WRITING RESEARCH THESIS / PUBLICATIONS

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Components in a research publication

1. Title
2. Abstract
3. Introduction
4. Materials and methods
5. Results
6. Discussion
7. Conclusions
8. Acknowledgements
9. References

Time plan for research thesis & publication of research

	YEAR 1		YEAR 2		YEAR 3	
ACTIVITIES	1	2	3	4	5	6
Literature survey						
Writing references list						
Writing abstract						
Writing introduction						
Writing materials and methods						
Writing results						
Writing discussion						
Publishing in journals						

Title

1. What is the question (problem) addressed by the thesis/ publication
2. State your aim as a title
3. Short and self-explanatory
4. Too short – the reader will not find what the thesis is about
5. Too long – reader loses interest by the time s/he finishes reading about it
6. It should tell the reader about contents of the thesis / publication

Modifications to the title

Done continuously as the research progresses and the scope changes

WORKING TITLE….

- **State your aim as the title**
- **Keep modifying the title, as research continues**

DEFINITIVE TITLE…..

- **It should tell the reader about contents of the thesis**

Example of selecting a title

- **ISSUE: Kandy lake seems to be over-populated with Tilapia fish. Dead Tilapia could be seen floating during certain seasons**
- **PROBLEM: What are the growth patterns in Tilapia fish in Kandy lake.**
- **PROBABLE TITLES: Which is the best ?**

1. **Tilapia**
2. **Tilapia fish in Kandy lake**
3. **Growth patterns of Tilapia fish in Kandy lake**
4. **Breeding seasons, seasonal deaths, and quality of water in and entering Kandy lake and their effect on tilapia fish population**

Working towards a definitive title

- **Listeria has become a pathogen of concern in foods. Is it a problem in Sri Lanka ?**

1. **Listeria in foods**
2. **Listeria in milk**
3. **Listeria in milk and milk products**
4. **Effects of processing on Listeria in milk and milk products**

Titles for your observations

1. Light railway for Malabe
2. Evaluation of problems leading to slow traffic on after Parliament
3. Changing the traffic flow along Parliament road
4. Changing patterns of vehicle use by Sri Lankans
5. Some studies in road traffic in Sri Lanka

[Locations, width of roads, number of cars per 1000 persons, number of people travelling, three wheelers, buses, efficiency of light railway system, traffic lights, role of traffic police, poor driving standards, absence of motor cycle lanes…]

General Rules on Title

1. All capitals
2. All words begin with capitals except prepositions and conjunctions
3. Only first word begins with capitals
4. Does not begin with digits
5. No full stop
6. Non-English words in Italics
7. Follow the house-style of the journal or the university guidelines for the thesis/dissertation

WRITING THE ABSTRACT – Distribution of contents

1. **FIELD OF STUDY: Introduce the field of study; Note your specific area of interest [10-15% of the length / words]**
2. **AIM: What have you been trying to do, or show, and why? [10-15%]**
3. **M & M: How did you address the aim [10-20%]**
4. **RESULTS: What did you achieve; did everything go as planned ? [35-45%]**
5. **DISCUSSION: What importance does your work have in relation to rest of your field of study ? [20-25%]**
6. **NEVER: ~~The results are / will be discussed~~**

Purpose of the Abstract

- **Abstract should allow a scientist in your discipline, who is not a specialist in your topic, to get an idea of what you have done [Start with a working abstract of 4-5 sentences and then expand]**

ABSTRACT DOES TWO JOBS IN 200 TO 400 WORDS

- **It tells what your thesis is about in a language the general readers can understand**
- **It highlights the interesting findings which will attract the readers**

THE AUDIENCES READING THE ABSTRACT ARE:

- **(a) Examiners (b) Researchers in your subject area**

Rules in Writing the Abstract

1. Avoid formulae
2. No references
3. Do not refer to figures, diagrams, and tables
4. Generally in past tense
5. Usually in one page
6. Provide quantitative information where possible, avoiding relative statements
7. Make paragraph the unit of composition [Generally not single sentences; First sentence in each paragraph indicates what you are writing about – objectives, methods, results, conclusions]

……Rules in writing the abstract

1. Write statements in positive form [Leaves did not turn brown during drought vs. Leaves remained green during drought]
2. Use specific, definite, concrete language [Traffic records showed no congestion on Sunday vs. There was no traffic congestion on Sunday.]
3. Omit needless words [The study was carried out in two seasons of low and high rainfall of 20 mm and 200 mm per month vs. The study was carried out during rainy periods of 20mm and 200 mm per month]
4. Place emphatic word of a sentence at the beginning or end [The traffic pattern was monitored in 5 locations at Borella only from 10 am to 5 pm on Sunday.

WRITING MATERIALS AND METHODS

- **MATERIALS: Reagents; Theories; Equations; Theoretical models; Human and animal subjects; Equipment and existing data.**

- **METHODS: Gives the process you have used to generate data**

  Your M & M should be clear and complete so that another person could practice the same experiments, exactly the way you did, without asking for any information from you

Guidance for writing M & M

1. **Start writing into the computer while you are performing experiments**
2. **Give references where you have exactly followed a published method**
3. **Include unsuccessful methods, if it may help somebody in preventing repetition of mistakes of yours.**

STYLE: ~~"Weighing agar was undertaken till 5 grams was measured out and then agar was later added to the solution"~~

" Agar (5g) was added to the solution"

Writing style

1. Use past or present tense
2. Mathematical equations may be included
3. Use subtitles

    - Materials
        - General reagents
        - Microbiological reagents
    - Methods
        - Estimation of moisture
        - Survey plan
        - Transport and storage of samples
        - Sample preparation

Style for M & M

AVOID COLLOQUIALISM: Write 'Methyl alcohol' instead of MeOH or CH_3OH

Use correct SI units and abbreviations:

[Metre = m; kilogram = kg; second = s; Mole = Mol; degrees Celsius = ^oC; day = d; Hour = h; Mega = M, micro = µ; milli = m.]

Explaining a principle: If this is done, ensure that you are extremely accurate in your statements. Otherwise the examiner will find that you do not know what you have done. (Ex; use of sophisticated equipment)

Give details of protocols to show right sequence of steps: Added 20.0 g of agar to 200 ml freshly squeezed tomato juice. Added 800 ml of water and autoclaved immediately at 15 psi for 10 min.

Style for M & M

1. **Controls and blanks: Should be indicated**
2. **Test kits: "According to manufacturer's instructions". Give reference on the published articles using the kit, reference on validation. May indicate the principle of the kit (Ex: PCR, Rapid Antigen kit, ELISA)**
3. **Special equipment you have made: Give line drawings, circuit diagrams, photographs, reasons for developing new equipment, calibrations, comparison with a standard existing equipment.**
4. **Equations: Correct symbols; Superscripts/subscripts, normal scripts, italics, lines**
5. **Software developed**

Style for M & M

1. **Values /readings/decimal points / accuracy**
2. **Round off to a number that reflects accuracy of your experiments**

   ~~pH is 8.5678~~ pH is 8.5

3. **Values being compared should have the same level of accuracy and error, wherever possible.**
4. **In giving means and standard error of the means they should show the same number of digits after the decimal mark.**

   5.38 ± 0.23 and not 5.38 ± 0.2345

5. **Replace fractions by decimals [¼ ; write instead 0.25]**

Style for M & M

1. Calculations: Examiner need to find whether you have understood the subject and analysis correctly. Give calculations including units.
2. Statistical analysis, approximation of methods, artefacts, repeatability of measurements
   a) Statistical analysis is an objective method in avoiding or detecting biases in data
   b) Always include estimations of errors and approximations
   c) Artefacts are results arising as bi-products of methodology
   d) List any factors that make it difficult for somebody to repeat your method.

Style for M & M

- **Computer programs: Give the web reference, published paper, manufacturer. If you have written a program, include as appendix.**
- **Hazards: Indicate for any uncommon chemicals, reagents, cultures.**
- **Questionnaires: Include English version.**
- **Acknowledging others who helped: HPLC analysis was performed with the aid of Mr. P. K. Lenage. Samples were provided by National Livestock Development Board.**
- **Figures & Tables: Use well labelled figures**

Style for M & M

AFTER WRITING

Imagine you are a scientist in another country, who does not know of what you did. See whether he would be able to replicate your work, without contacting you for details – Get a friend to help you

Style for M & M - COMMON MISTAKES

1. Different or non-standard abbreviations
2. Details of computer programs & data bases
3. Correct Greek letters - ~~a, b,~~ {α, β}
4. 20% Ethanol {w/v, v/v, w/w}
5. ~~Sodium Chloride~~, {sodium chloride}; ~~CH3OH~~ {CH_3OH}
6. Italics at correct place Benzo(*a*)pyrene
7. Avoid colloquialism –Popular/ Hot/ Warm/ Radioactive
8. Replace rpm (Centrifuge) by centrifugal force *xg* (do not confuse with g)
9. Conventions of notations Ex. gene ~~CTBP2, VCP~~ {*Ctbp2, Vcp*}
10. Names of species – *Homo sapiens*
11. Consistent in spacing 5g or 5 g.
12. Detailed information on materials – pH, %

References (Bibliography)

[to cite] = refer to a piece of work in your text

[citation] = indication in the text that you are doing so

NUMERICAL SYSTEM

Apparel industry is a main income source for Sri Lanka[3]. The highest demands for our products are from USA and EU[4,5].

HARVARD SYSTEM

The plumage in most Asian land fish is yellow (Peries, 1989), but specimens with red plumage are occasionally seen (Peiris & Peiries, 1999; Pieris *et al*., 2000).

References (Bibliography)

[Reference] = Original document or direction for reader to find original document

- **Jayawardana, P. T. and Jayewardene, J. P. (2003) Observations on the artisanal prawn fishery in shallow coastal waters off Chilaw. *Journal of the National Science Foundation of Sri Lanka* 48 (3): 28 –39.**

Purpose: For the reader to check back the original source.

What do you refer? : Anything in public domain – journals, books, thesis, conference proceedings, web articles, your own published work. Do not refer to statements of general knowledge (ex: Sri Lanka is an island)

References (Bibliography)

- **What to cite? :**

Every time you make use of a reference. [Avoid citing conversations and seminar talks, which are not available in public domain]. In citing work which are not in public domain, get permission.

- **How many references and how old ?**

In a thesis 200 to 300. In a research article 20-30. Review article 50-100. Most recent references should be within last year. [Show you are keeping up with the current developments of subject and possess good background knowledge.]

References (Bibliography)

- **Problem in finding references: Difficult to find original document in an article published in an obscure foreign journal. Indicate it as "cited in" or "cited by". Be cautious as you are depending on interpretation by a third party.**
- **Quoting: If less than 20 words, use inverted commas followed by citing. If longer insert as a 'block indent'.**
- **Senaratne maintains that, ……**
- **The variation patterns of the catch rates ……. during both years studied (Senaratne, 2004)**
- **However these observations are doubtful in the light of findings of Weerasinghe (2003)**

References (Bibliography)

- **Writing the thesis: Enter citations while preparing the first draft of the text. Also prepare the list of references while writing.**
- **Writing the references [Follow house-style]**

a) From journals;

- **Soysa S.J.B., Zoysa U.N.P. and Soyza J.V.P. 2003. A new method for estimating iodine in fruits. *Journal of the Association of Official Analytical Chemists*. 53: 24-35.**
- **Soysa, P.A., Zoysa, U.N.P. and Soyza, J.V.P. (2003). A new method for estimating iodine in fruits. *Journal of the Association of Official Analytical Chemists.* 53: 24-35.**

References (Bibliography)

- Soysa, P.A., Zoysa, U.N.P. and Soyza, J.V.P. 2003. A new method for estimating iodine in fruits. *J Assoc. Offic. Anal. Chem.* 53: 24-35.

b) From books;

- Tilakaratne, P. and Tilakeratne, Q. (2003) The biology of plants. (Academic Press, London).

Page numbers may be included as [pp.205-208] or [p.205]

c) A book chapter edited by another person;

- Amaraweera, P. (2003) Aflatoxin and polycyclic aromatic hydrocarbon contamination in foods and its implications in human health. In *Fungi in Human and Animal Health*. R. K. S, Kushwaha, R.K.S. (Ed.) (Science Publishers, Jodhpur, India). pp.403-422.

References (Bibliography)

d) From a thesis;

- **Gunawardene, K. (2003) The effect of carbide on ripening quality of banana. (PhD Thesis) University of Timbaktu. p. 223.**

e) From abstracts;

- **Goonasekara, P., and Gunasekera, S. (2001) Disposal of the products of toddy fermentation. *Annual Sessions of the Sri Lanka Association for the Advancement of Science, Colombo*. 54: 23.**

f) From World Wide Web;

- **Bide, Mark. In search of unicorn: The Digital Object Identifier from a user perspective [online]. Revised. London: Book Industry Communication, February 1998 [cited 9 June 1998]. Portable Document Format. Available from: <http: //www. bic. org. uk/bic/unicorn2.pdf> ISBN 1 873671 19 9.**

WRITING THE RESULTS -1

1. **May be in a single chapter - May be in several chapters.**
2. **Do not mix up with discussion [Discussion review the existing theories and findings in relation to results].**
3. **Up to this point one should be continuously upgrading literature.**
4. **Now, go through all the reviewed literature and references analytically :–**
   - **Note down the key points related to your results.**
5. **Arrange results logically / not chronologically.**
   - **Clarify your aims.**
   - **Arrange results to support your aims.**

WRITING THE RESULTS -2

- **Your aim may have changed due to,**
  - **Recent research of other scientists.**
  - **Recent publications.**
  - **Failure of experiments.**
  - **More important findings than originally thought of.**
- **What to include ?**

  Everything relevant to your aim both,
  - **Major (around which you build the chapter) &**
  - **Minor (calibrations, introduction of a new technique).**
- **Do not exclude any contradictory results; explain them instead, indicating why your experiment did not work – BE HONEST.**

WRITING THE RESULTS -3

- **Cite any work by others (*Plagiarism results in a failed degree)* – BE HONEST.**

- **Exclude:**
  - **Results not related to aim.**
  - **Materials & methods under results section**
  - **Detailed protocols – only mention briefly.**

WRITING THE RESULTS - 4

ACTUAL WRITING OF RESULTS !!!!

1. Get into an undisturbed location with free mind.
2. Identify subtitles based on the aims.
3. In results you give facts and not opinions.

   i.e. experiments briefly and related results (outcome)
4. [When the fruits were weighed in analog balance machine it read 300, while the use of digital balance gave reading as 302]

Refer to M & M in text

Use past tense

Use complete sentences

WRITING THE RESULTS -5

- **[The final mean average weight dropped from 55 g for immature to 32 g for mature nuts] ???**
- **[The final mean average for mature nuts was 55 g, which was significantly higher than that of 32 g for mature nuts].**

Use accepted scientific terms

Avoid jargon

Avoid scientific colloquialism

Use correct units and their abbreviations

[5 h and not hr., hours, or hrs.]

WRITING THE RESULTS - 6

- **Keep notes of points that should go to the introduction and discussion**
- **Statistics and numbers:-**

  Be concerned on significant figures, rounding off and the levels of statistical significance. Be extremely careful in using the word "significance". Instead interpret data to explain outcome of the experiment.
- **Figures and Tables:**

  Decide carefully on the way of presenting.

  Do not describe the figures & tables in the text, but highlight the key points and trends.

PREPARING FIGURES AND TABLES

1. Tables – caption above.
2. Figures – caption below.
3. Caption should give sufficient information to understand the contents in the table or figure without going back to the text.
4. Follow the house-style of the journal in preparing tables.
5. Enter the data into excel program and examine the best means of presentation considering nature of data.
6. Label the pictures properly.

Fig. 1.1 - Distribution of the total number of cited research publications for 1991-2000 by the universities and research institutes in Sri Lanka listed in science and social science citation indices (1185 entries).

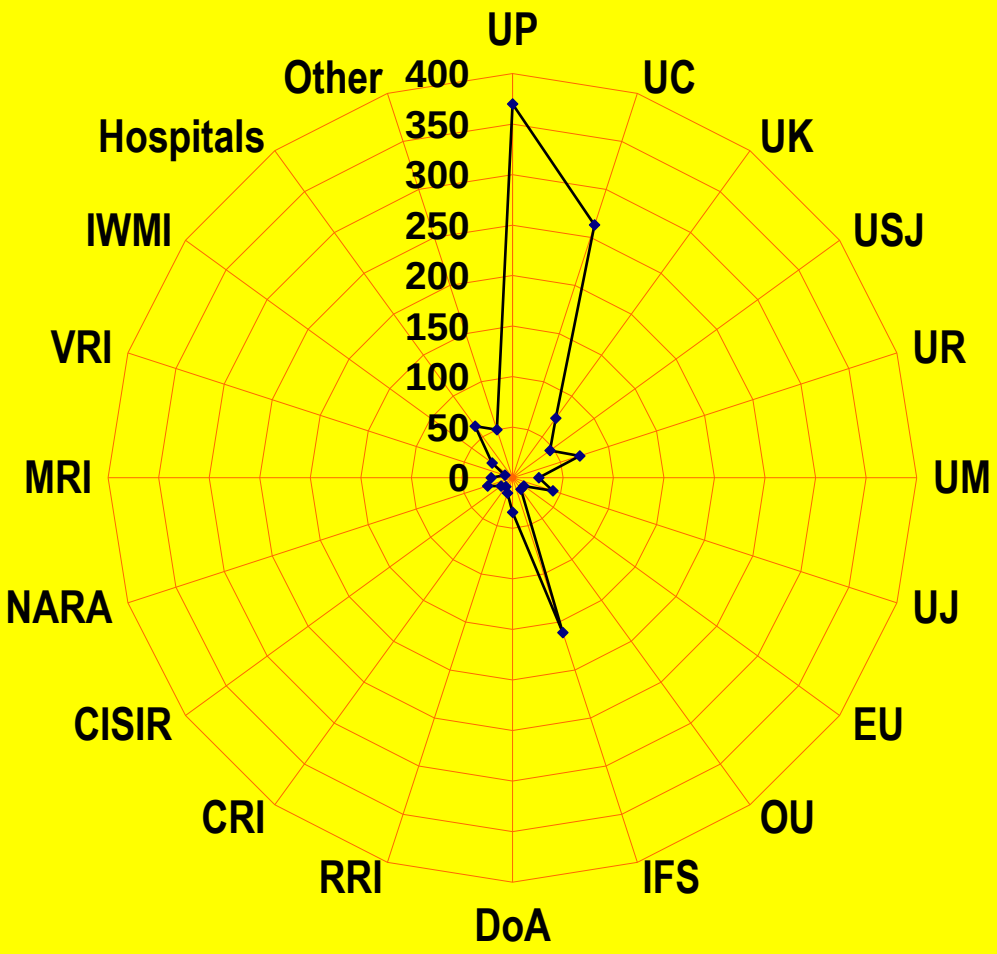
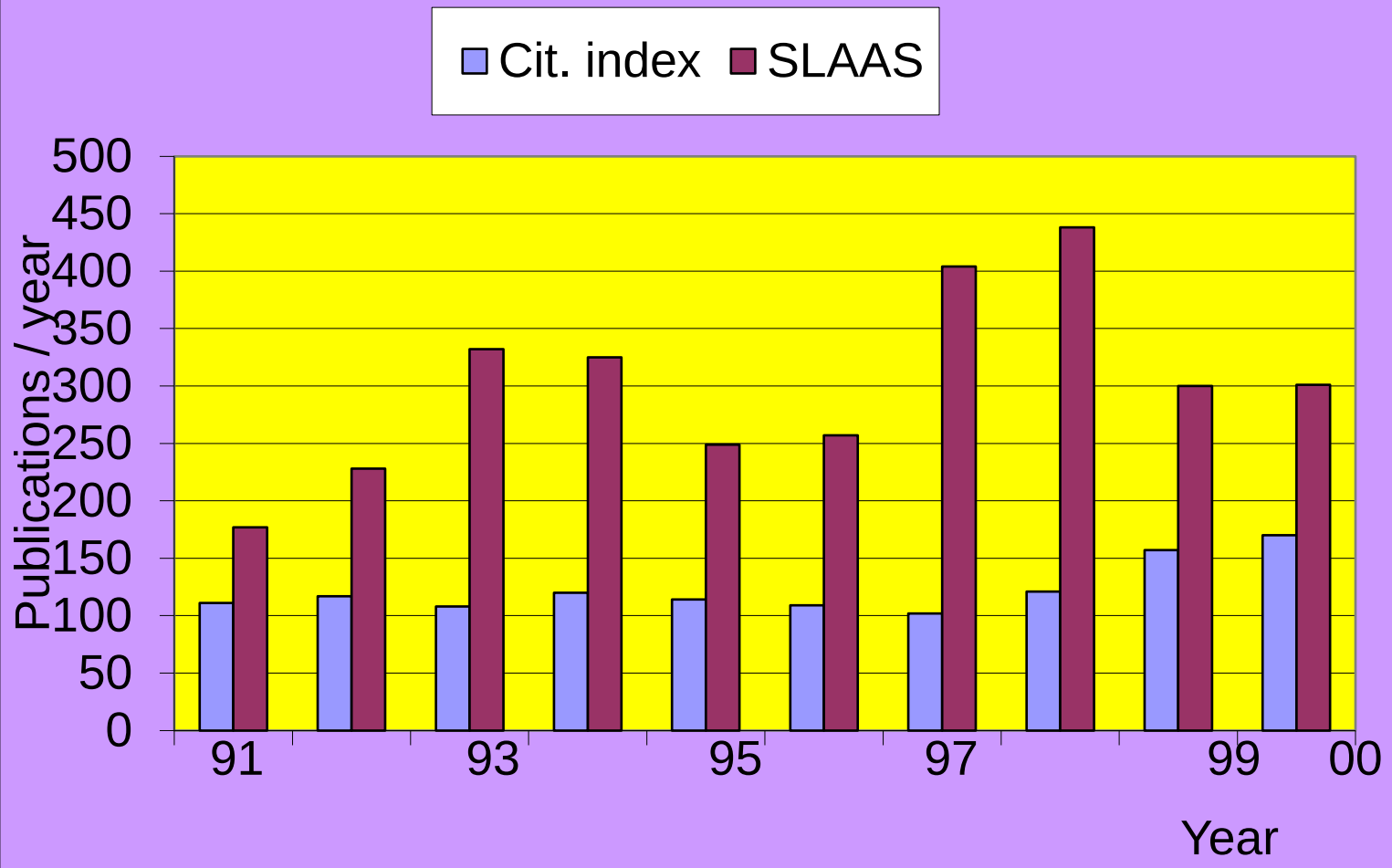


Fig.4.6 - Annual pattern of research publications from Sri Lanka as listed in citation indices and SLAAS abstracts for 1991-2000



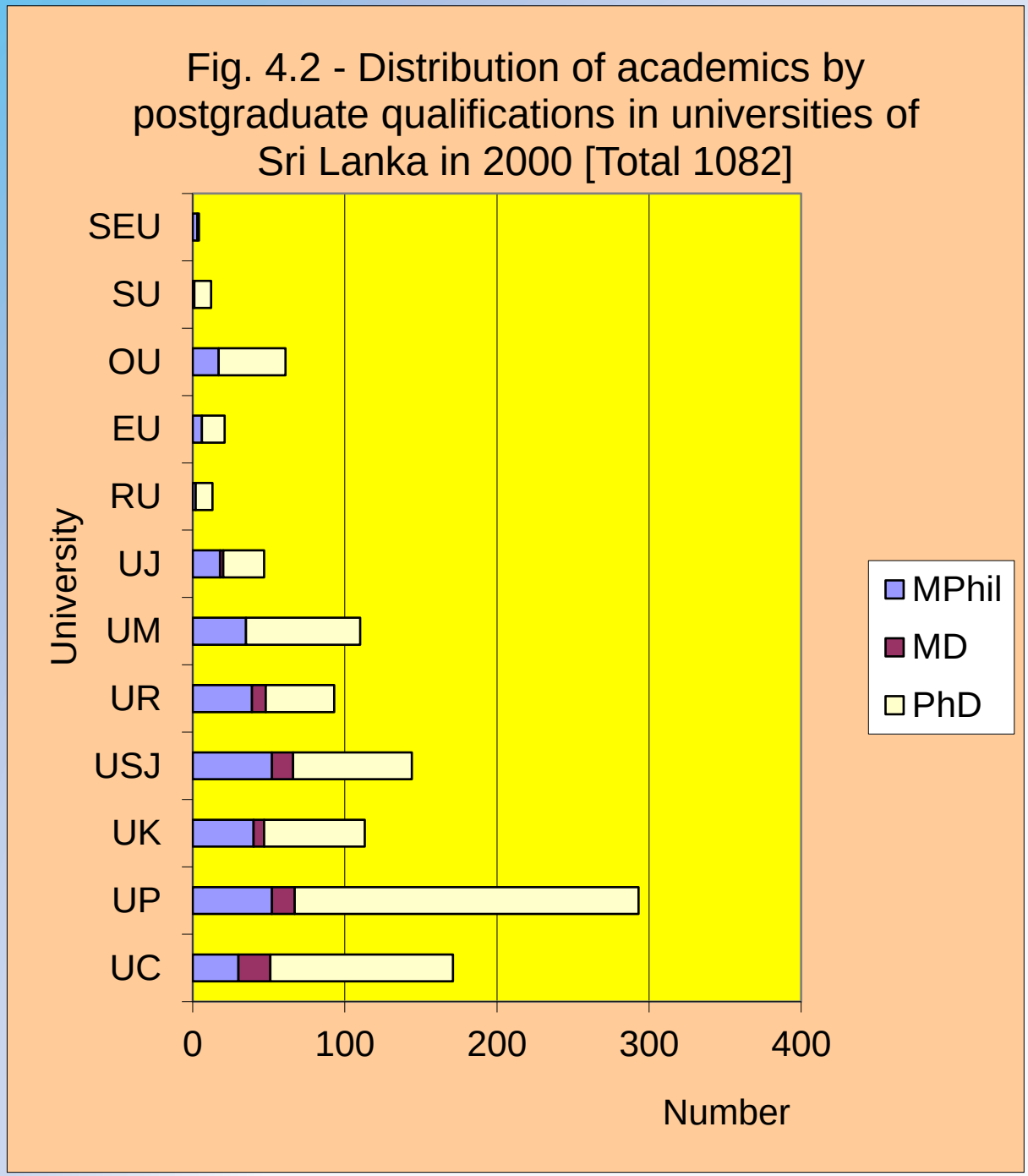


Fig. 4.2 - Distribution of academics by postgraduate qualifications in universities of Sri Lanka in 2000 [Total 1082]
SEU
SU
OU
EU
RU
UJ
UM
UR
USJ
UK
UP
UC
University
0
100
200
300
400
Number
MPhil
MD
PhD

Fig 4.7 - Pattern of research publications and communications at University of Peradeniya 1991-1999.

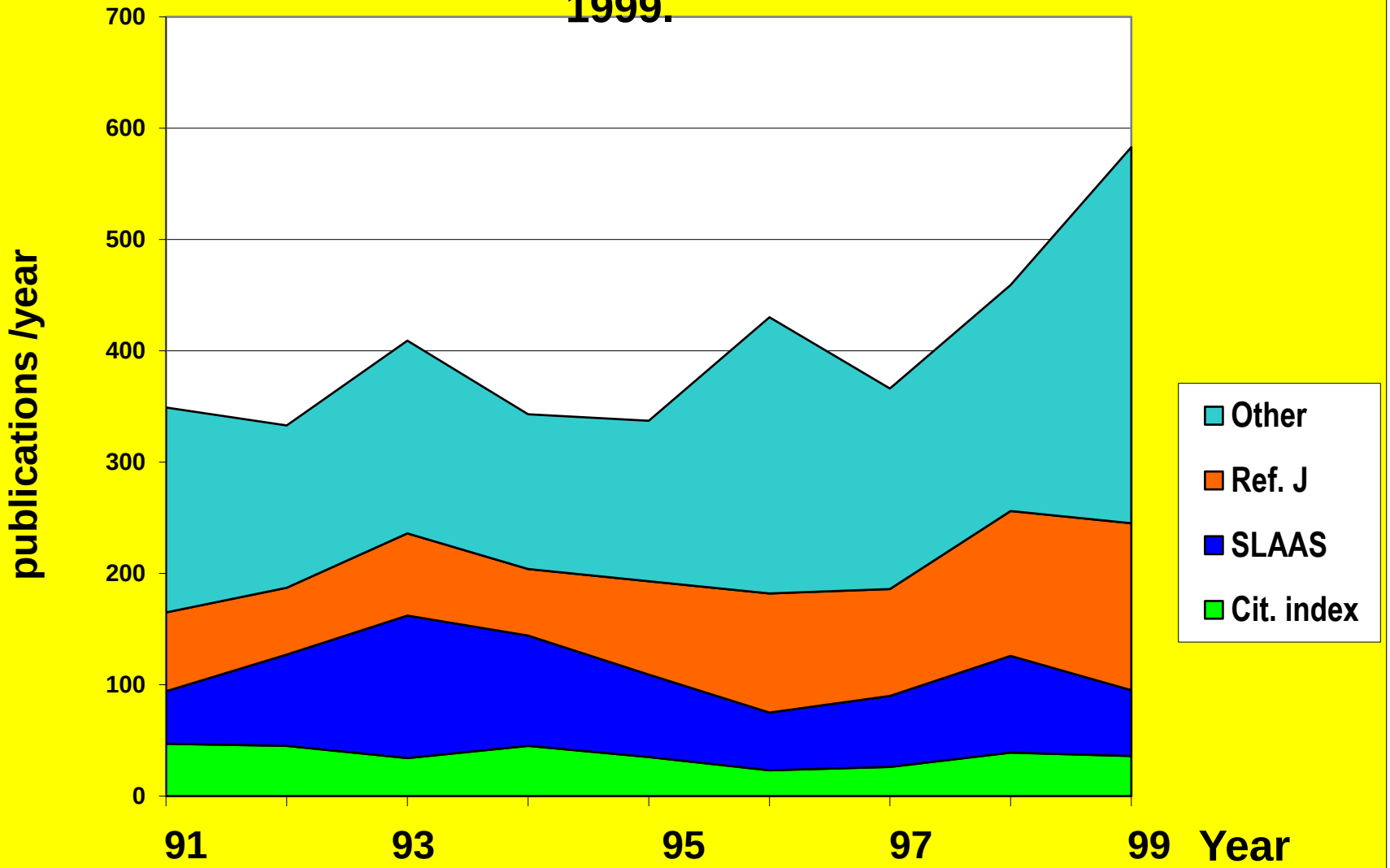
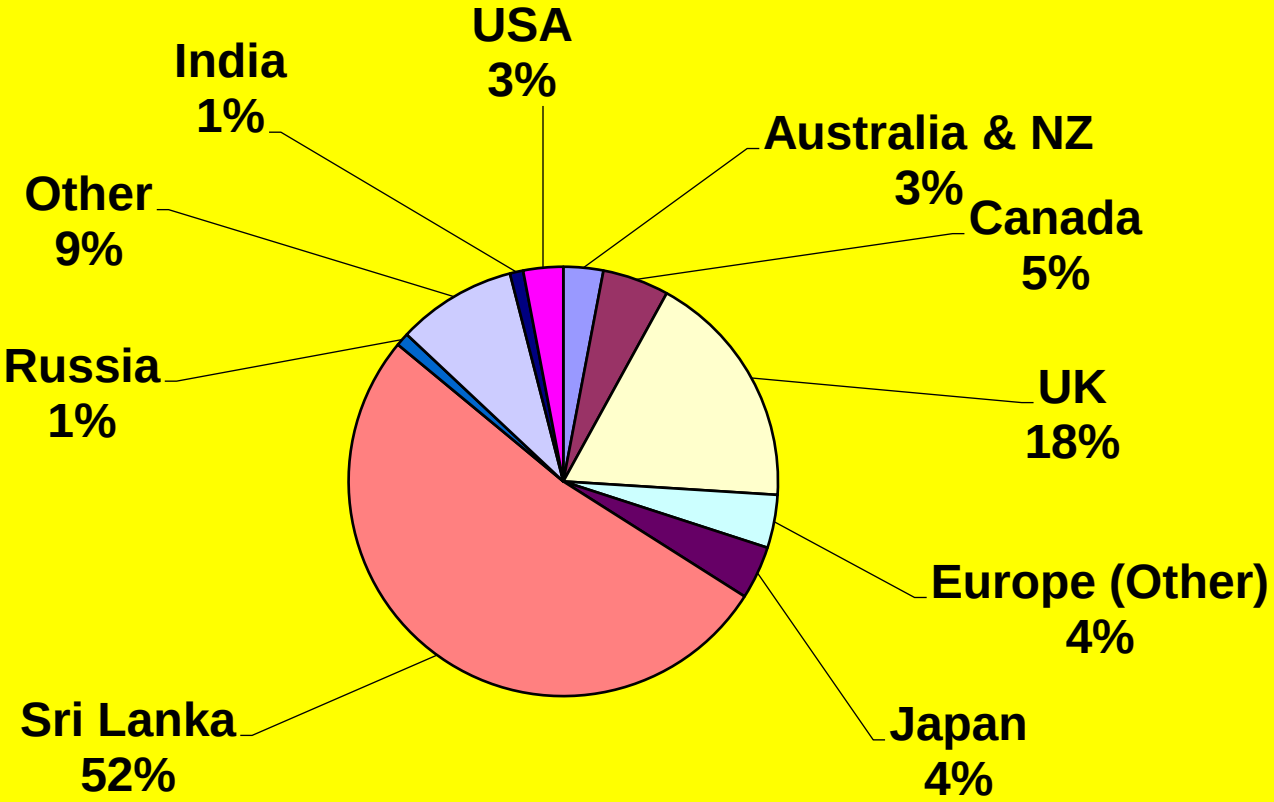


Fig. 6.2 - Percent distribution of Masters degree holders in the academic staff by country of study as in year 2000 [295 entries]

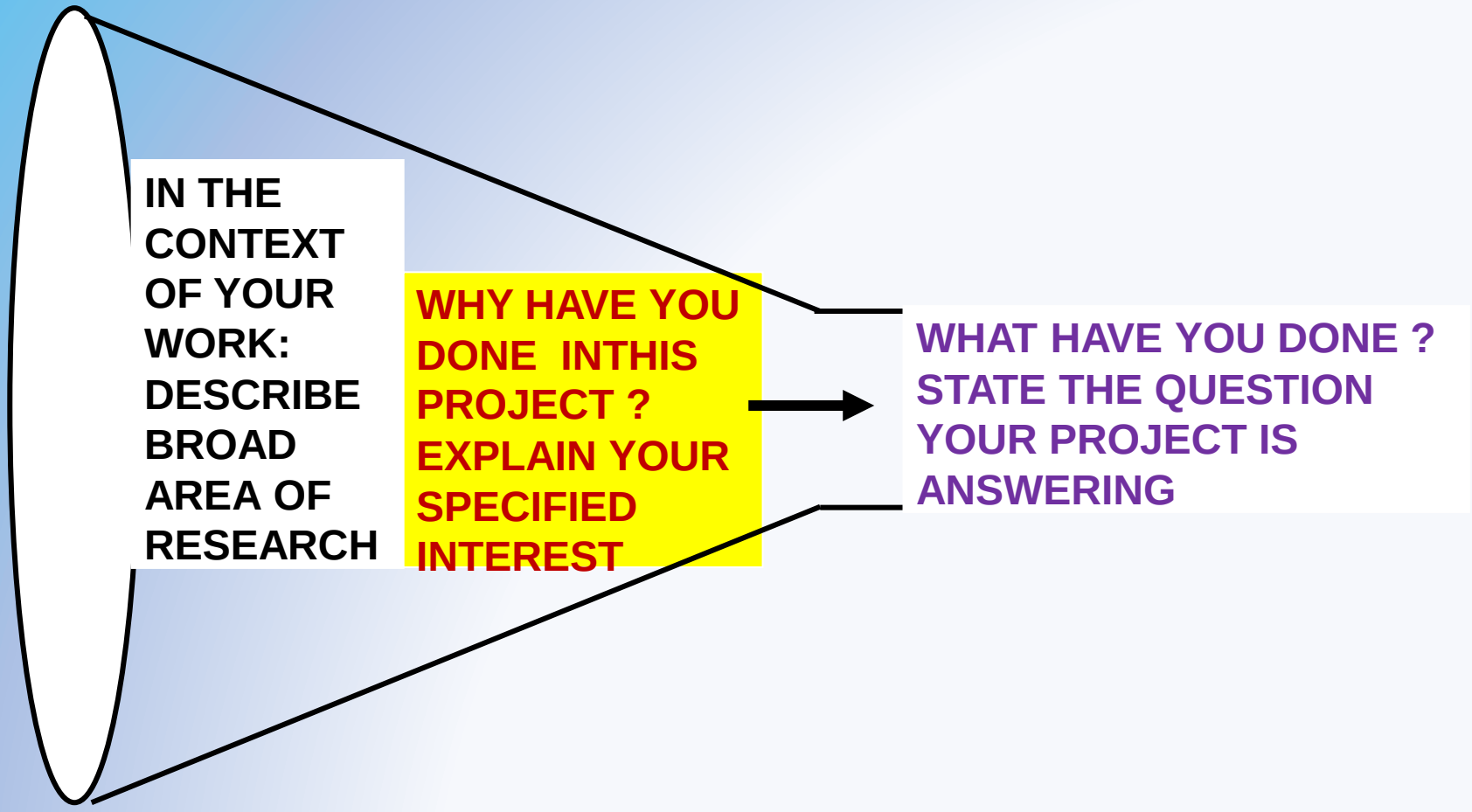


OBJECTIVE OF THE INTRODUCTION

1. Thesis is not a heap of data + 1 or 2 hints.
2. You have to take the reader stepwise logically through M & M to Results, to Discussion, to Conclusions.
3. Introduction lays the foundation for it by giving the background of your research and relationship between your work & research in wider field.
4. Indicate why your project is interesting ?
5. What questions you have aimed to answer ?
6. Narrow down then to,

   Pose the question your thesis is answering.

INTRODUCTION BRINGS IN FOCUS



Planning the Introduction

➢ ***Beginning:***

1. **Account of your subject at the time of writing,**

   OR

2. **Brief history of subject up to the time of writing.**

3. **Introduction = Deals specifically with details of the project.**

   +

4. **Literature survey = Reviewing literature about area of interest.**

Planning the Introduction

Middle:

1. **Take reader from general to specific – your aims.**
2. **Give up-to-date outline of findings & theories.**
3. **Provide reference to every statement.**
4. **Compare & contrast different theories & findings providing constructive criticism.**
5. **If you have used new methods, techniques, equipment indicate why the old does not suit.**
6. **Show that you are aware of all controversial theories, arguments, in subject.**
7. **Synthesize your own tables and figures combining results from different workers.**

Planning the Introduction

- **Structure of introduction should reflect your results chapter.**
  –

- *The end* -

Style of writing:

- **Write what is relevant: Be honest**
  Be rational
  Back the statements with evidence
  developed through your arguments
- **Avoid, flowery adjectives (huge, popular), and undefined terms**
- **Make a clear distinction between <u>facts</u> and <u>opinions</u>**
- **Remember !!! All directly copied material (plagiarism) will carry a different style of writing from yours and is obvious to the examiner.**

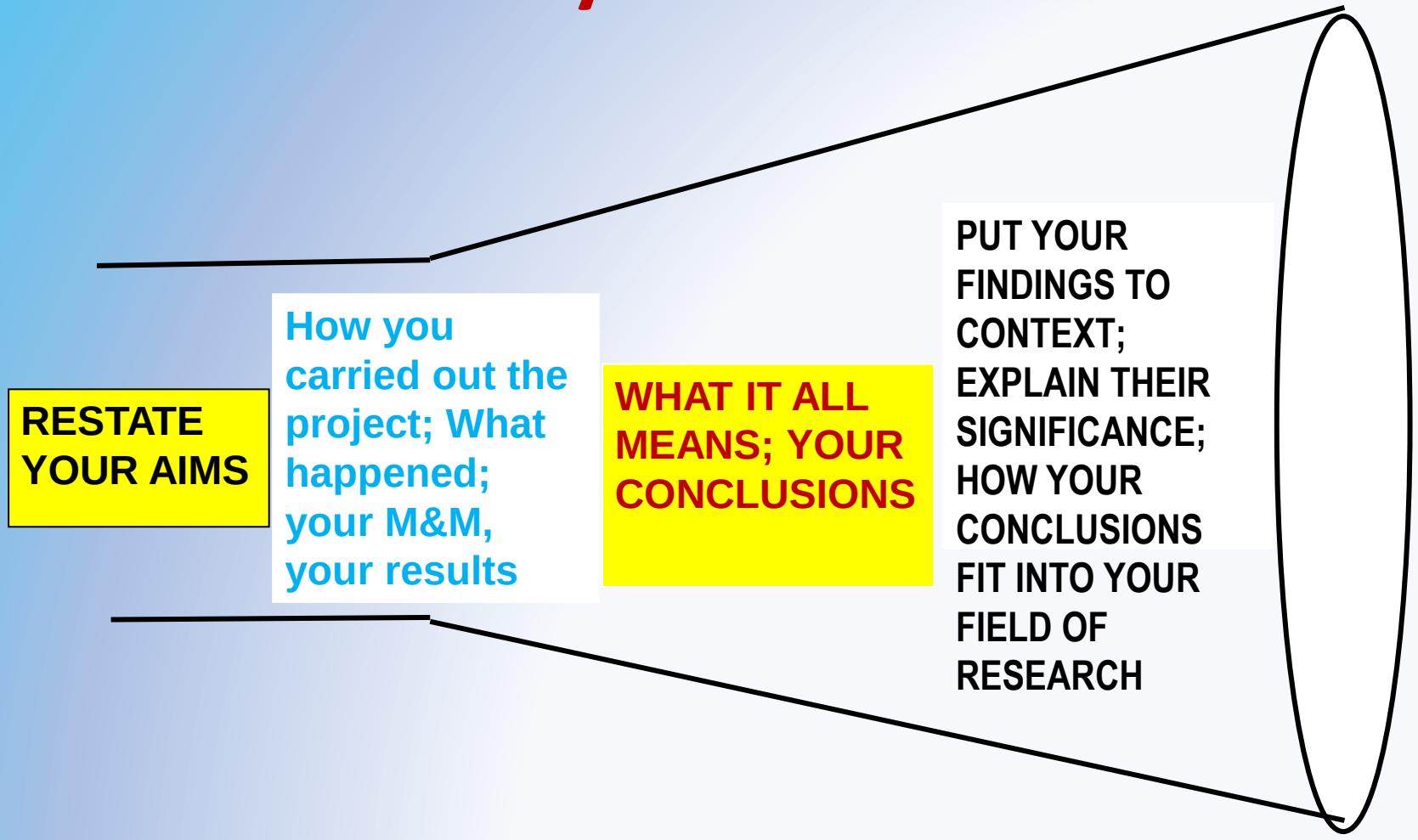
Introduction – Key points

1. Up-to-date review of literature
2. Broad beginning
3. Narrowing down middle focussing on your research subject
4. Aim at the end
5. Keep writing to point, dynamic and crisp.
6. Use past tense
7. Review the related literature analytically focussing on your research

WRITING THE DISCUSSION

1. Introduction = What you were planning to do.
2. Literature review = Background to research.
3. Methods = How you did it.
4. Results = What you have observed.
5. Discussion = What it all means (relevance of the research and conclusions drawn).
6. References = Your link to the subject knowledge related to thesis

Open up for showing the value of your work



Before writing the discussion

1. Consider the results
2. Think of details of experiments
3. Can I improve figures
4. Can I improve on calculations
5. Consider results in relation to wider field
6. Think of information in references
7. Think of information in introduction
8. Identify the new knowledge you have generated

THINKING IS THE MOST IMPORTANT

PART OF YOUR RESEARCH

– THE EXERCISE OF THE MIND –

THE NEED FOR THE NATION.

Planning writing of the discussion

- ***Beginning***

  The aim of this project was …….

- ***Middle***

1. **Preferably follow the order in which results were presented,**

OR

1. **Go into more specific subtitles addressing the aim of the research.**
2. **Collect points from individual results to build the body of information addressing aims.**
3. **Remind reader why you changed methods, did certain calculations.**

Planning writing of the discussion

1. **Look at your results in the light of facts, theories & opinions presented in the introduction.**
2. **Make sound speculations, if you wish, indicating they are not statements of facts.**
3. **Never present speculations as facts.**
4. **Deal carefully the awkward points and comparisons:**

"While there is disagreement on the …..my findings points more towards ….."

"It appears that differences of observations between X and Y are more associated with their methodologies / calculations / techniques "

Writing the discussion

➢ ***The end***

1. **Brief statement of whether original aim has been addressed or not.**
    - ➢ **Suggestions for future work.**
    - ➢ ***The conclusion***
2. **It should be backed up by your data.**
3. **It should arise from discussion.**
4. **May draw from results & from things you have not been looking for.**
5. **Clearly indicate whether the research answered the question posed originally in your introduction.**

Style of writing the discussion

1. **Be descriptive, flowing, explaining what you did and why you did so.**
2. **Lubricate with words ‘and’, ‘therefore’, ‘but’, ‘however’.**
3. **Use headings for main points**
4. **Refer to tables and figures in text.**
5. **Use present tense for general conclusions and past tense to write about results.**
6. **Write in the active form.**

Ex. The micro-organisms passed through the membrane….

Common mistakes in the discussions

1. Insufficient discussion on experimental and theoretical approaches taken.
2. Lack of organization leading to poor flow from experiments to calculations to discussion.
3. Not addressing key points raised in the introduction.
4. Giving speculations as facts.
5. Using information not supported by scientific evidence.

Language, grammar, style

1. Your document should be reader friendly
2. Use Google editor to correct spelling, grammar, selection of most appropriate words
3. Decide on British/ American/Canadian/*etc.* English.
4. They differ in spelling, punctuations, and use of adjectives.
5. Check punctuation marks and spacings in the references listed
6. Check for correct spelling of names of authors
7. After Google editing there could be misspelled words in sentences.

Planning the writing of thesis - 1

Rules:

Information on format [No. of copies, Layout, Title page, Abstract /Summary, Binding, Paper size]

Conventions:

Mode of writing, Efficient ways of conveying information, Preferences of supervisor, Style of writing references. Follow a thesis of same Department, Supervisor, similar subject.

Planning the writing of thesis - 2

Structure:

- **Beginning** [Title page, Abstract, Dedication, Acknowledgements, Table of Contents, List of Figures, List of tables, List of appendices, List of abbreviations, Introduction including literature review]
- **Middle** [Materials & Methods, Results]
- **The End** [Discussion, References, Glossary, Appendices, Published papers]

Planning the writing of thesis - 3

1. Is not a list of experiments with vague outline
2. Needs a structure which starts by introducing the reader to topic
3. State aim of research
4. Decide on the key points around which the thesis will be built
5. Get key points reshuffled to present a well linked ‘story’
6. Get information in an easy to rearrange form [ideas, calculations, data tables, figures, pictures, *etc*]
7. Show the results
8. Discuss their significance
9. If you do not plan you will be jumping about randomly and missing important points – AND THESIS GETTING RETURNED FOR REVISIONS REPEATEDLY -

Plan the order of the sections to be written; Start with the simplest [what you have done]

a) Materials & methods (What you did and how you did)

- Sampling methods
- Experimental techniques
- General procedures
- Data acquisition

b) References (Where and how you got ideas from)

- How many references ????

c) Results (What you learned from experiments – primary & derived data, figures, pictures, tables)

d) Introduction (Introduce reader to field, aims & experimental system)

e) Discussion (Significance of your findings to your field of study, comparative tables, your conclusions, suggestions for future research)

f) Abstract

Material for further reading

1. O'Connor, M. and Woodford, F.P. (1989) Writing scientific papers in English. (Pitman Medical Publishing Co Ltd, London). p 108.
2. Holtom, D. and Fisher, E. (1999) Enjoy writing your science thesis or dissertation. (Imperial College Press, London) p 278.
3. THE COMPLETE PLAIN WORDS, Sir Ernest Gowers (1954); PLAIN WORDS: a guide to use of English (2014), Published by Her Majesty's Stationary Office, England.

What is the difference between A and B

A. *"We will continue to support international initiatives to achieve reconciliation, stability and justice across the world, and in current or former conflict zones such as Cyprus, Sri Lanka and the Middle East, where we maintain our support for a two-state solution."*

B. *"We will continue to support international initiatives to achieve reconciliation, stability and justice across the world, and in current or former conflict zones such as Cyprus, Sri Lanka and the Middle East where we maintain our support for a two-state solution."*

Thank You