What was the question?
- **M**ethods: How did you try to answer it? (Materials and Methods)
- **R**esults What did you find?
- **D**iscussion What does it mean?

- A format used in some journals: IRDaM
- People read sections in various orders.



The Front Matter

- Title
- Authors
- Abstract

Title

- The fewest possible words that adequately indicate the contents of the paper
- Important in literature searching
- Should not include extra words, such as “a study of”
- Should be specific enough but not overly narrow

Good Research Title

- Why is it important?
  - First thing noticed by Readers & Reviewers.
  - Available in abstracting and indexing databases
  - Its indexed by search engine and seen in queries.
- Make sure that Research Title
  - Captures all of the relevant aspects of our study,
  - Shows in a way that is accessible and captivating to readers.
- Challenge? – To create a title that is
  - Specific, Crisp, Clear, Concise (Neither too short or too long)
  - Expressive.
  - No undue expectations.
- Choose words that are used for indexing purposes
  - Avoid waste words like “Studies on”, “Investigation on” etc.
  - Avoid Opening Words like “A/An/The”

Good Research Title: How?

- Basic questions about the research paper.
  - What, Method used, Subjects, Results
- Identify Keywords/phases from the above questions
- Create a “long” sentence with these keywords
- Create a working title, Eliminate extra words/phrases

Authors

- Those with important intellectual contributions to the work
- Often listed largely from greatest contributions to least
- Head of research group often is listed last
- Important to list one's name the same way from paper to paper

Abstract

- Summarizes the paper (miniature version of the paper)
- A well-prepared abstract enables readers to identify the basic content of a document quickly and accurately, to determine its relevance to their interests, and thus to decide whether they need to read the document in its entirety
- Widely read and therefore important
- Returned by search engines (based on search query)
- Commonly organized in IMRAD format (may be structured abstract, with headings corresponding to the various sections)
- Content must be consistent with that in the paper
- Normally should not include figures, tables, references

Abstract

- E. I. Karac, B. Turhan and N. Juristo, "A Controlled Experiment with Novice Developers on the Impact of Task Description Granularity on Software Quality in Test-Driven Development," in IEEE Transactions on Software Engineering, doi: 10.1109/TSE.2019.2920377.

- Objective & Scope
- Methods Employed
- Summary of results
- Principal Conclusions

- Usually written after the main sections of the paper are written.
- Tendency to cut/paste from the main body: strict no-no

Abstract—Background: Test-Driven Development (TDD) is an iterative software development process characterized by test-code-refactor cycle. TDD recommends that developers work on small and manageable tasks at each iteration. However, the ability to break tasks into small work items effectively is a learned skill that improves with experience. In experimental studies of TDD, the granularity of task descriptions is an overlooked factor. In particular, providing a more granular task description in terms of a set of sub-tasks versus providing a coarser-grained, generic description.

Objective: We aim to investigate the impact of task description granularity on the outcome of TDD, as implemented by novice developers, with respect to software quality, as measured by functional correctness and functional completeness.

Method: We conducted a one-factor crossover experiment with 48 graduate students in an academic environment. Each participant applied TDD and implemented two tasks, where one of the tasks was presented using a more granular task description. Resulting artifacts were evaluated with acceptance tests to assess functional correctness and functional completeness. Linear mixed-effects models (LMM) were used for analysis.

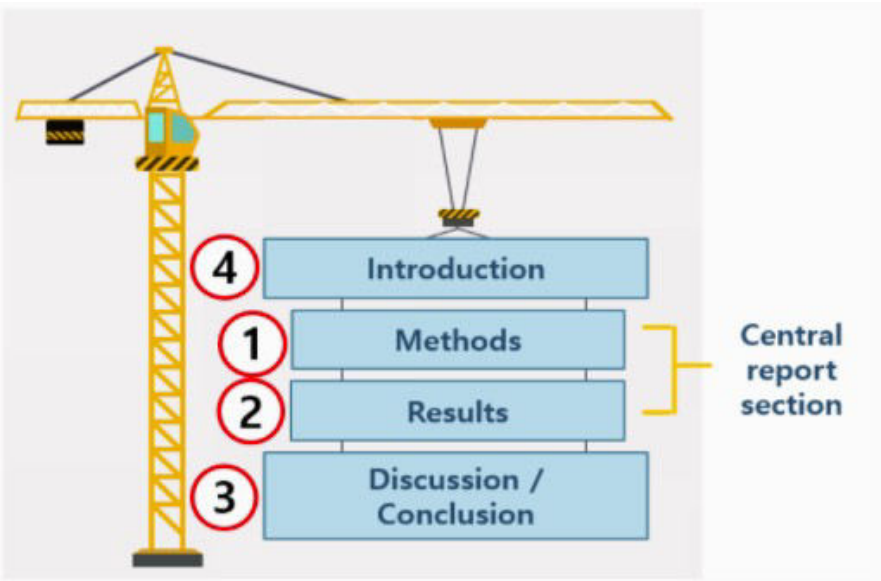
Results: Software quality improved significantly when participants applied TDD using more granular task descriptions. The effect of task description granularity is statistically significant and had a medium to large effect size. Moreover, the task was found to be a significant predictor of software quality which is an interesting result (because two tasks used in the experiment were considered to be of similar complexity).

Conclusion: For novice TDD practitioners, the outcome of TDD is highly coupled with the ability to break down the task into smaller parts. For researchers, task selection and task description granularity requires more attention in the design of TDD experiments. Task description granularity should be taken into account in secondary studies. Further comparative studies are needed to investigate whether task descriptions affect other development processes similarly.

Index Terms—Test-driven development, programming task description, controlled experiment, empirical software engineering, crossover experiment, software quality, requirement granularity

The Core of the Paper

- Introduction
- Methods
- Results
- Discussion



The Methods and Results comprise the core content of your paper. Write these sections first.

- [ ] Write up your manuscript:
  - [ ] Prepare tables and figures (if required)
  - [ ] Write up the literature review (if required)
  - [ ] Write the method
  - [ ] Write up your results
  - [ ] Write the discussion and conclusions
  - [ ] Write the introduction
  - [ ] Write the abstract
  - [ ] Create a compelling title

Introduction

- Provides background/context needed to understand the paper and appreciate its importance
- Must clearly motivate, why the work is important
- Identifies the question the research addressed
- In general, should be fairly short
- Typically should be funnel-shaped, moving from general to specific.
  - Key primary literature
  - Hypothesis/research problem investigated
  - Approaches and rationale
  - Contributions

Research Question: Does task description granularity impact functional correctness and functional completeness of the software developed by novice developers using TDD?

Introduction

- Identify the knowledge gap (research gap)
- What is known -> what is unknown
- Explain why its needs to be filled
- Summarize how the study attempts to fill the gap.
- Concise sentences
- Strong verbs
- Active voice
- Written after the main body of the paper is completed

Research Question: Does task description granularity impact functional correctness and functional completeness of the software developed by novice developers using TDD?

The contributions of this study are threefold:

1) Provides a thorough analysis of a controlled experiment in an academic setting to understand the performance of novice TDD developers with respect to task description granularity (A replication package is available online at [23])
2) Demonstrates of the impact of task description granularity on software quality created with TDD
3) Provides empirical evidence on the importance of task selection in TDD experiments

We believe, these contributions will have two major impacts:

1) Calls attention (in practice and education) to the non-triviality of the "choose a small task" step of the TDD process for novice developers
2) Provides insight on factors that impact TDD experiments for consideration when designing future studies

Introduction (Guideline for writing)

- Answer “What is the problem solved”
  - Identify the knowledge gap
  - Explain why it needs to be filled
  - Summarize how the study fills the gap
- Answer “How the problem is solved”
  - Brief background/context
  - Rationale/Reason for filling the gap
  - Key references to very closely related work.
  - Clarification of terms/definitions

Introduction: How

- Step1: (Background Information)
  - Strong statement that reflects your research area
  - Clear aim of the study
  - Don’t include obvious/broad facts
- Step 2: Show the research gap
  - Based on current know information/data
  - What is unknown
- Step 3: How the study fills the gap
  - Hypothesis -> What is purposed/objective of study

Materials and Methods Section

- Purposes: to allow others to replicate and to evaluate what you did
- Should describe the study design
- Should identify (if applicable)
  - Equipment, organisms, reagents, etc used (and sources thereof)
  - Approval of human or animal research by an appropriate committee
  - Statistical methods

Materials and Method Section

- Introduction -> Methodology Employed (why it was chosen)
- Materials and Methods Section => Experimental Procedures
- The validity of the results depends on sound methodology (Good reviewer will read this section in detail)
- Reproducibility of results (Sufficient Information to allow the reader to repeat)
- Our credibility is also at stake (poor method section)
- Written in Past Tense (because its all the work that has been done, after with the report is being written)
- Minimize Passive Voice (with due care)

Methods (cont)

- May include tables and figures
- An issue: level of detail in which to describe
  - Well-known methods
  - Methods previously described but not well known
  - Methods that you yourself devised
- Helpful to use papers published in the same journal as models

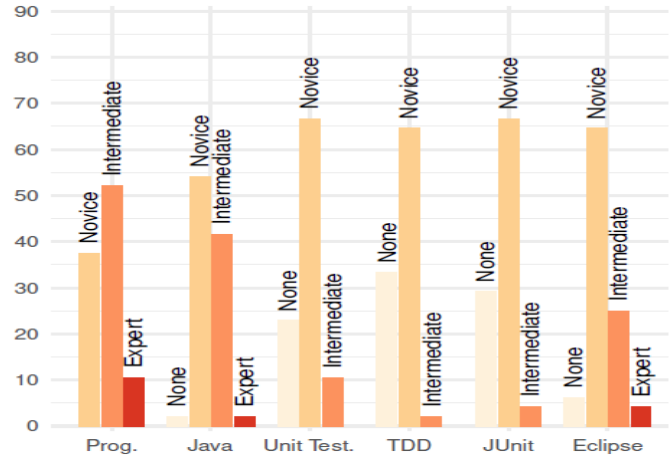
Materials and Methods : Example

E. I. Karac, B. Turhan and N. Juristo, "A Controlled Experiment with Novice Developers on the Impact of Task Description Granularity on Software Quality in Test-Driven Development," in IEEE Transactions on Software Engineering, doi: 10.1109/TSE.2019.2920377.

- Section 3: Experimental Setting
  - Research Objectives
  - Design
  - Variables
  - Instrumentation (metrics)
  - Hypothesis
  - Analysis (Statistical)
  - Evaluation of Design Validity
    - Give a rationale for why specific experimental procedures were chosen.
    - Methodology is proper (we can believe the findings)
  - Experimental Execution (Good to provide link to detailed Methodology etc)

TABLE 2
Experiment Design

	Periods	
Sequences	Period 1 Task: BSK	Period 2 Task: MR
Sequence 1	coarser-grained	finer-grained
Sequence 2	finer-grained	coarser-grained



Results

- The core of the paper
- 2 Subsections
  - kind of overall description of the experimental results, providing the big picture (without repeating the experimental details)
  - Presentation of data
- Often includes tables, figures, or both
- An issue: how much the information in the text should overlap with that in the tables and figures
- Should present results but not comment on them (Discussion is designed to tell what they mean).
- Organize in the order if answering the “Research Questions”

- Should not include any information about “methods”
- Past tense
- Should not present raw data (must be summarized as needed)
- In Powell’s words: “The fool collects facts; the wise man selects them.”
- Avoid “Its clearly seen that the mean value of CORRECTNES is ..”
- Use “The mean value of CORRECTNESS is

TABLE 5
Descriptive statistics for CORRECTNESS

statistic	coarser-grained	finer-grained
Mean (Std. Err.)	31.64 (3.8)	47.70 (4.69)
95 % CI for mean	(24, 39.28)	(38.26, 57.14)
5% Trimmed Mean	30.54	47.50
Median	23.44	42.97
Std. Deviation	26.33	32.47
Min.- Max.	0 - 90.62	0 - 100.00
Range	90.62	100.00
Interquartile Range	31.23	56.25
Skewness	0.85	0.24
Kurtosis	-0.36	-1.26

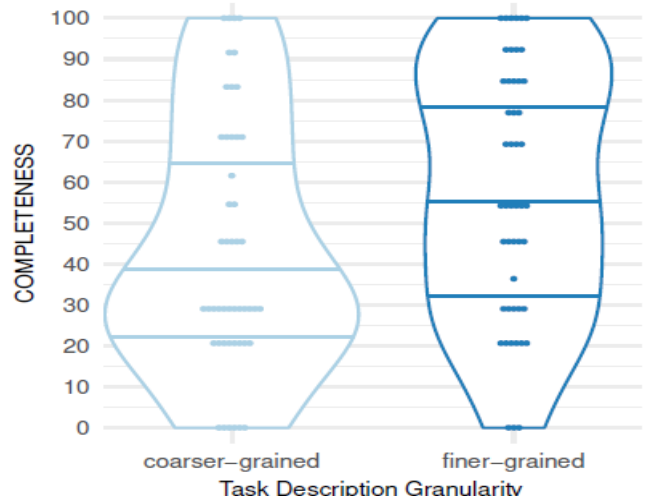


TABLE 11
Tests of fixed effects for *COMPLETENESS*

Source	Numerator df	Denominator df	F	Sig.
TASK_GRA	1	46	9.04	.004
TASK	1	46	37.03	< .001

Discussion

- Considered as the hardest section.
- Objective:
  - Answer the research question stated in the introduction
  - With justifications, based on evidence from the results section

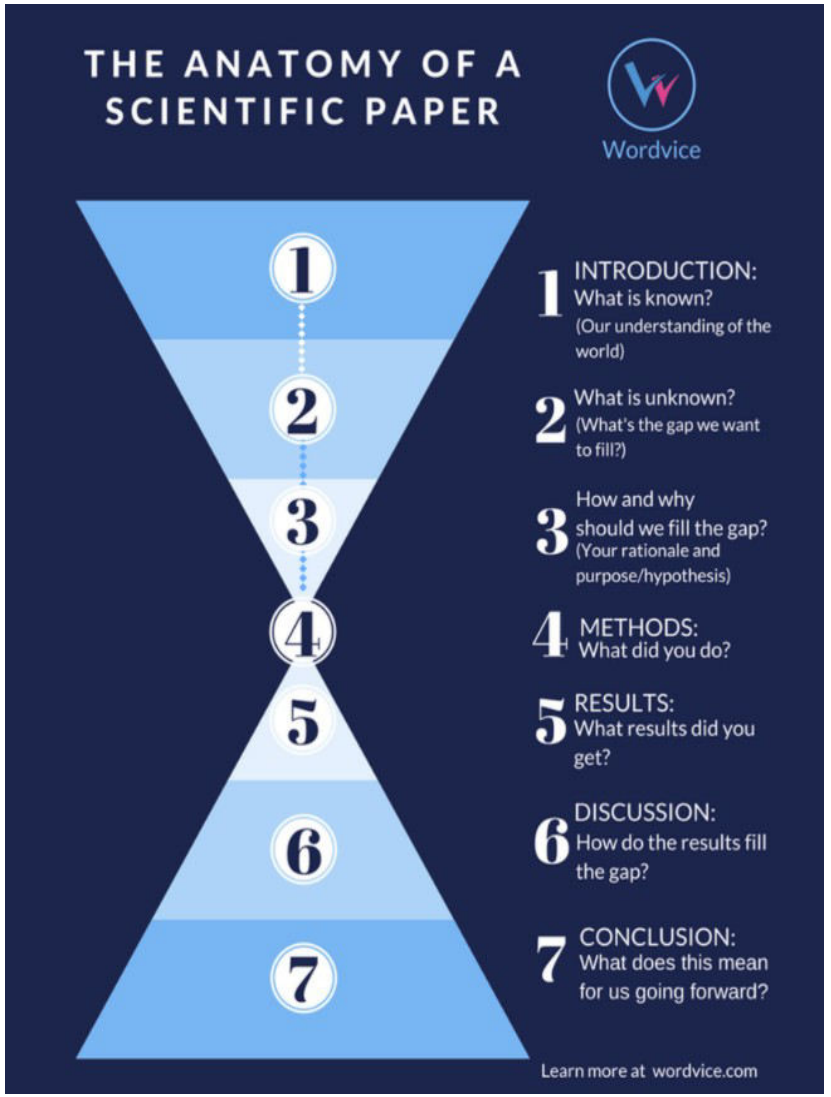
- What goes in to Discussion Section/How to organize it
  - Briefly describe the research gap (missing knowledge)/ research question
  - Brief summary of the main findings (Remind the reader why should be interested in the paper)
  - Ensure that research question stated in the introduction is answered/ how it fills the research gap
  - Explain the reasons found

- Don’t just cut and paste sentences from the introduction
- Consider Discussion and Introduction as a pair (Discuss the answers
- Principles/Relationships/Generalizations.

- Some other items commonly addressed:
  - Limitations of the study
  - Relationship to findings of other research
  - Other research needed

Discussion (cont)

- Typically should move from specific to general (opposite of introduction)
- Significance of the paper
- Active voice



Discussion (cont)

- Typically should move from specific to general (opposite of introduction)

Story by Claude Bishop, the dean of Canadian science editors.

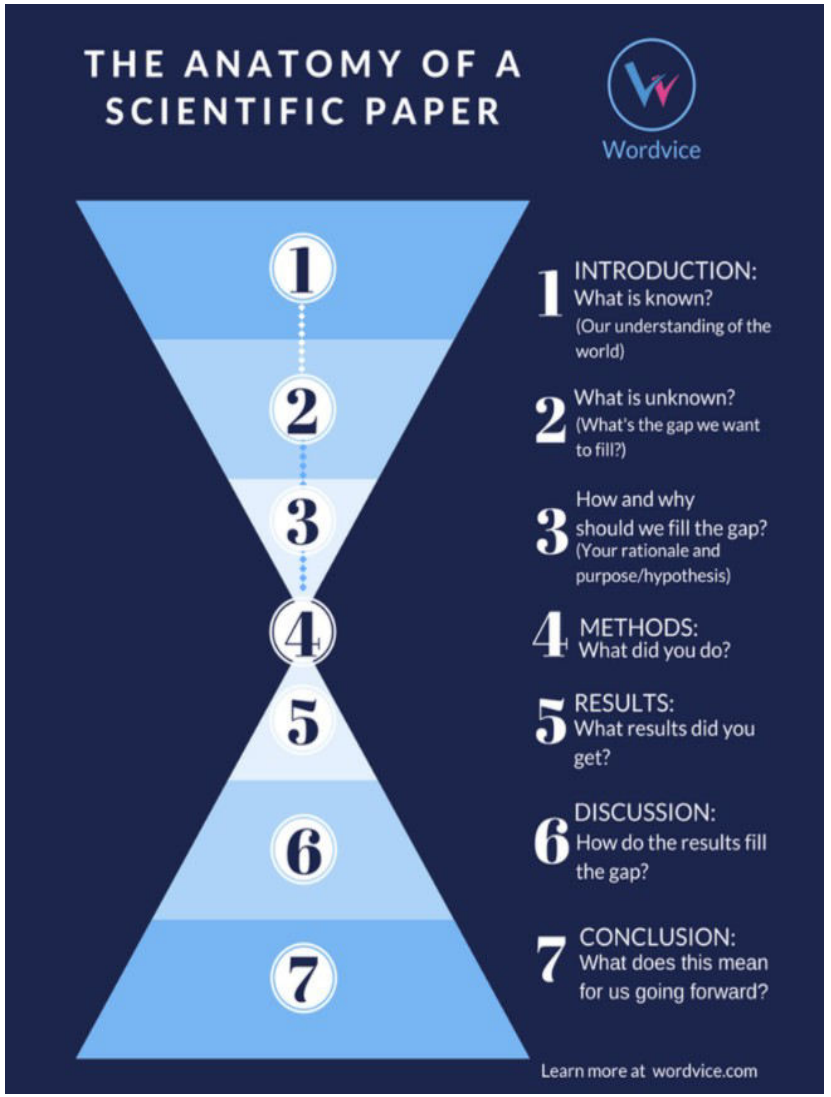
A science teacher set up a simple experiment to show her class the danger of alcohol.

She set up two glasses, one containing water, the other containing gin. She dropped a worm into each of the glasses.

The worm in the water swam merrily around.
The worm in the gin quickly died.

“What does this experiment prove?” she asked.

A student from the back row piped up:
“It proves that if you drink gin you won’t have worms.”



Tables: A Few Suggestions

- Use tables only if text will not suffice.
- Design tables to be understandable without the text.
- If a paper includes a series of tables, use the same format for each.
- Table no: Description appears above the table
- Be sure to follow the instructions to authors.

TABLE 5
Descriptive statistics for CORRECTNESS

statistic	coarser-grained	finer-grained
Mean (Std. Err.)	31.64 (3.8)	47.70 (4.69)
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Range	90.62	100.00
Interquartile Range	31.23	56.25
Skewness	0.85	0.24
Kurtosis	-0.36	-1.26

Figures: A Few Suggestions

- Use figures (graphs, diagrams, maps, photographs, etc) only if they will help convey your information.
- Avoid including too much information in one figure.
- Make sure any lettering will be large enough once published.
- Figure no: Description appears below the figure
- Follow the journal's instructions.

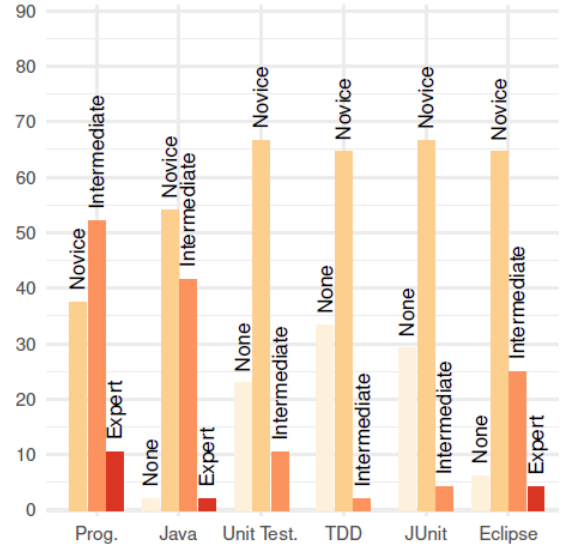


Fig. 1. Summary of participant's experience

End Matter

- Acknowledgments
- References

Acknowledgments

- A place to thank people who helped with the work but did not make contributions deserving authorship
- Permission should be obtained from people you wish to list
- Sometimes the place where sources of financial support are stated

References/Bibliography

- Functions:
  - To give credit
  - To add credibility
  - To help readers find further information
- Importance of accuracy
- Existence of various reference formats
- Availability of citation management software (examples: mendley, zotero)

References/Bibliography Style

- APA (American Psychology Association)
  - Sample citation (Raskin, 2002)
    List References alphabetically, using the author's last name.
- ACM (Association of Computing Machinery)
  - Enclose the last name of the first author and the year of publication in brackets, for example: [Zawistoski 2015].
  - If there are two authors use both last names: [Zawistoski and Gwinn 2015].
  - If there are more than two authors, use the first author's last name and "et al": [Zawistoski et al. 2015].
- IEEE (Institute of Electrical and Electronics Engineers)
  - Cite the number of the reference in a square bracket inside of punctuation: "previous studies [1] and [2] have shown..." The references should be listed in the bibliography in the order in which they appear, which means that you may need to re-order them as you edit your text.

References Style

- Journal articles
- ACM:
  - Author Name. Year. Title of paper. Abbrev. Title of Periodical* vol, issue (Mon. Year), pages. DOI
  - John Grundy and John Hosking. 2002. Developing adaptable user interfaces for component-based systems. Interact. Comput. 14, 2 (Apr. 2002), 175-194. DOI:10.1016/S0953-5438(01)00049-2
- *IEEE:*
  - [1] A. Author, "Name of paper," Abbrev. Title of Periodical*, vol. x, no. y, pp. zzz-zzz, Mon, year. DOI
  - [1] J. Grundy and J. Hosking, "Developing adaptable user interfaces for component-based systems," Interact. Comput., vol. 14, pp. 175-194, Apr. 2002. DOI:10.1016/S0953-5438(01)00049-2

A Suggestion

Start by drafting whatever part of the paper you find easiest to prepare. (Many people find it easiest to start with the methods section.)

- [ ] Write up your manuscript:
  - [ ] Prepare tables and figures (if required)
  - [ ] Write up the literature review (if required)
  - [ ] Write the method
  - [ ] Write up your results
  - [ ] Write the discussion and conclusions
  - [ ] Write the introduction
  - [ ] Write the abstract
  - [ ] Create a compelling title

Active vs Passive Voice

- Active voice emphasizes the agent of the action—that is, the person or object performing the action.
  - Eg. We arranged the sample groups.
  - Technicians injected the mice with
- The passive voice emphasizes the person or object receiving the action.
  - Eg. Sample groups were arranged (by us/by the researchers).
  - Mice were injected with …

- Since active-voice constructions are usually stronger, clearer, more direct, and often more concise than their passive-voice counterparts

- When the agent of the action is unimportant, unknown, or obvious to readers
  - Eg. Over 20,000 patients **are diagnosed** with diabetes each year (by doctors) in the United States.

Active vs Passive Voice

- When the object or action itself is more important than the agent performing the action
- When the recipient of the action is the topic of the sentence
- Active voice: “Scientists once **classified** slime molds as fungi, but they no longer **classify** them as part of that particular kingdom.”
- Passive voice: “Slime molds **were** once **classified** as fungi but **are** no longer **considered** to be part of that particular kingdom.”

Active Voice vs Passive Voice

- Rule of Thumb – Use active voice
  - To place emphasis on the most important element of the sentence
  - To cut down on word count (sometimes using active, sometimes using passive)
  - To make your paper easier for the reader by creating variations in cadence and syntax
- Choose passive voice
  - The agent is unknown, unimportant, or obvious to the reader
  - The agent is less important than the *action* of the sentence
  - The agent is less important than the *topic* of the sentence
  - One topic (among several) has greater importance

Keyword for Research Article

- Keywords are indexed by search engines (and hence used in
- Keywords help to retrieve the article quickly and accurately
- What terms would we use to search for papers related to topic discussed in the Research Article?
  - Others also may use similar keywords
- Avoid using terms already present in the title
  - because its already in the search db, hence redundant
- Use alternate terms to ones found in the title
  - These should supplement the title
- Include those terms which could be incorporated in the title(due to length limitations), but are relevant to the research
- Test your keywords before submitting the paper
  - If the results return similar papers, then it's a good indicator the chosen keywords
  - If not, revise the terms until similar paper are seen in query results.

Thesis/Dissertations

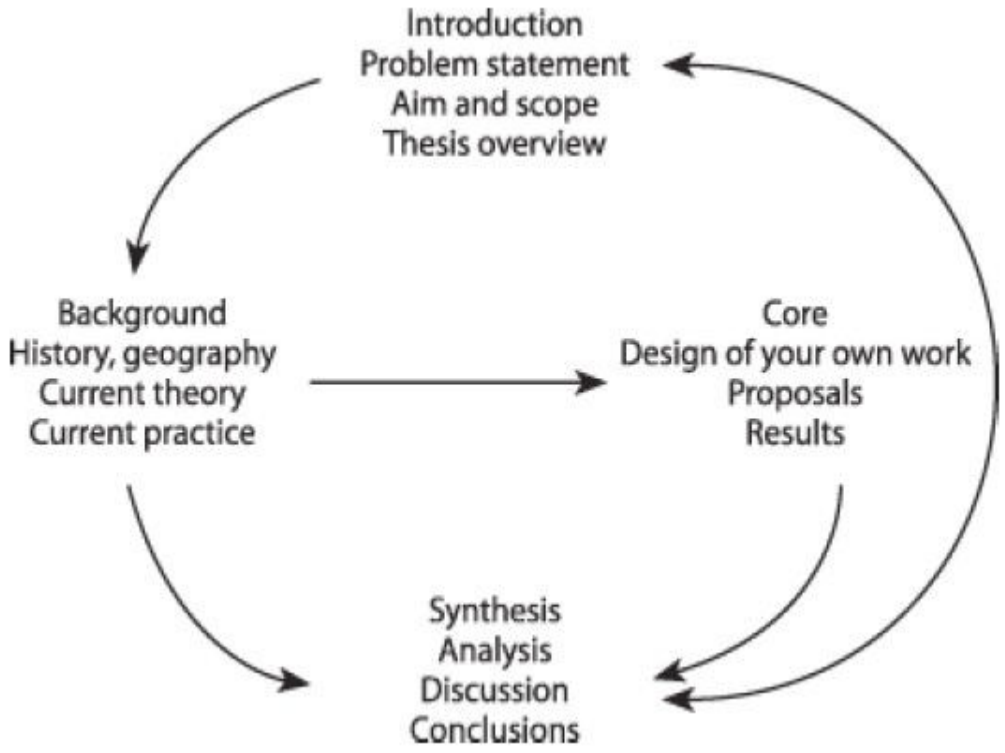
- a thesis is an extended argument.
- a thesis must demonstrate logical, structured, and defensible reasoning based on credible and verifiable evidence presented in such a way that it makes an original contribution to knowledge
- Judged by experts in the field.
- Usually submitted as a part of Degree (Bachelor/Masters/PhD)

- PhD Thesis is not a collection of Research Papers
- Usually has a main theme, and in-depth treatment of different aspects of the theme.
- Research Paper has different sections,
- Thesis/Dissertation is organized in the form of chapters

Table 13.1 Features of technical reports, journal manuscripts and theses

	Technical reports	Manuscripts for journals	Theses/dissertations
Expected length	No set length. Usual range: 50-150 pages*	Often a set maximum length (i.e. a page or word limit). Usual range: 10-30 pages for manuscripts.	Expected length may be specified by university or other host institution (e.g., 50,000 words for a PhD). Usual range: 120-300 pages.
Cover page included	Yes, for paper copies.	Yes, showing title and author names.	Yes
Title page included	Yes	No	Yes
Table of contents	Yes, good practice.	No, not required.	Yes, expected.
Abstract or summary	Usually an extended summary (approx. 2-10 pages)	Brief abstract usually about 150-400 words. Might have to be divided into sections with headings.	Usually an extended summary (approx. 2-4 pages).
Expected level of detail for methods information	Considerable detail expected	Usually only brief information required	Considerable detail expected, including extended review and discussion of methodological options.
Expected level of detail for findings	Considerable detail expected	Reasonable detail expected but concise, focused.	Considerable detail expected, including extended review and discussion.
Separate literature review?	Optional	No, literature briefly reviewed in the introduction section.	Yes, expected.
Text divided into chapters?	Yes, usually. In some cases may only use sections.	No, only sections.	Yes, expected.
Option to include appendices?	Yes	No, not usually	Yes

Thesis Structure



1. An Introductory Chapter
   – Tell the reader the problem you are tackling in this project.
   – State clearly how you aim to deal with this problem.
   – Limit the scope of your study.
   – Sketch out how the thesis is structured to achieve your aim .
2. Background Chapters
   – Include in these chapters all the material required to lead up to your own work .
   – Ensure that there is a flow of narrative that explains why each topic is being discussed .
3. A ‘Core’ Account of Your Own Work
   – Begin with a formal statement of your hypotheses or research questions.
   – Follow this with an account of the methods you chose to test your
   hypotheses or answer your questions, and why you chose them.
   – Report the results of applying these methods.
4. Synthesis
   – You are now ready to pull the whole thesis together.
   – Discuss the implications of your results.
   – Draw strong conclusions backed up by your discussion.
   – Check that they respond to the aim stated in your introduction

Research Impact

- Every researcher's desire: Their work should have impact (what is the effect of the work?)
- How to achieve "research impact"
- How to measure "research impact"
  - Article-level metrics
    - Article views
    - Citations
    - Altemetric Attention Score
  - Journal-level metrics

Impact Factor of Journals (IF)

- Definition: The journal Impact Factor is the average number of times articles from the journal published in the past two years have been cited in the Journal Citation Report (JCR) year.
- The Impact Factor is calculated by dividing the number of citations in the JCR year by the total number of articles published in the two previous years.

Impact Factor of Journals (IF)

Year	Citations in yr 2008	Publication
2007	250	50
2006	300	40
Sum	550	90

$$Impact\ Factor_y = \frac{Citations_{y-1} + Citations_{y-2}}{Publications_{y-1} + Publications_{y-2}}$$

$$Impact\ Factor_{2008} = \frac{Citations_{2007} + Citations_{2006}}{Publications_{2007} + Publications_{2006}}$$

Uses of Impact Factor of Journals (IF)

- Authors to decide where to submit an article for publication.
- Libraries to make collection development decisions
- Academic departments to assess academic productivity
- Academic departments to make decisions on promotion and tenure.

Sources of Further Guidance

- *Presentation adapted from*

  Barbara Gastel, Writing a Scientific Paper: Basics of Content and Organization
- *How to Write and Publish a Scientific Paper,* 8th edition, by Robert A. Day and Barbara Gastel (Greenwood Press, 2008)
- *Fundamentals of Writing Biomedical Research Papers,* 2nd edition, by Mimi Zeiger (McGraw-Hill, 2000)
- *Preparing Scientific Illustrations: A Guide to Better Posters, Presentations, and Publications,* 2nd edition, by Mary Helen Briscoe (Springer, 1996)
- E. I. Karac, B. Turhan and N. Juristo, "A Controlled Experiment with Novice Developers on the Impact of Task Description Granularity on Software Quality in Test-Driven Development," in IEEE Transactions on Software Engineering, doi: 10.1109/TSE.2019.2920377. (This used for example/illustration purposes)
- www.wordvice.com

THANK YOU

Raghu B. A.
Department of Computer Science & Engineering

THESIS WRITING

(Guidelines, format and sample)

WHAT IS A THESIS?

The word "thesis" has two meanings, both of which are applicable to your writing.

- the word refers to either a Master's Thesis or a PhD Thesis (dissertation).
- "thesis" signals the fact that your thesis must be a work of persuasive argumentation. You first make a statement defining the focus of your research (the problem/question/issue that needed to be solved) and signal your results. Then, through evidence and reasoning, you persuade your committee of the validity of your research.

PARTS OF A THESIS

INITIAL PAGES

- Title Page
- Approval Sheet
- Abstract
- Acknowledgment
- Dedication
- Table of Contents
- List of Tables
- List of Figures

TITLE PAGE

The following information needs to be on the title page:

- The title (and possibly the subtitle) of your thesis
- First name and surname of the author(s)
- Whether it is a ‘Bachelor’s thesis’ or a ‘Master’s thesis’
- Faculty and department
- Place and date of completion

Title Sample

Three-dimensional geometric image analysis for interventional electrophysiology

John E McManigle Jr
Wolfson College
University of Oxford

A thesis submitted for the degree of
Doctor of Philosophy
Michaelmas 2014

COOPERATIVE LEARNING APPROACH AND PROBLEM SOLVING SKILLS OF STUDENTS IN FATIMA HIGH SCHOOL

An Undergraduate Thesis
Presented to
The Faculty, College of Education
Mindanao State University
General Santos City

In Partial Fulfillment
of the Requirements for the Degree
Bachelor of Secondary Education

by

DIASY C. CAMANSI
July 2012

APPROVAL SHEET

- This is to prove that the authors have passed the requirements needed for the thesis.
- This is signed by the thesis/FS adviser, panel and the Dean.
- This also states the grade obtained by the author/s.

Approval Sheet Sample

Republic of the Philippines
LAGUNA STATE POLYTECHNIC UNIVERSITY
San Pablo City Campus
San Pablo City

COLLEGE OF TEACHER EDUCATION

APPROVAL SHEET

This thesis entitled "FACTORS AFFECTING CAREER PREFERENCES AMONG SENIOR STUDENTS OF SAN PABLO CITY NATIONAL HIGH SCHOOL A.Y. 2010 - 2011" prepared and submitted by *Bonie Pauline T. Eballa* in partial fulfillment of the requirements in Action Research for the Degree of Bachelor of Secondary Education major in Mathematics has been examined and is recommended for approval and acceptance.

EDEN C. CALLO, ED.D.
Research Adviser

PROF. MAURO D. LUCIDO JR.
Dean College of Teacher Education

PROF. MARILYN P. SANTOS
Director for Research and Development

Approval Sheet Sample

APPROVAL SHEET

This thesis entitled "**Thesis Title**" was prepared and submitted by **Researcher's Name** partial fulfillment of the requirements for the degree of Bachelor of Science in Nursing.

Mark Fredderick R. Abejo RN, MAN
Adviser

PANEL OF EXAMINERS

Approved by the Committee on Oral Examination with a grade of _____%

_____

_____ _____

Accepted and approved in partial fulfillment of the requirements for the degree of Bachelor of Science in Nursing.

Mr. Peter V. Agruda RN, MAN
OIC, College of Nursing

ABSTRACT

- An abstract presents a brief summary of your thesis.
- The aim of the abstract is to briefly provide the reader with the most important information from the entire text.
- An abstract never contains new information.
- This summary is no longer than 2 pages of A4.

ABSTRACT

- 350 words for Ph.D.
- 150 words for a Masters

- The abstract must summarize the contents of the thesis, not merely say what it is about. Write it last because you must have written the Introduction and Conclusion before you can summarize their main ideas in the Abstract.

Abstract Sample

ABSTRACT

According to a very complicated algorithm that no body but me understands, the genomics era shall come to an end at precisely midnight, December 31, 2015. This algorithm takes into consideration the precise number of total species thus identified, the precise number of genes in each species, the precise number of nucleotides in each genome, the precise number of scientists working, the precise number of venture capitalists, the precise size of their bank accounts, the precise level of interest of the general public, and the precise number of incidents of Mad Birds Disease in East Pacific per year. A slight variation in this end date can occur only if the above-mentioned data is not collected properly. In that case, the genomics era shall evolve slowly but never end.

350 or fewer words.

Do not put diagrams, photocopies, abbreviations, reference, or footnotes in the abstract.

ACKNOWLEDGMENT

- This is a page focused on expressing gratitude to organizations, agencies or individuals who, in one way or another, have aided the researchers in finishing the thesis.

Acknowledgment Sample

ACKNOWLEDGMENT

Sincere gratitude is hereby extended to the following who never ceased in helping until this paper is structured:

The Clinical Instructor, J C. Kong, RN, MAN, the thesis adviser, for the unwavering guidance;

Prof. Ronnie J, Smith, M.EnP, the statistician, for the shared mathematical expertise that indeed, contributed positively in the analysis and interpretation of data;

The members of the defense panel, Dr. Lyn Chee; Clinical Instructor Joyce B. Meneses, RN, RM, MAN and Prof. Gems L. Baize, M. Sci, for sharing their precious time and positive insights that;

For the unwavering moral, emotional and financial support of the proponents' family and friends;

Above all, utmost appreciation to the Almighty God for the divine intervention in this academic endeavor.

The Research Team.

TABLE OF CONTENTS

- The table of contents is essentially a topic outline of the thesis.
- It is compiled by listing the headings in the thesis down to whichever level you choose.

Table Of Contents Sample

TABLE OF CONTENTS

ACKNOWLEDGEMENTS i

LIST OF FIGURES v

LIST OF TABLES vii

CHAPTER Page

1 INTRODUCTION 1
Section One One 1

2 POLICY DIVERGENCE AND TRADITIONAL RESEARCH . 3
Section Two One 3
Section Two One One 3

Table Of Contents Measurement

TABLE OF CONTENTS

LIST OF TABLES ix
LIST OF FIGURES x
LIST OF ABBREVIATIONS xi
CHAPTER 1: TITLE OF CHAPTER 1 1
Introduction 1
Section 1.1 1
Subheading 1 2
Subheading 2 2
Section 1.2 2
CHAPTER 2: TITLE OF CHAPTER 2 4
Introduction 4
Ad Nulla Dolor Dolor Magna Quis ex in Aute Tempor Magna Convallis Lacus Eiusmod in est Commodo et Veniam 4
Praesent Vel Justo Dapibus 5
Mauris Est Auctor Ligula 8
ENDNOTES 10
APPENDIX 1: TITLE OF APPENDIX 11
APPENDIX 2: TABLE OF DATA FINDINGS 12
REFERENCES 13

1”

1”

LIST OF TABLES / LIST OF FIGURES

- Include a list of figures (illustrations) and a list of tables if you have one or more items in these categories.
- Use a separate page for each list.
- List the number, caption, and page number of every figure and table in the body of the thesis.

List Of Tables / List Of Figures Samples

Contents

List of Tables 1

List of Figures 1

1 Introduction 3

List of Tables

1.1 A first fake table 4

1.2 A second fake table 4

List of Figures

1.1 A first fake figure 3

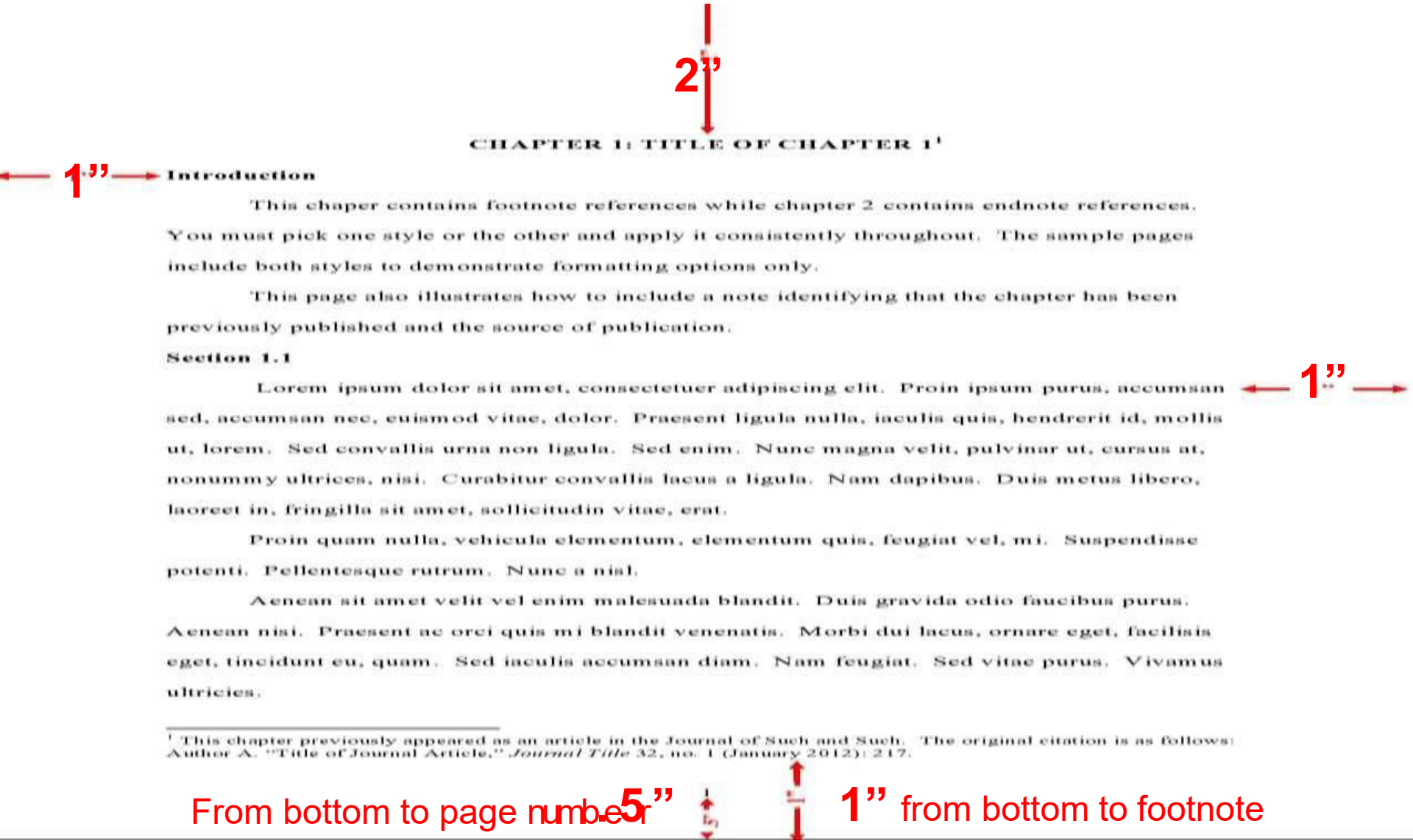
1.2 A second fake figure 3

TITLE OF CHAPTERS

1. Problem and Its Background
2. Review of Related Literature and Studies
3. Methodology of the Study
4. Presentation, Analysis and Interpretation of Data
5. Summary, Conclusions and Recommendations

Title Of Chapters

Measurement



How to write an effective title and abstract and choose appropriate keywords

How to write an effective title and abstract and choose appropriate keywords

- Ironically, these three elements—the title, abstract, and keywords—may well hold the key to publication success.

The title, abstract, and keywords: Why it is important to get them right

- The title, abstract, and keywords play a pivotal role in the communication of research. Without them, most papers may never be read or even found by interested readers[1-4]. Here's why:

1. Most electronic search engines, databases, or journal websites will use the words found in your title and abstract, and your list of keywords to decide whether and when to display your paper to interested readers.[1,2,5-8]Thus, these 3 elements enable the dissemination of your research; without them, readers would not be able to find or cite your paper.

2. The title and abstract are often the only parts of a paper that are freely available online.[1,9] Hence, once readers find your paper, they will read through the title and abstract to determine whether or not to purchase a full copy of your paper/continue reading.[2-4]

The title, abstract, and keywords: Why it is important to get them right

- Finally, the abstract is the first section of your paper that journal editors and reviewers read. While busy journal editors may use the abstract to decide whether to send a paper for peer review or reject it outright, reviewers will form their first impression about your paper on reading it.[10]

- Given the critical role that these 3 elements play in helping readers access your research, we offer a set of guidelines (compiled from instructions and resources on journals' websites and academic writing guidelines, listed in the references) on writing effective titles and abstracts and choosing the right keywords.

Writing the title

- *Answer the questions: What is my paper about? What techniques/ designs were used? Who/what is studied? What were the results?*
- *Use your answers to list key words.*
- *Build a sentence with these key words.*
- *Delete all waste words (e.g., study of, investigates) and repetitive words; link the remaining*
- *Delete non-essential information and reword*

Writing the abstract

- The abstract should work like a marketing tool.[4,11] It should help the reader decide "whether there is something in the body of the paper worth reading" [10] by providing a quick and accurate summary of the entire paper,[2,3] explaining why the research was conducted, what the aims were, how these were met, and what the main findings were.[1,2,6-8,12]

Types of abstracts

- Generally between 100 and 300 words in length,[1,3,4,12] abstracts are of different types: descriptive, informative, and structured.

1. Descriptive abstracts, usually used in the social sciences and humanities, do not give specific information about methods and results.[13,14]
2. Informative abstracts are commonly used in the sciences and present information on the background, aim, methods, results, and conclusions.[13,14]
3. Structured abstracts are essentially informative abstracts divided into a series of headings (e.g., Objective, Method, Results, Conclusion)[9,15,16] and are typically found in medical literature and clinical trial reports.

Writing the abstract

1. Begin writing the abstract after you have finished writing your paper.

2. First answer the questions “What problem are you trying to solve?” and “What motivated you to do so?” by picking out the major objectives/hypotheses and conclusions from your Introduction and Conclusion sections.

3. Next, answer the question "How did you go about achieving your objective?" by selecting key sentences and phrases from your Methods section.

4. Now, reveal your findings by listing the major results from your Results section.
5. Finally, answer the question "What are the implications of your findings?“

6. Arrange the sentences and phrases selected in steps [2, 3, 4,] and [5] into a single paragraph in the following sequence: Introduction, Methods, Results, and Conclusions.

7. Make sure that this paragraph is self-contained[1,2,7,12] and does not include the following:[1-3,7,12]
   - Information not present in the paper
   - Figures and tables
   - Abbreviations
   - Literature review or reference citations

Writing the abstract

8. Now, link your sentences.

9. Ensure that the paragraph is written in the past tense1,[7,17] and check that the information flows well, preferably in the following order: purpose, basic study design/techniques used, major findings, conclusions, and implications.

10. Check that the final abstract
    - Contains information that is consistent with that presented in the paper.
    - Meets the guidelines of the targeted journal (word limit, type of abstract, etc.)
    - Does not contain typographical errors as these may lead referees and editors to "conclude that the paper is bad and should be rejected."[10]

Choosing your keywords

1. Read through your paper and list down the terms/phrases that are used repeatedly in the text.
2. Ensure that this list includes all your main key terms/phrases and a few additional key phrases.
3. Include variants of a term/phrase (e.g., kidney and renal), drug names, procedures, etc.
4. Include common abbreviations of terms (e.g., HIV).
5. Now, refer to a common vocabulary/term list or indexing standard in your discipline (e.g., GeoRef, ERIC Thesaurus, PsycInfo, ChemWeb, BIOSIS Search Guide, MeSH Thesaurus) and ensure that the terms you have used match those used in these resources.
6. Finally, before you submit your article, type your keywords into a search engine and check if the results that show up match the subject of your paper. This will help you determine whether your keywords are appropriate for the topic of your paper.