UTM
UNIVERSITI TEKNOLOGI MALAYSIA

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RESEARCH METHODOLOGY
UAP 0012
SEM II, 2012/2013
Faculty of Civil Engineering
Universiti Teknologi Malaysia

- Problem Formulation -

Content

- **Objective**
- What is Research & Research Process
  - Comparison between Masters and PhD
  - What are: Concept of 'Originality', Contribution & Intellectually independence
- **Research Hypothesis**
- **Research Problem**
  - **Criteria for Selecting a Problem**
  - **Formulating Research Problem**
  - **Writing of Research Problem**
  - **Evaluating Research Problem**

Course Outcome

Able to impart the skills on how to :

(i) formulate and

(ii) structure

a research problem

What is Research?

(i) Finding out

(ii) Problem Solving

(iv) Application of the scientific approaches to study a problem

(iii) Controlled inquiry concerning a certain event or events

(v) Systematic, controlled, empirical and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among such phenomena

(Basic)

Comparison Between Masters and Ph.D Research

- Masters:

✓ To solve a problem using the methodology that you have learned

- Ph.D

✓ Using the methodology that you have learned and experience of solving problem, to **produce something new**

CRITERIA: Report/ Dissertation /Thesis

Level	*Description*	*Criteria*
First degrees and some masters' degrees which require the completion of a project	Project report	1. A well structured convincing account of a study, the resolution of a problem, or the outcome of an experiment
Master's degree by study and dissertation	Dissertation	1. An ordered, critical and reasoned exposition of knowledge gained through the student's efforts 2. Evidence of awareness of the literature
Master's degree by research	Thesis	1. Evidence of an original investigation or the testing of ideas
	Thesis	2. Competence in independent work or experimentation 3. An understanding of appropriate techniques 4. Ability to make critical use of published work and source materials 5. Appreciation of the relationship of the special theme to the wider field of knowledge 6. Worthy, in part, of publication
Doctoral degree	Thesis	1. to 6. As for Master's degree by research 7. Originality as shown by the topic researched or the methodology employed 8. Distinct contribution to knowledge

(i) Concept of Originality ?

("How to Get a PhD" Phillips, M. and Pugh, D.S.,1994)

- Setting down a major piece of new information in writing for the first time
- Continuing a previously original piece of work
- Carrying out original work designed by the supervisor
- Providing a single original technique, observation, or consult in an otherwise unoriginal but competent piece of research

(i) Concept of Originality ?

(Phillips, M. and Pugh, D.S.,1994)

- Showing originality in testing somebody else's idea
- Carrying out empirical work that hasn't been done before
- Making a synthesis that hasn't been made before
- Using already known material but with a new interpretation
- Trying out something in this country that has previously only been done in other countries
- Taking a particular technique and applying it in a new area

(i) Concept of Originality ?

(Phillips, M. and Pugh, D.S.,1994)

- Bringing a new evidence to bear on an old issue
- Being cross-disciplinary (integration) and using different methodologies
- Looking at areas that people in the discipline haven't looked at before
- Adding to knowledge in a way that hasn't previously been done before

(ii) Contribution ?

- Contributions made to the field is identified
  - Gap filled
  - Inadequacies addressed
  - Extending the boundary of knowledge
- Results of research could be applied for “practice” / in wider field
- Implications for future research indicated
  - New territory
  - Unfinished business
  - Extension of work

(iii) Intellectually Independent ?

- Having a questioning attitude, can think of important question
- Can use a wide range of question answering methods and tools and know which ones to use to answer the particular questions
- Able to evaluate their own as well as others' answers
- Can thoughtfully plan and manage intellectual task

(iii) Intellectually Independent ?

- Able to
  - Get to know and critique the field of scholarship within which the research is located
  - Identify precisely what is being researched and why
  - Competently identify, gather, analyse, interpret relevant data
  - State the contribution that the research makes to the field

Remember .....

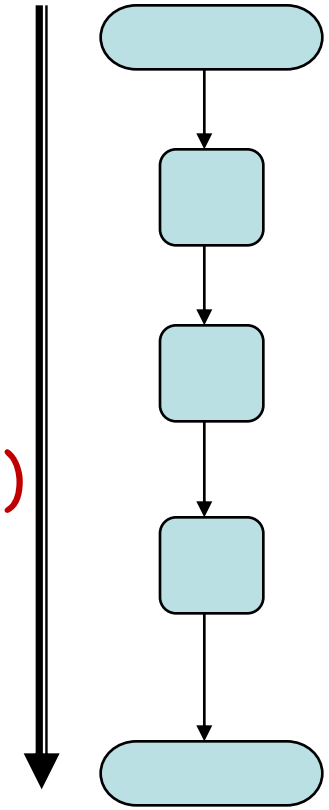
The purpose of Graduate Education is

…to extend the frontiers of knowledge…

… thus, the depth & breadth of study, originality and creativity is important ….

Research Process

Follow certain steps (systematic)



Problem Identification

Reviewing Information

Data Collection

Analysis

Conclusions

Characteristics of Research

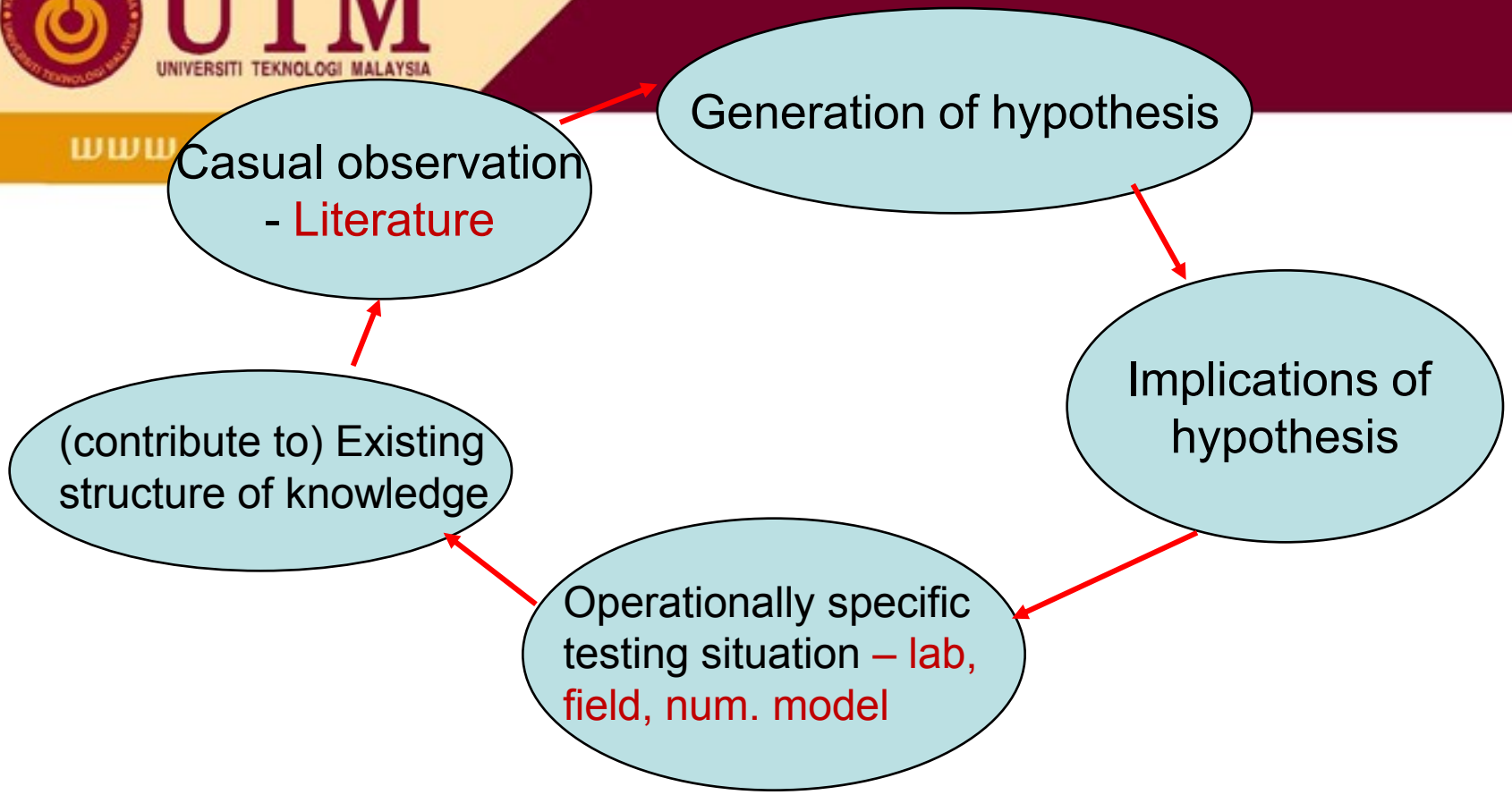
Research Process

Research follows "Scientific Method"

Makes an integrated use of :

- Inductive reasoning
- Deductive reasoning

"The basic assumption of the scientific method is that '**every effect has a cause**'. It starts with the construction of hypotheses from casual observations and background knowledge (**inductive** reasoning) to reasoning out consequences or implications of hypotheses (**deductive** reasoning), followed by testing of the implications and confirmation or rejection of the hypotheses"



Scientific method of acquiring knowledge of problem solving

→ **Research becomes cyclic and dynamic**

HYPOTHESIS

Is an educated guess. It is an attempt to :

(i) explain the nature of the relationship between the variables identified in the problem and

(ii) suggest a possible answer to the problem based on available facts or information that the researcher already knows.

HYPOTHESIS (Cont'd)

Definition:

The tentative proposition suggested as a solution to a problem or an explanation of some observed state of affairs. It is a statement of the problem solver's expectations about a relationship between variables, within a problem.

HYPOTHESIS (Cont'd)

- to set a destination

- **A statement serves to provide an answer to the research question**
- **Mental technique or the principal intellectual instrument in research**
- **Help one sees the significance of research & to direct investigation**
- **Use as tools & could be modified as research progresses**

(Very personal matter but must resist temptation to become too attached to own hypothesis)

Step in Conducting Research

1. Selecting and defining a problem
2. Describing the method of research
3. Collecting data
4. Analysing and interpreting results

RESEARCH PROCESS

Three phases of research process (in engineering)

- ✓ **Phase One** - Starting the research, choosing a general topic (area of research), narrowing the topic and collecting information
- ✓ **Phase Two** - Recording information, organising ideas and analysis
- ✓ **Phase Three** - Writing, documentation and presentation

DECIDING ON A TOPIC

To interpret the gathered information. Some initial questions about a topic might include:

- ✓ What background information should I read?
- ✓ What additional areas of the topic should I investigate?
- ✓ Should I concentrate gathering information more on one area of the subject than on other areas?

SELECTING AND DEFINING A PROBLEM

This marks the beginning of a research study and is the most difficult and important steps. The steps are:

a. **identifying and stating the problem in specific form**

b. **identifying the variables in the problem situation and defining them adequately**

c. **generating tentative guesses (hypotheses) about the relation of the variables, or writing explicitly the questions for which answers are sought; and**

d. **evaluating the problem for its researchability.**

WHAT IS "RESEARCH PROBLEM"

- Is a situation, quantitative or otherwise, that confronts an individual, that requires resolution, and for which the individual sees no apparent or obvious means or path to obtaining a solution.
- Is the focus of a research investigation – a problem that a researcher wishes to investigate

- Are questions about state of affairs in the field.

WHAT IS "RESEARCH PROBLEM"

(Cont'd)

Although there are different types of research problems, all involve a question, whereby the answer is being sought in the research

FORMULATING RESEARCH PROBLEM

Begin with **two** important questions:

- **WHAT** PROBLEM CAN BE SOLVED?
- **HOW** CAN THE PROBLEM BE SOLVED?

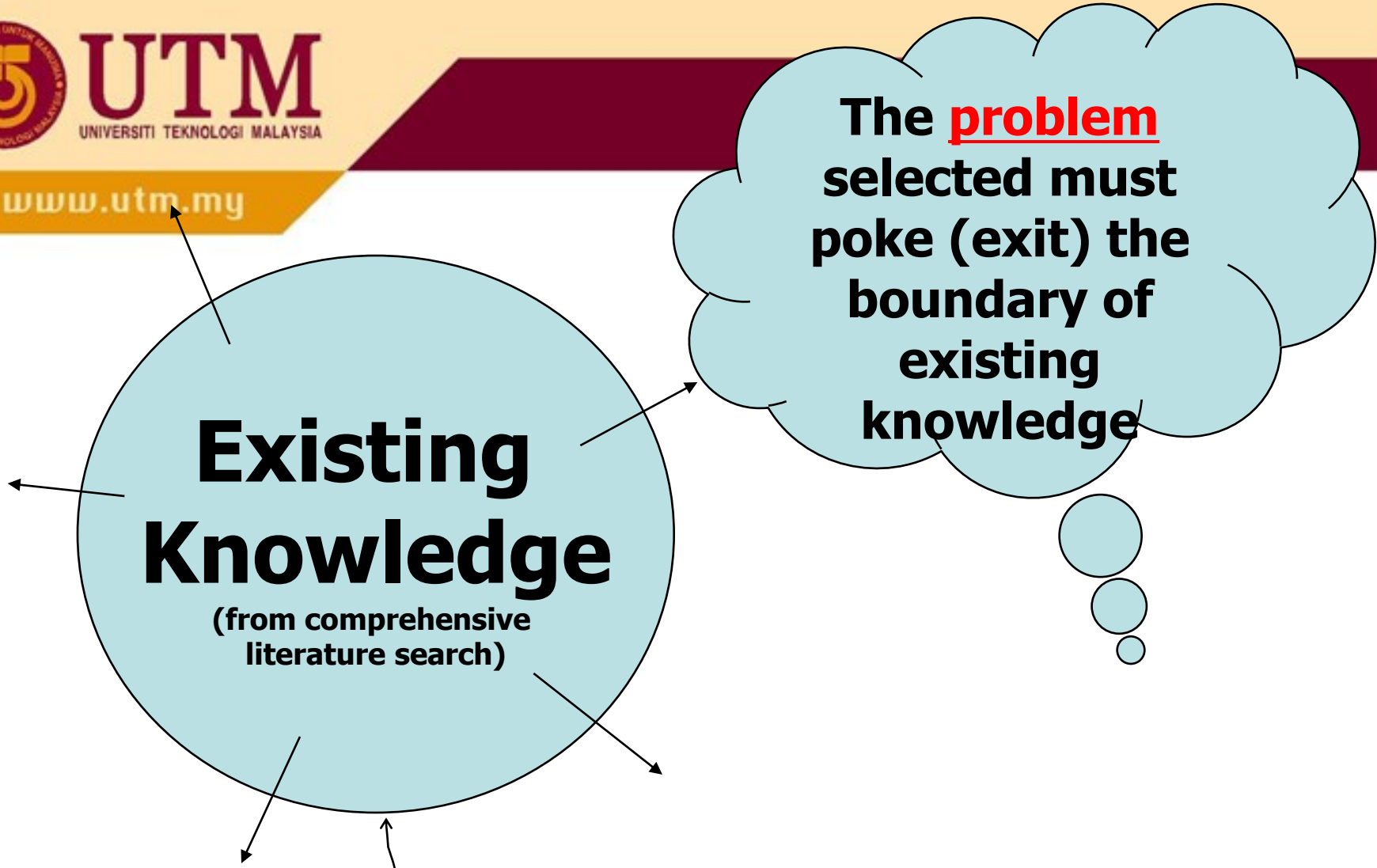
"PROBLEM IS A TASK"

- In which the researcher is interested and engaged for which he/she wishes to obtain a resolution

- For which the researcher does not have a readily accessible means or ways by which to achieve that resolution

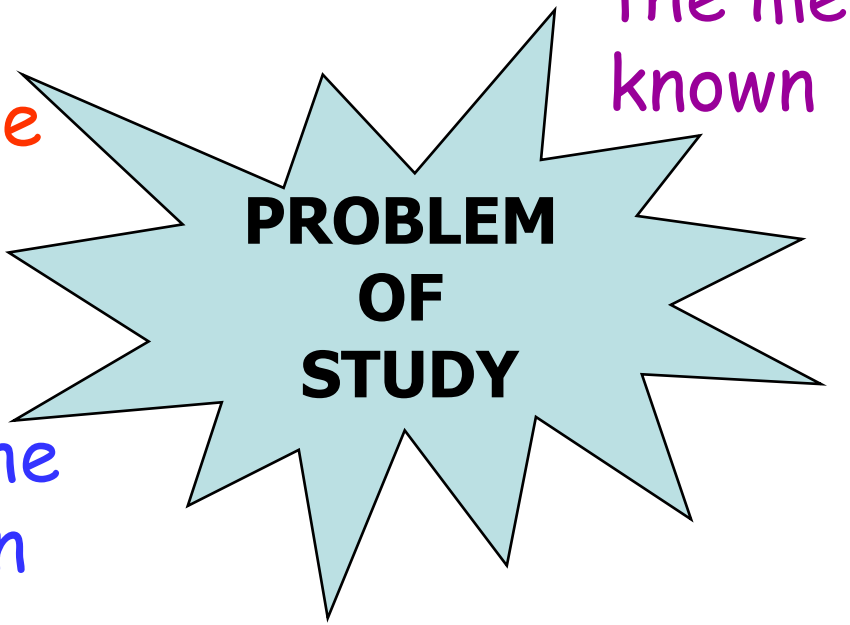
Q ????

- How many of you already finalised your research problem & agreed by your supervisor?
- How many of you still don't have a research problem?
- How many of you think you have a research problem but wish to change the research problem?
- None of the above?


Existing Knowledge
(from comprehensive literature search)
The problem selected must poke (exit) the boundary of existing knowledge
"Boundary of knowledge"

Data but not the method is known

Data and method are known



Method is known but not the data

✓ Neither the method or the data is known

"Research problems include only those problems which the method and the data, necessary to achieve the goal, are not known"

Criteria for Selecting a Problem

Capabilities & Limitations

Own, supervisor's, people's support

Interest

Own interest

Size

Not too large

Uniqueness

Do not duplicate: If similar study
- can use different method, design or sample, or perform different statistical analyses

Economy

Time, money

HOW DO YOU SELECT A PROBLEM??

- Personal Practical Experience
  - eg. From workplace / home country

HOW DO YOU SELECT A PROBLEM??

- From past studies, i.e look for
  - Solution already found in parallel situation
  - Incomplete solution
  - Result unclear, doubtful, debatable, etc.

Sources: books, journals, periodicals, annual reports….

NOTE

- **Need a *Critical Study* of the literature:**
  - Define the problem
  - Limit the problem area
  - Avoid unnecessary repetition
  - Search for new approaches
  - Recommend suitable methods

HOW DO YOU SELECT A PROBLEM??

- Consultation / interaction with others
  - Ask experts in area of interest – industries, universities, etc
- Study current developments and trends – newspaper,
  - Examine the theoretical structure of the field
  - Explore areas of dissatisfaction, public interest journal, magazine

HOW DO YOU SELECT A PROBLEM??

- Websites of various organisations – govt., private sectors, etc.

Look for :

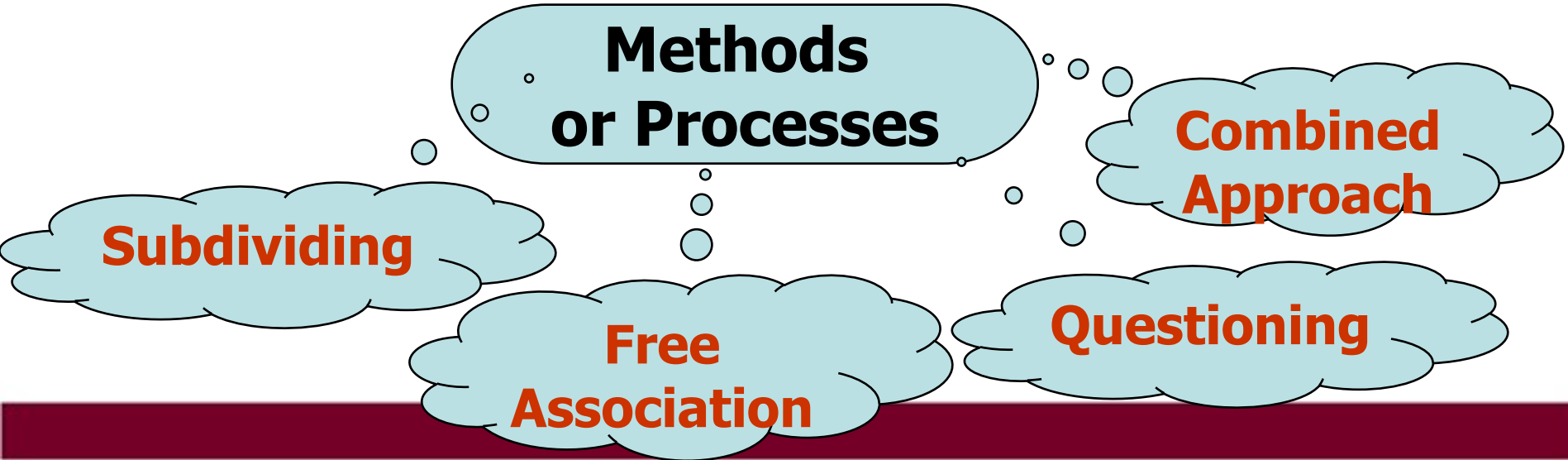
Requests For Proposals (RFPs)

- Brainstorming

FORMULATING THE RESEARCH PROBLEM

OBJECTIVES:

- ✓ To focus on a subject for research
- ✓ To examine a subject in multi facets (to apply creativity)



Free Association Approach

Write down words or phrases that occur to us as they come to mind, without worrying about order, spelling, usefulness, applicability, or any other judgement

Subdividing Approach

Divide the general area into progressively small units, subdividing it until one reaches a **subject** that is interesting to research

Asking Questions Approach (5W's)

Each of the answers will **help to zero in** on the specific issue(s) and frame the Issue Statement. Your problem statement should be **solvable.** That is, it should take a reasonable amount of time to formulate, try and deploy a potential solution

Asking Questions Approach (5W's)

Who does the problem affect? Specific groups, organizations, customers, etc

What are the boundaries of the problem, What is the **issue**? - What is the impact of the issue? - What impact is the issue causing? - What will happen when it is fixed? - What would happen if we didn't solve the problem?

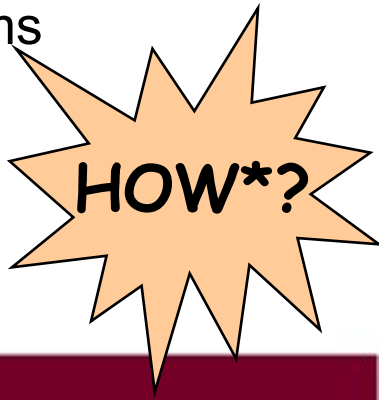
Where is the issue occurring? Only in certain locations, processes, products, etc.?

When does the issue occur?

When does it need to be fixed?

Why is it important that we fix the problem? - What impact does it have on the business or customer? - What impact does it have on all stakeholders, e.g. employees, suppliers, customers, shareholders, etc

Methods, techniques, mechanisms



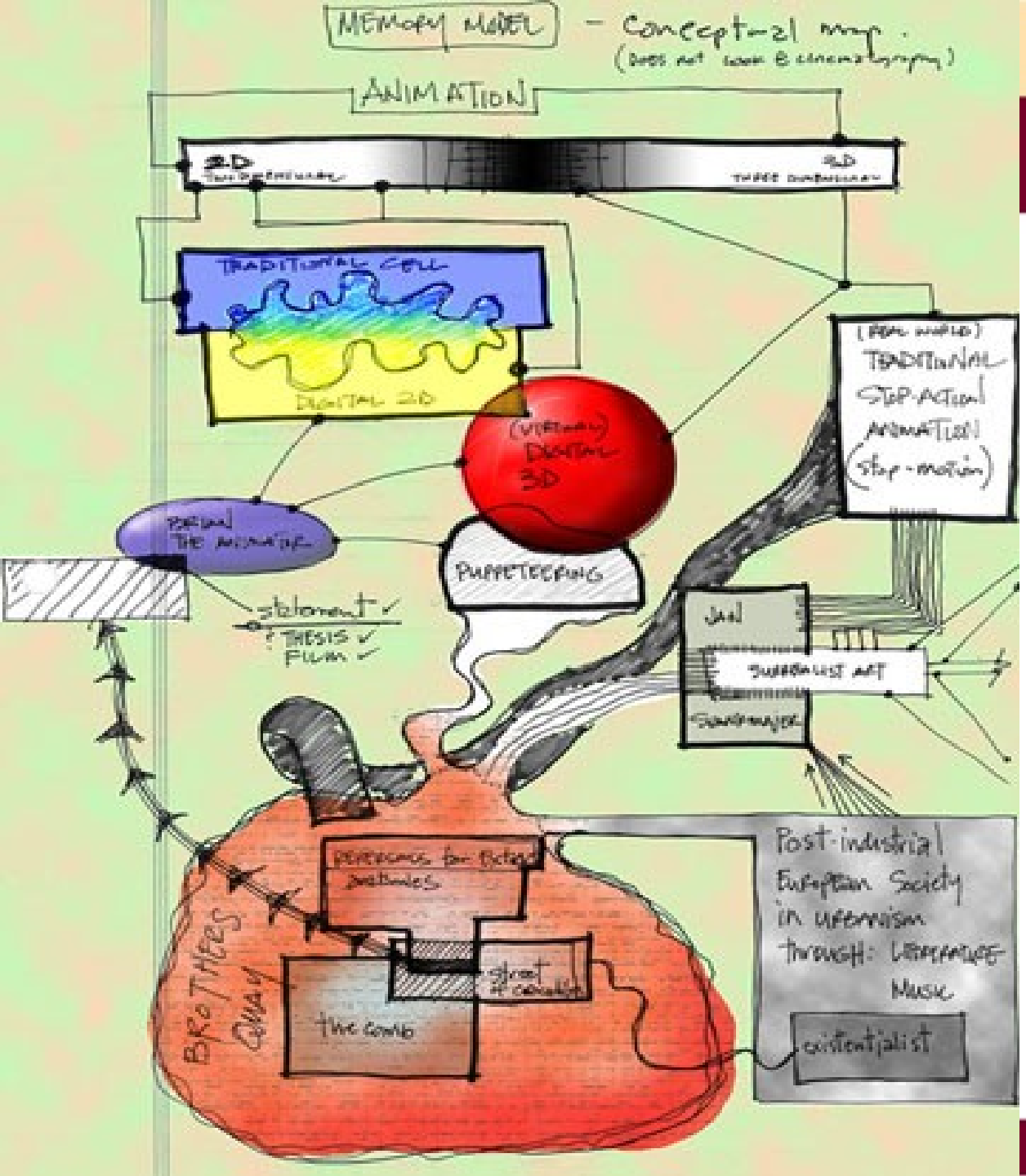
Combined Methods Approach

To combine the above approaches in formulating a research problem

(*more satisfactory practice*)

Affinity Diagram / Conceptual Map to Identify Problem and Purpose

1. Identify Large Topic Area
2. Determine what is attached. Make a conceptual map identifying related topics
3. Which part do you wish to explore now? (Fence off place in diagram)
4. What part is most important? Identify "real" problem area. What is the most important and possible relative to scope and scale of study?
5. Identify purpose area. What question most interests you about the purpose area that meets the requirements of #4. Construct refined conceptual map of the purpose area.



Example

Affinity Diagram / Conceptual Map to Identify Problem and Purpose

Affinity Diagram

- An Affinity Diagram shows the **relationships between information, opinions, problems, solutions, issues, contributing factors, and more by placing them in related groupings**.

- It allows a broad range of ideas to be simplified and organized so they can be more effectively analyzed.

Evaluating Research Problem

Having considered these questions, it is wise to consult others for their honest opinions

Is the problem Feasible?

(practical/possible for me to do it)?

- **how long the research will take** to accomplish
- important **ethical constraints** that need consideration
- can achieve the **needed cooperation** to take the project to its successful conclusion
- how **significant** are the **costs** of conducting the research

Is the problem Researchable?

The questions include:

- **Has the problem been specified?**
- **Is the problem amenable to research?**
- **Is the problem too large?**
- **How is the availability of the data?**
- **Am I capable of solving the problem?**

Will the result be Significant?

The questions include:

- Will the result advance knowledge?
- Will the research have some value?
- Will the results be of interest to others?

Typical General Questions asked by Examiners

- Why do you choose the research problem (topic) – who will benefit?
- What contribution to knowledge you feel your research makes?
- The appropriateness of your choice of methodology and data analysis
- Outcome that are publishable
- How the research can be extended (further works?)

The Flow

Research Problem

Aim/Purpose (& Hypothesis)

Objectives & Scope

STATEMENT OF RESEARCH PROBLEM

- To state the **basic problem** that prompts the research -

May be written in two forms:

- ❑ Statement form
- ❑ Research Question form

STATEMENT OF RESEARCH PROBLEM

-Example

Problem written in question form:

What effect has the introduction of an individualised programme had on the skill acquisition of technician students in a printing course?

STATEMENT OF RESEARCH PROBLEM

-Examples

Problem written in statement form:

This study is designed to measure the effect the introduction of an individualised programme has had on technician course.

A statement of purpose: (*see the diff. from both*)

The purpose of this study is to investigate the impact the introduction of an individualised programme has had on technician courses.

DEVELOPING PROBLEM QUESTIONS OR RESEARCH QUESTIONS

The significance:

A clearly stated research question or research problem would streamline a research effort

Usefulness: (The research question should)

- guide subsequent work
- influence information gathering
- guide data analyses
- influence the content of the writing

Thus it focuses the effort, minimises false starts, and save time and unnecessary work

Content of Research Proposal (UTM context)

Content of Research Proposal

Chapter 1 Introduction

- Background of the problem (to give scholarly background & rationale for the investigation)
- Statement of the problem (to state in general & specific way)
- Objectives of the study (should be measurable)
- Scope of the study (what is covered?)
- Significant of the study (refers to the rationale for the study & its relationship to theory, knowledge or practice)

Content of Research Proposal

- **Chapter 2 Literature Review***
  - Review of relevant research to provide rationale of the work eg:
    - Present unanswered questions, untried method
    - Findings of others that is being challenged and extended

*** [Should give an up to date & critical appraisal of review of literature Should demonstrate awareness of the debates & issues raised – for PhD, need to demonstrate that proposed work has not been studied before – identify niche]**

THESIS EXAMINATION - WHAT EXAMINERS LOOK FOR

(Beginning)

- Does the thesis contain a concise critical review of what is currently known?
- Have the deficiencies in our current knowledge been clearly identified and the significance of addressing them been established?
- **Is there sufficient background provided, so that examiner can appreciate the research problems that need to be tackled?**
- Are the objectives clear and justified?

Content of Research Proposal

- **Chapter 3 Research Methodology**
  - Research Design & Procedure
  - Operational Framework
  - Subjects or data sources
  - Instrumentation & Data Analysis
  - Assumptions & Limitations
  - Research Planning & Schedule
- **Chapter 4 Expected Findings and Summary**
- **References**

THESIS EXAMINATION - WHAT EXAMINERS LOOK FOR

(The work itself)

- Are the materials and methods detailed enough to ensure that the work is reproducible?
- Is the use of novel or non-standard methods or approaches, fully justified?
- Is the experimental design clearly articulated appropriate to the objectives
- Are the methods of statistical analysis appropriate?

A note from "an external examiner's viewpoint"

…….. The most acceptable introduction is one which explains in a straightforward manner how the candidate became interested in the subject, what made him/her consider it important enough to spend a substantial part of his/her life investigating it, and what outcomes were expected …….

THESIS EXAMINATION - WHAT EXAMINERS LOOK FOR

The End:

- Is the significance of the results fully explored in relation to current literature?
- Are the substantive discussion points brought up with finality? Can one sees clearly what the candidate has concluded?
- Has the ownership of the contribution been established? Something new?

...THANK YOU...

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