Metodología de la Investigación

Investigar en la universidad: presente y futuro

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Research?

❖**Research is an endeavour to discover answers to intellectual and practical problems through the application of scientific method.**

❖**“Research is a systematized effort to gain new knowledge”.**

-Redman and Mory.

V. Redman and AVH Mory. The Romance of Research, 1923, p.10

Research

What It Takes?

- Creativity
- Open mind
- Curiosity
- Patience
- Persistence
- Positive Attitude
- Discipline and focus

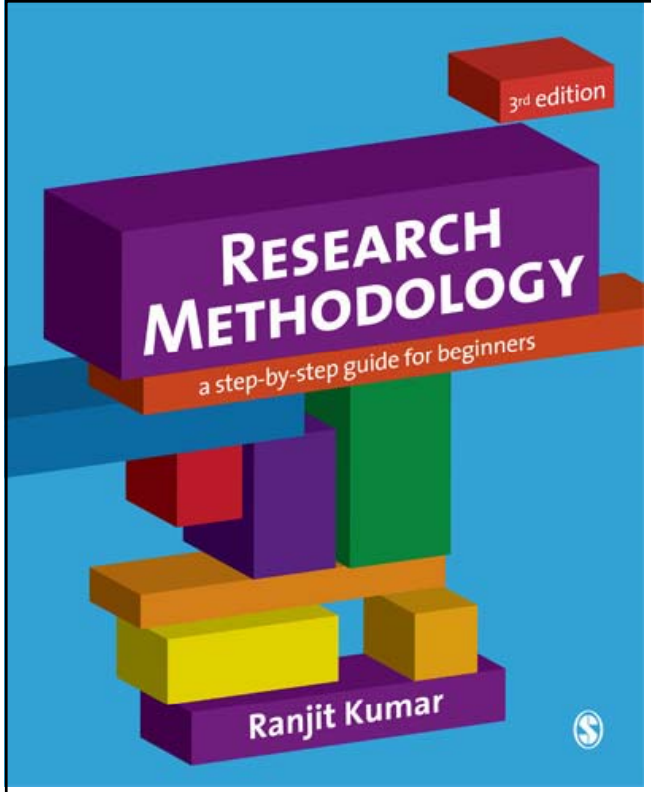
"Thinking outside of the box is difficult for some people. Keep trying."

Creativity

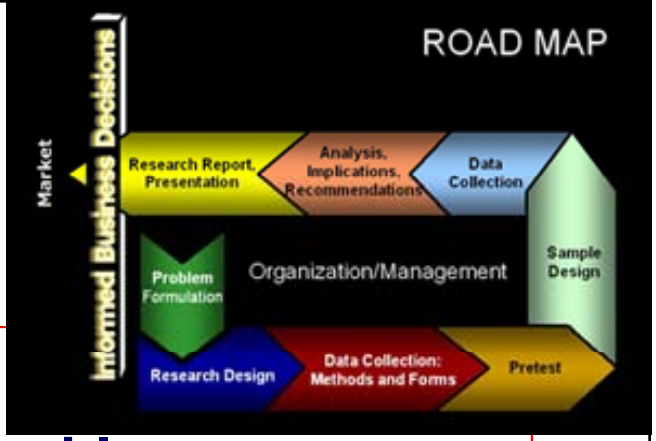
Nature of Creativity

- The ability of making something new
- Originality
- Utility
- Creative personality
- Nature vs nurture (¿se nace o se hace?)

Nature and nurture both important



Part I



Step 1. Formulating a research problem

Step 2. Conceptualising a research design

Step 3. Constructing an instrument for data collection

Step 4. Selecting a sample

Step 5. Writting a research proposal (paper)

Part II

I have publications and a PhD Thesis.
How do I launch an academic career (research career)?

Research Methodology

Introduction: Research

Writting a research paper

How do I launch an academic career (research career)?

Final Comments

Research Methodology

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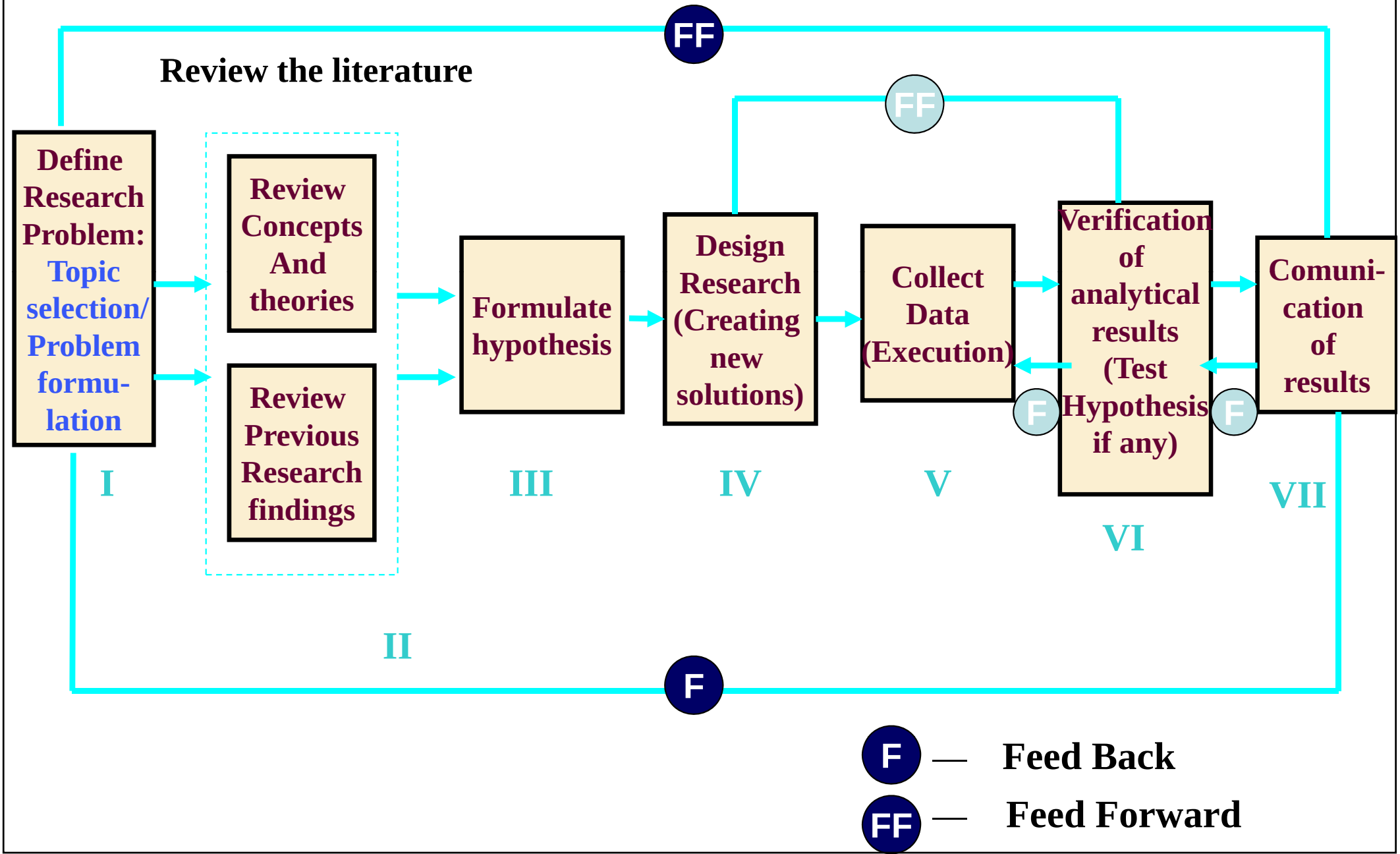
Characteristics of Research

- Research is directed towards the solution of a problem.
- Research is based upon observable experience or empirical evidence.
- Research demands accurate observation and description.
- Research involves gathering new data from primary sources or using existing data for a new purpose.
- Research activities are characterized by carefully designed procedures.
- Research requires expertise i.e., skill necessary to carry out investigation, search the related literature and to understand and analyze the data gathered.
- Research is objective and logical – applying every possible test to validate the data collected and conclusions reached.
- Research involves the quest for answers to unsolved problems.
- Research requires courage.
- Research is characterized by patient and unhurried activity.
- Research is carefully recorded and reported.

Qualities of a good research

- Systematic
- Logical
- Empirical
- Replicable
- Creative
- Use of multiple methods

Research sequence/process



Problem selection: How do we know we have a research problem?

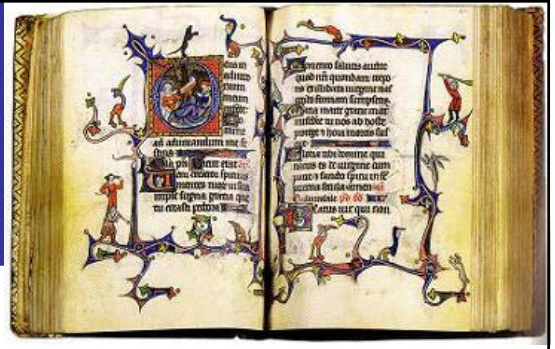
- **ICT problems - ranging from experimental to mathematical**
- **Problem sources – advisor, industry, reading research papers, conferences, “hot” areas, brainstorming, intuition**
- **Important problems lead to important discoveries**

Establishment of research objectives

- Research Objectives are the specific components of the research problem, that you'll be working to answer or complete, in order to answer the overall research problem. - Churchill, 2001

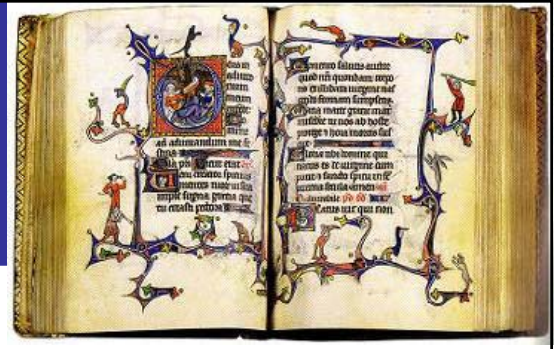
- **The objectives refers to the questions to be answered through the study. They indicate what we are trying to get from the study or the expected results / outcome of the study.**

Review of literature



- Literature Review is the documentation of a comprehensive review of the published and unpublished work from secondary sources of data in the areas of specific interest to the researcher.
- The main aim is to find out problems that are already investigated and those that need further investigation.
- It is an extensive survey of all available past studies relevant to the field of investigation.
- It gives us knowledge about what others have found out in the related field of study and how they have done so.

Purpose of literature review



- To gain a background knowledge of the research topic.
- To identify the concepts relating to it, potential relationships between them and to formulate researchable hypothesis.
- To identify appropriate methodology, research design, methods of measuring concepts and techniques of analysis.
- To identify data sources used by other researchers.
- To learn how others structured their reports.

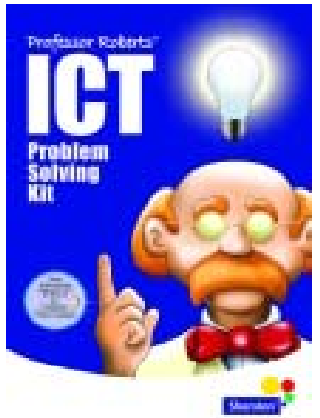
How to conduct the literature survey? Sources

- Identify the relevant sources.
- Extract and Record relevant information.
- Write-up the Literature Review.

(Write a review paper?)

- Books and Journals
- Electronic Databases
- Govt. and Industry Reports
- Internet
- Research Dissertations / Thesis

Hypothesis



- Hypothesis are tentative, intelligent guesses as to the solution of the problem.
- A hypothesis is a specific statement of prediction. It describes in concrete terms what you expect to happen in the study.
- A hypothesis is an assumption about the population of the study.
- It delimits the area of research and keeps the researcher on the right track.

Problem vs Hypothesis

- A hypothesis is an assumption, that can be tested and can be proved to be right or wrong.
- A problem is a broad question which cannot be directly tested. A problem can be scientifically investigated after converting it into a form of hypothesis.

Sources of Hypothesis

- Discussions and brain storming with the advisor and group, its origin and objectives in seeking a solution. Asking the right questions. Developing analytical models, designing algorithmic descriptions.
- Examination of data and records for possible trends, peculiarities.
- Review of similar studies.
- Exploratory personal investigation / Observation.
- Logical deduction from the existing theory.
- Continuity of research.
- Intuition and personal experience.

Characteristics of Hypothesis

- **Conceptual Clarity -** It should be clear and precise.
- **Specificity -** It should be specific and limited in scope.
- **Consistency -** It should be consistent with the objectives of research.
- **Testability -** It should be capable of being tested.
- **Simplicity -** It should be stated as far as possible in simple terms.
- **Objectivity -** It should not include value judgments, relative terms or any moral preaching.
- **Theoretical Relevance -** It should be consistent with a substantial body of established or known facts or existing theory.
- **Availability of Techniques –** Statistical methods should be available for testing the proposed hypothesis.

Verification of Theoretical Results

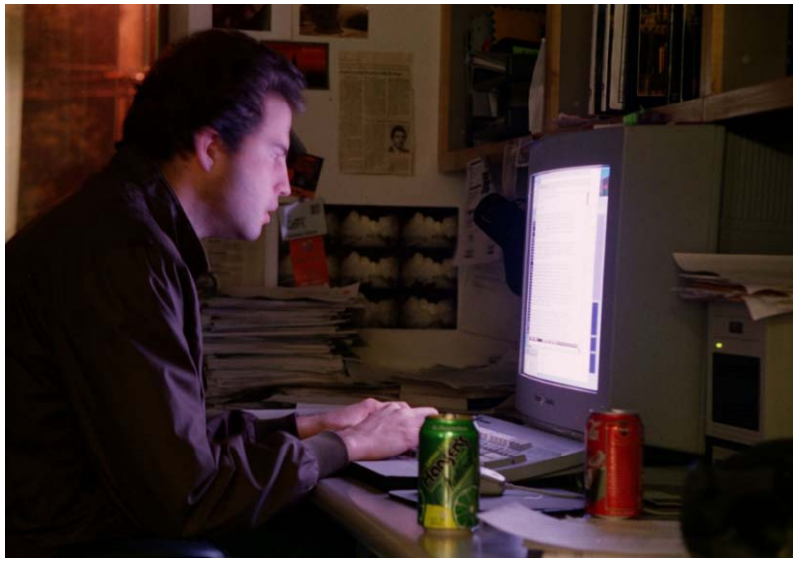
- Computer simulations
- Hardware and field tests

Communication of Research Findings

- Seminars
- Conference papers
- Journal papers
- Theses
- Books

Writing Papers

- Focus on innovation
- Paper structure
- Make it readable and interesting
- Where to publish?
- Ethics and integrity
- Quality counts more than quantity



Commercializing Research Outcomes

- Intellectual property
- Developing prototypes
- Patents
- Business plans
- Venture capital

Research Methodology

Introduction: Research

Writting a research paper

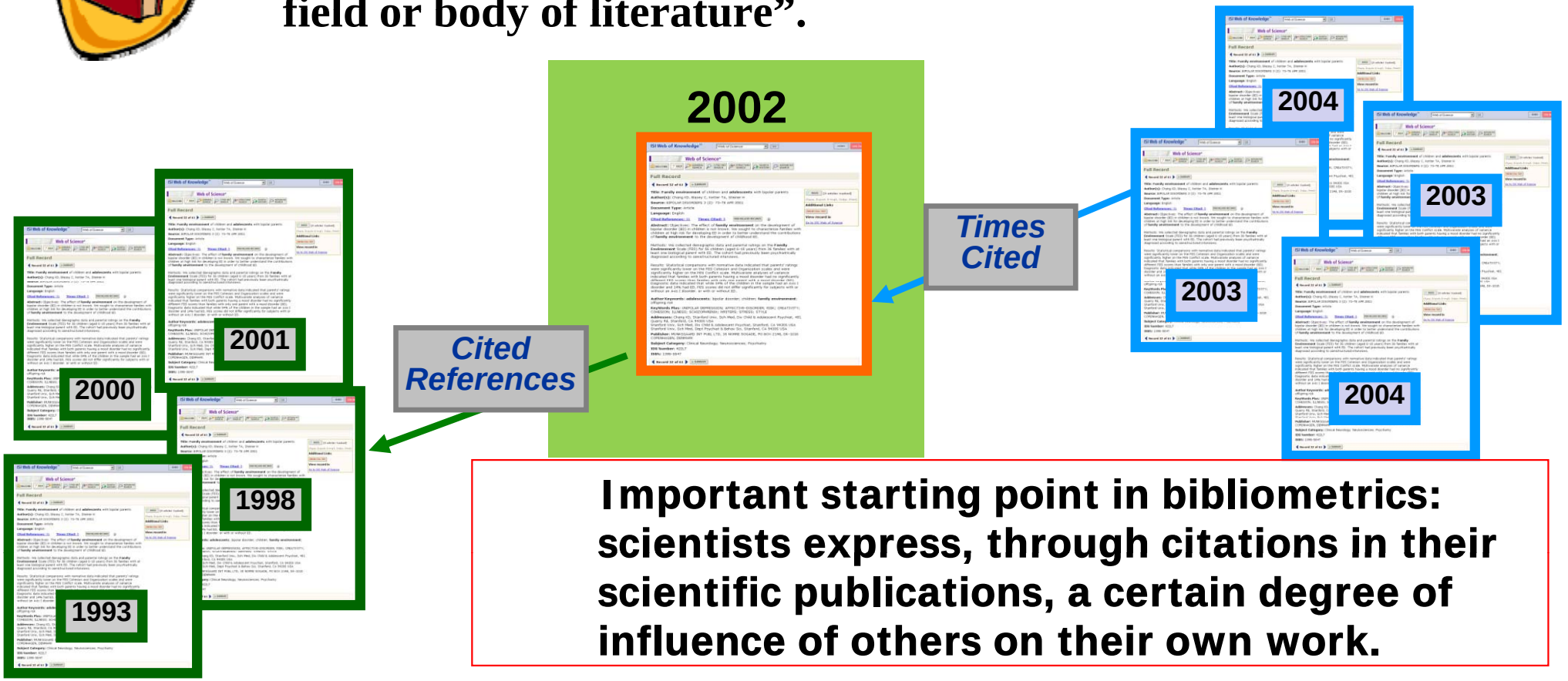
How do I launch an academic career (research career)?

Final Comments

The papers are the starting point for Scientometrics
The patents are tools for technology transfer

Scientometrics: the "quality" of science.

"***Bibliometrics*** *can be defined as the* **performance analysis of science and technology performance. It utilizes quantitative analysis and science mapping to describe patterns of publication within a given field or body of literature".**



Important starting point in bibliometrics: scientists express, through citations in their scientific publications, a certain degree of influence of others on their own work.

Writing a research paper

1. Many papers are badly written and hard to understand
2. This is a pity, because their good ideas may go unappreciated
3. Following simple guidelines can dramatically improve the quality of your papers
4. Your work will be used more, and the feedback you get from others will in turn improve your research

Writing a research paper

It is easier to assemble all the data BEFORE writing the paper, than during the process.

(Figures, tables, algorithms, …)

Writing a research paper

Decide what are the key conclusions of the paper- **the important message that you want to put across.**
Do you have all the data AND the figures to prove your point?

Experiments need to be reproducible (well-documented data, details of experiments provided).

If possible, give an informal ORAL presentation of the work before you start to write the paper. This way you will clarify the story you want to tell and can anticipate objections or misunderstandings that must be addressed in the text.

Writing a research paper

General considerations:

Before you start writing, preferably choose the journal. Make sure that the journal's readership corresponds to your own target audience.
(One can also write the paper and then to choose the journal according to the paper content).

Download Instructions for Authors. Note limitations like page number, word and/or character count, number of Figures, fonts for Figures, number of references, word length of Abstract . It is best to know the limits in advance than have to go back and change the paper later.

Print out one or two examples of a high quality paper in your field in this journal.

Writing a research paper

STARTING OUT

•In general it is easier to start writing RESULTS and MATERIALS and METHODS.

Just start writing the data as if you were describing them to your colleagues. Lay out general arguments and then go into details so that you prepare the readers for what follows and the logic you are going to use.

•Next, write the INTRODUCTION, then DISCUSSION, and finally ABSTRACT. By this time you will have honed down your ideas.
•The TITLE is critical- it must be short and ” big-picture” without over selling.

Expect to write multiple drafts, so keep track of them carefully.

Writing a research paper

STRUCTURE

- **Abstract**
- **Introduction**
- **Preliminaries: The problem, background**
- **My idea**
- **The details**
- **Experimental framework**
- **Results**
- **Analysis of results (including discussion)**
- **Conclusions and further work**

Considering the importance of "reproducible results" in science, it is quite obvious why this second application is so vital.

Read: "EASE Guidelines for Authors and Translators of Scientific Articles to be Published in English" http://www.ease.org.uk/guidelines/index.shtml

Writing a research paper

THE ABSTRACT

Abstract: A summary of the research problem, your claim, and the evidence.

We usually write the abstract last.

Writing a research paper

INTRODUCTION

1. **Describe the problem**
2. **State your contributions**

...and that is all ONE PAGE AND NO MORE THAN TWO!

The **first paragraphs** are crucial for catching the attention of the audience and for conveying to them the importance of the questions that you have addressed in the paper. If you don't catch the attention of the audience in the first few sentences the chances are high that they won't continue reading.

So, make the first sentence both concise and profound.

Writing a research paper

INTRODUCTION

1. **Describe the problem**
2. **State your contributions**

...and that is all ONE PAGE AND NO MORE THAN TWO!

Introduction: Motivation, a re-statement of the abstract information, formulate the problem and the hypotheses to be tested, significance, an outline of the rest of the paper.

The introduction should survey the whole paper.

It is not meant to be an exhaustive review.

It is important to have good connection between paragraphs making it attractive to read.

Writing a research paper

BACKGROUND

Provide the necessary background information to put your work into context.

DISCUSSION

It should present the overall significance of your work and show how it agrees or disagrees with previous models or allows disparate observations to be drawn together.
It is often very helpful to have a Figure of new model that is based on your findings. Discuss the limitations of the study.

CONCLUSION

A summary of the research contribution, a discussion on its significance, and a mention of future work.

Writing a research paper

GENERAL STYLE

Keep sentences short. 15-20 words is about right but shorter ones can be used for impact or emphasis. Check that each sentence makes sense and is not ambiguous.

Paragraphs are important to break the text up into readable units.

Vary the sentences used when writing the abstract or describing findings at the end of the introduction.

Don’t copy from other sections verbatim!

Writing a research paper

GENERAL STYLE

The three "C"s (C^3) principles.
Good writing possesses the following three "C"s:

- **Clarity**
- **Conciseness**
- **Correctness (accuracy)**

The key is to be as brief and specific as possible without omitting essential details.

Writing a research paper

BEFORE GIVING THE DRAFT TO YOUR SUPERVISOR

Check the Figures versus the text

Check the References versus the text

(all the references must maintain the style, you must use the necessary ones but no to use a large list of them and use the classical ones for introducing the fields/problems . It is very important to cite them correctly.)

Check the Figure legends

In general, edit a paper after printing it out and reading it as a whole, rather than editing it on a computer screen where you can only see one page at a time. Once a page has scrolled off the screen the text tends to be forgotten!

Be psychologically prepared to throw out and rewrite whole sections and not to cling to the original.

Writing a research paper

BEFORE SENDING TO THE JOURNAL

Have the paper read by several people. Listen to what they say, especially if same criticism comes up several times. **Ask colleagues to take a look and be critical.**

Check and recheck spelling, figures, references, legends etc Reviewers can be really annoyed by careless editing and mistakes reflect badly on your science.

Make sure you have followed all the requirements of the journal about electronic submission etc Some have a specific Checklist and Front Page format (key words; contact Information; e-mail address etc

Writing a research paper

BEFORE SENDING TO THE JOURNAL

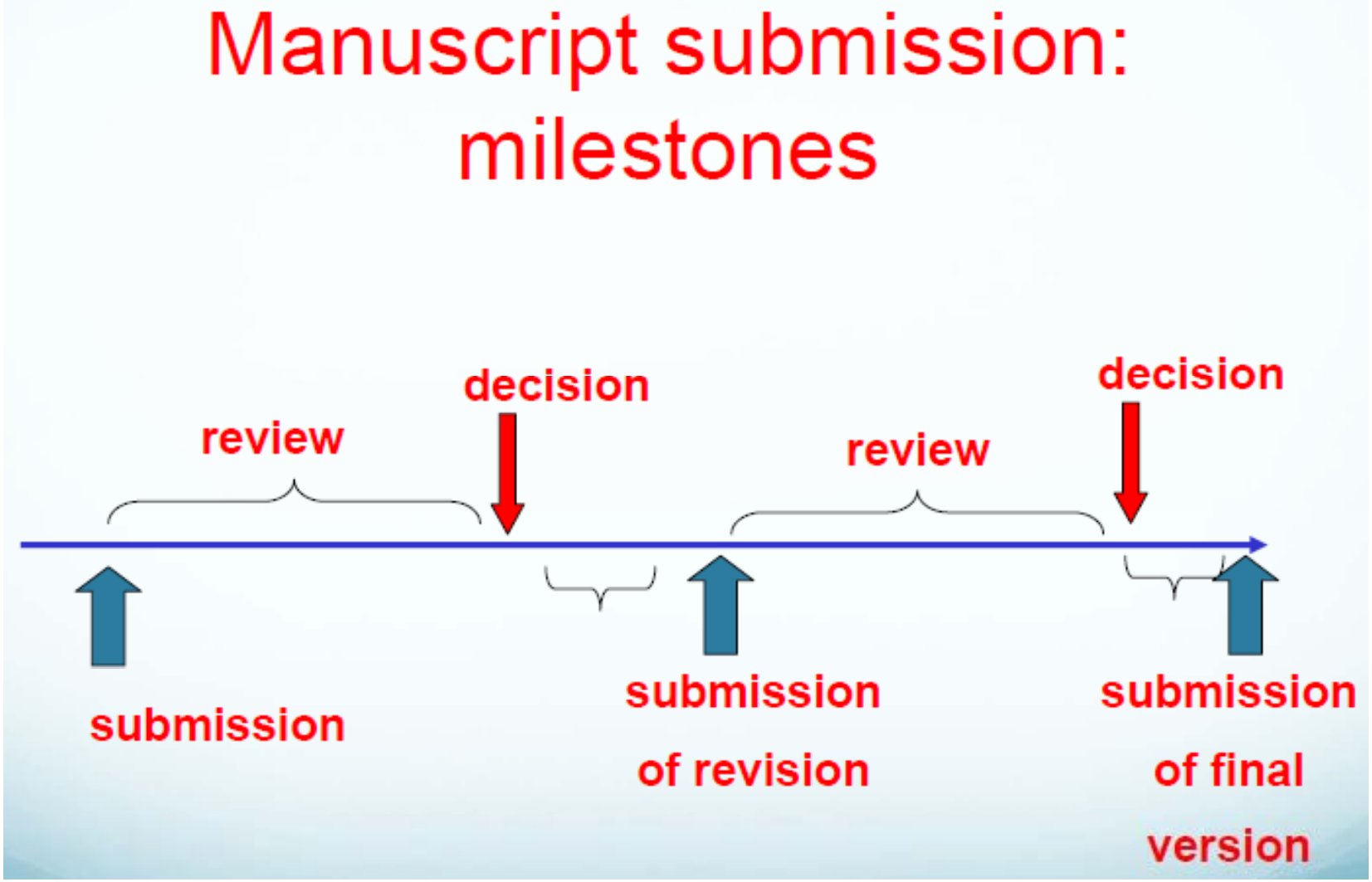
Include a cover letter outlining the originality and important findings of the paper and why it will be of interest to the typical audience of the journal you have selected.

Include a list of research highlights.

Sometimes it is helpful to suggest possible referees, especially if the topic is unusual.

Writing a research paper

MANUSCRIPT SUBMISSION



Writing a research paper

POST-REFEREE REVISION

Carefully study the reviewers' comments and prepare a detailed letter of response

- Respond to all points; even if you disagree with a reviewer, provide a polite, scientifically solid rebuttal rather than ignore their comment.
- Provide page and line numbers when referring to revisions made in the manuscript.
- Perform additional calculations, computations, or experiments if required; these usually serve to make the final paper stronger.
- State specifically what changes you have made to address the reviewers' comments, mentioning the page and line numbers where changes have been made.
- Provide a global answer with a general description of changes and a particular answer to each referee's comment.

Writing a research paper

ACCEPTING REJECTIONS

Don’t take it personally!

- Try to understand why the paper has been rejected

- Evaluate honestly – will your paper meet the journal’s requirements with the addition of more data or is another journal more appropriate?

- Don’t resubmit elsewhere without significant revisions addressing the reasons for rejection and checking the new Guide for Authors

Writing a research paper

SOME RECOMMENDATIONS

Fallacy You need to have a fantastic idea before you can write a paper. (Everyone else seems to.)

Write a paper,
and give a talk, about

any idea,

no matter how weedy and insignificant it may seem to you

Writing a research paper

SOME RECOMMENDATIONS

A goal: To publish in the most important journals of your area (Q1 if possible)

What to know and how to write a top-quality paper?

- Choose a promising topic
- A convincing case
- In-depth analysis of empirical results
  (use statistical tests if possible)
- The most important part: the introduction. **A good introduction with a good motivation is half of your success!**
- Are the experimental results consistent and conclusive?

It is NOT enough to design yet another technique or system without a convincing evaluation

Writing a Thesis

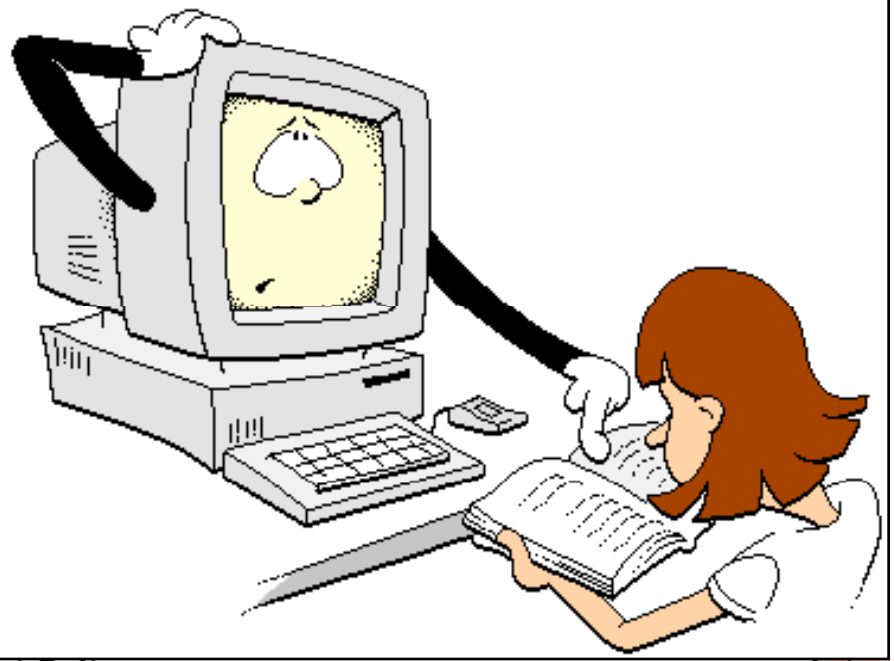
What is a thesis?

- **Demonstration of an understanding of the state of the art**
  - ✓**Critical appreciation of existing work**
- **A novel contribution**
  - ✓**Evaluated systematically**

Writing a Thesis

PhD thesis possibilities

- **Opens a new area**
- **Provides unifying framework**
- **Resolves long-standing question**
- **Thoroughly explores area**
- **Contradicts existing knowledge**
- **Experimentally validates theory**
- **Produces ambitious system**
- **Provides empirical data**
- **Derives superior algorithms**
- **Develops new methodology**
- **Develops new tools**
- **Produces negative result**



Writing a Thesis

The long path

- **Writing a thesis is hard, painful work**
  - ✓ **You've already done the fun part (the research)**
- **It's unlike any other document**
  - ✓ **Thesis writing is not a marketable skill**
- **If you're lucky, your thesis will be read by:**
  - ✓ **Your supervisor**
  - ✓ **Your committee**

Research Methodology

Introduction: Research

Writting a research paper

How do I launch an academic career (research career)?

Final Comments

How do I launch an academic career (research career)?

What does a career in academia involve?

A postgraduate research degree (especially a PhD) is often viewed as a stepping stone to a career in Higher Education.

- If you decide on an academic career, you should note that it is unlikely (though not unheard of) that you will gain a permanent lectureship straight after your PhD.
- You are more likely to begin with one or more short-term contracts or research fellowships before obtaining a lecturing post.
- These may take the form of research assistant or fellow posts, where you are paid to work on a specific programme of research, or 'early career' or 'post-doc' fellowships, where you may have secured funding to develop your own research.

How do I launch an academic career (research career)?

Post-doctoral Research Posts?

'Post-doc' commonly refers to a range of posts that you might be employed in after completing your doctorate.
They are usually temporary contracts that can last between a few months and several years. Potentially they can lead on to a permanent academic post or alternatively be used as a stepping stone to a career in industry. Although they are generally research oriented, there may be teaching and/or administrative commitments involved.

There are a number of different paths these posts can take. Many research councils and funding sources offer Early Career and/or Postdoctoral Research Fellowships.

How do I launch an academic career (research career)?

Post-doctoral Research Posts: SPAIN?

http://www.educacion.es/educacion/universidades/investigacion/carrera-investigadora/etapa-postdoctoral.html

Juan de la Cierva Programme

Ramon y Cajal Programme

Torres Quevedo Programme

For getting a RC post is appreciated to have a post-doc out of Spain.

For getting a RC post is necessary to have 2 years experience in a different University or research center.

The TQ Programme is devoted to company positions.

There are good possibilities preparing applications for Research Centers. They need ITC researchers (Spain, Europe, USA, ...)

How do I launch an academic career (research career)?

Para entrar en el Sistema de I+D+I como profesor universitario es necesario la Acreditación regional (solo valida en la región) o nacional vía la ANECA (válida para todas las Universidades españolas):

Importante: Publicaciones en revistas del máximo nivel. Realizar estancias internacionales. Congresos internacionales del máximo nivel. Formación académica. Experiencia docente …
Leer el documento: ***Principios y orientaciones sobre los criterios de evaluación*** **.**

http://www.aneca.es/Programas/PEP/Requisitos-previos-para-solicitar-la-evaluacion

Research Methodology

Introduction: Research

Writting a research paper

How do I launch an academic career (research career)?

Final Comments

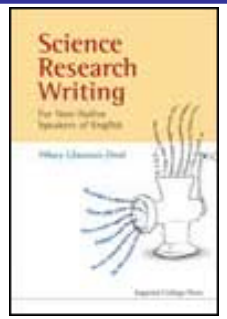
Final Comments

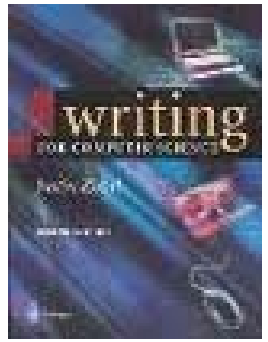
- **Follow the research process**
- **Read TOP Journal papers**
- **Write high quality papers for TOP Journals**
- **Research as Career**

- **Rewarding and satisfying career**
- **Opportunities for life-long growth**
- **ICT - exciting fields for innovation**
- **Global career opportunities**
- **Main reward in doing**

Final Comments

REFERENCE RECOMMENDATIONS





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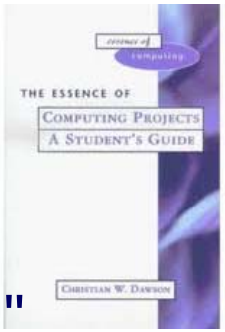

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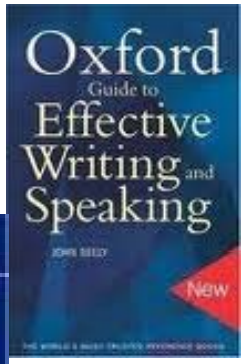

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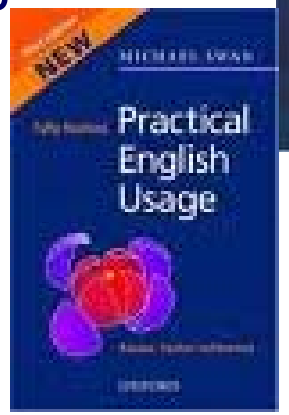

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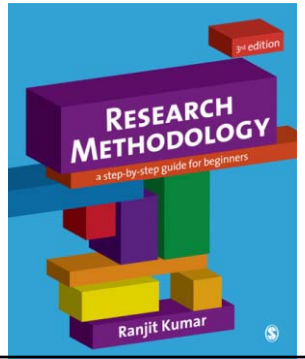

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Good Luck!