Inside the Planet Earth

What Causes Gravitational Pull??
Is Earth core made of Liquid Molten iron?

If Earth is a huge dynamo,
What is the Source of Earth’s B field?
Is the source depleting?

EARTHQUAKE...
VOLCANIC ERUPTIONS..
Nuclear radiation..

Standing firm on the ground

Terminal Velocity
Air Density: Air Friction

Delicious & Appetizing
International Meals
Hungry??
Health News

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Malaysia's Ministry of Health

Food Safety Research Multidisciplinary Workshop
Insituto de EMA, Port Dickson, Sep 10th, 2011
Annex 1 to Prof Dr. Jaafar Jantuan aka Dr JJ

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The 'poison squad' and the advent of food and drug regulation

By Carol Lewis

A century ago, 12 men sat down to a plate of food laced with poison and came back for more. Blessed by Congress, the dinner was the first in a series of meals containing steadily increasing doses of suspected toxic chemicals. What better animal to test toxicity in humans, than a human?

The infamous five-year human feeding experiment took place in the basement of the Agriculture Department’s former Bureau of Chemistry, located on what is now Independence Ave., in Washington, D.C.

Complete with kitchen and dining room and backed by a government laboratory, the project was the brain-child of scientists from the Bureau of Chemistry (now the Food and Drug Administration). Chief chemist Harvey W. Wiley, M.D., considered by many to be the founding father of the FDA, spearheaded the effort to separate scientific facts on food safety from the recurrent food safety scares that had fast become the subject of growing public mistrust, inflammatory publications, and Congressional hearings. Wiley's earliest concerns stemmed from the widespread use of borax as a food preservative. And, in fact, fraud was so
The 'poison squad' and the advent of food and drug regulation

Carol Lewis

*FDA Consumer:* Nov/Dec 2002; 36, 6; Research Library Core

pg. 12

Members of the "Poison Squad" dine at the "hygienic table" located in the former Bureau of Chemistry building in Washington, D.C. Experiments conducted there a century ago by Harvey W. Wiley, M.D., were designed to test the safety of food preservatives.

**Why Am I Here??**

**AIM:** This half-day talk & workshop intends to provide you with an overview of RESEARCH and its relevant processes

**The objectives** (what I plan to do) of this half-day workshop are:

1. Describe the concept of research
2. Describe the various TYPES of research
3. Engage you with Scientific Research process
4. Engage you with Literature Review characteristics
AIM: This half-day talk & workshop intends to provide you with an overview of RESEARCH and its relevant processes

Learning Outcomes (what YOU will know and be able to do- this is your TAKE-AWAY for today)
Upon successful completion of this workshop, you will be able to:

1. Discuss the concepts of research & its characteristics. (LO1-C2)
2. Describe the various TYPES of research. (LO1-C2)
3. Explain the processes involved in undertaking a scientific research. (LO1-C2)
4. Discuss the characteristics of literature review for a proposed scientific research. (LO3-C3).
5. Critically review the research components in a food safety research article.
The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them.” - William Lawrence Bragg

What is RESEARCH & SCIENTIFIC RESEARCH??

- Hunting for facts or truth about a subject
- Organized scientific investigation to solve problems, test hypotheses, develop or invent new products.
- Research is systematic, because it follows certain steps that are logical in order

These steps are:
- Understanding the nature of problem to be studied and identifying the related area of knowledge.
- Reviewing literature to understand how others have approached or dealt with the problem.
- Collecting data in an organized and controlled manner so as to arrive at valid decisions.
- Analyzing data appropriate to the problem.
- Drawing conclusions and making generalizations.

What is RESEARCH..

Research is:

- a habit of questioning what you do
- a systematic examination of the observed information to find answers with a view to instituting appropriate changes for a more effective professional service.
- more than a set of skills, it is a way of thinking: examining critically the various aspects of your professional work.

The difference between research and non-research activity is, in the way we find answers: the process must meet certain requirements to be called research.


What is RESEARCH..

Re-search is a process of describing a careful, systematic, patient & resilient study or investigation in some field of knowledge, undertaken to establish facts or principles.

Research is:

- a structured enquiry
- utilizes acceptable scientific methodology
- solve problems and create new knowledge that is generally applicable.

Although we engage in such process in our daily life, the difference between our casual day-to-day generalisation and the conclusions usually recognized as scientific method lies in the degree of formality, rigorousness, verifiability and general validity of latter.

What is Meaningful & HIGH QUALITY RESEARCH ??

- It is based on the work of others.
- It can be replicated (duplicated).
- It is generalizable to other settings.
- It is based on some logical rationale and tied to theory.
- It is doable!
- It generates new questions or is cyclical in nature.
- It is incremental.
- It is apolitical activity that should be undertaken for the betterment of society.


<table>
<thead>
<tr>
<th>TABLE 1.4 Characteristics of good and poor research projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Research problem and scope</td>
</tr>
<tr>
<td>Literature review</td>
</tr>
<tr>
<td>Methodology</td>
</tr>
<tr>
<td>Analysis and discussion</td>
</tr>
<tr>
<td>Conclusions</td>
</tr>
<tr>
<td>Referencing</td>
</tr>
<tr>
<td>Communication</td>
</tr>
</tbody>
</table>

Research

Acceptable Criteria

When you say that you are undertaking a research study to find answers to a question, you are implying that the process;

- is being undertaken within a framework of a set of philosophies (approaches);
- uses procedures, methods and techniques that have been tested for their validity and reliability;
- is designed to be unbiased and objective.

Philosophies means approaches e.g. qualitative, quantitative and the academic discipline in which you have been trained.

Validity means that correct question. Reliability refers to repeatability and accuracy.

Unbiased and objective means that you have taken each step in an unbiased manner and drawn each conclusion to the best of your ability and without introducing your own vested interest.

(Bias is a deliberate attempt to either conceal or highlight something).


Research Characteristics

Research is a process of collecting, analyzing and interpreting information to answer questions. But to qualify as research, the process must have certain characteristics: it must, as far as possible, be controlled, rigorous, systematic, valid and verifiable, empirical and critical.

Controlled: The concept of control implies that, in exploring causality in relation to two variables (factors), you set up your study in a way that minimizes the effects of other factors affecting the relationship.

Rigorous: you must be scrupulous in ensuring that the procedures followed to find answers to questions are relevant, appropriate and justified. Again, the degree of rigor varies markedly between the physical and social sciences and within the social sciences.

Research Characteristics - cont.

**Systematic:** this implies that the procedure adopted to undertake an investigation follow a certain logical sequence. The different steps cannot be taken in a haphazard way. Some procedures must follow others.

**Valid and verifiable:** this concept implies that whatever you conclude on the basis of your findings is correct and can be verified by you and others.

**Empirical:** this means that any conclusion drawn are based upon hard evidence gathered from information collected from real life experiences or observations.

**Critical:** critical scrutiny of the procedures used and the methods employed is crucial to a research enquiry. The process of investigation must be foolproof and free from drawbacks. The process adopted and the procedures used must be able to withstand critical scrutiny.


Purpose of Research

- to review and synthesize existing knowledge
- to investigate some existing situation or problem
- to provide solutions to a problem
- to explore and analyse more general issues
- to construct or create a new procedure or system
- to explain a new phenomenon
- to generate new knowledge
- a combination of any of the above.

Add new information through

- New facts that was not known before.
- Validates results of previous research.
- Tests theories
- Explains findings of a previous research.
- Find out new relationships among present phenomena

Source: Understanding Research.
“Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world. Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence.” René Dubos, *Pasteur and Modern Science*, Doubleday, Garden City, NY, 1960, p. 145. (1)

---

Research Types/Classification

Research can be classified according to the perspectives:

- **Purpose** (why do it) of the research – the reason why it was conducted
- **Process** (how to do it) of the research – the way in which the data were collected and analysed; structured (quantifying extent of problem) vs. unstructured (explore nature of problem without quantifying it)
- **Outcome** (benefit) of the research – whether the expected outcome is the solution to a particular problem or a more general contribution to knowledge.
- **Logic** of the research – whether the research logic moves from the general to the specific or vice versa

**TABLE 1.1 Classification of main types of research**

<table>
<thead>
<tr>
<th>Type of research</th>
<th>Basis of classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory, descriptive, analytical or predictive research</td>
<td>Purpose of the research</td>
</tr>
<tr>
<td>Quantitative or qualitative research</td>
<td>Process of the research</td>
</tr>
<tr>
<td>Applied or basic research</td>
<td>Outcome of the research</td>
</tr>
<tr>
<td>Deductive or inductive research</td>
<td>Logic of the research</td>
</tr>
</tbody>
</table>

### Table 1: Key Categories of Research

<table>
<thead>
<tr>
<th>Approach</th>
<th>Most common type of data</th>
<th>Stage of problem</th>
<th>Categories of Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Quantitative</td>
<td>Evaluation</td>
<td>Testing or revising</td>
</tr>
<tr>
<td>Causal-comparative</td>
<td>Quantitative</td>
<td>Evaluation</td>
<td>Testing or revising</td>
</tr>
<tr>
<td>Historical</td>
<td>Quantitative or Qualitative</td>
<td>Description</td>
<td>Testing or revising</td>
</tr>
<tr>
<td>Developmental</td>
<td>Quantitative and qualitative</td>
<td>Description</td>
<td>Building or revising</td>
</tr>
<tr>
<td>Correlational</td>
<td>Quantitative</td>
<td>Description</td>
<td>Testing</td>
</tr>
<tr>
<td>Case study</td>
<td>Qualitative</td>
<td>Exploration</td>
<td>Building or revising</td>
</tr>
<tr>
<td>Grounded theory</td>
<td>Qualitative</td>
<td>Exploration</td>
<td>Building</td>
</tr>
<tr>
<td>Ethnography</td>
<td>Qualitative</td>
<td>Descriptive</td>
<td>Building</td>
</tr>
<tr>
<td>Action research</td>
<td>Quantitative and qualitative</td>
<td>Applied exploration</td>
<td>Building or revising</td>
</tr>
</tbody>
</table>


### Types of Research

**Based on Purpose**

- Historical
- Descriptive
- Correlation
- Ex-post Facto
- Experimental
- Case
- Survey
- Content Analysis

Classification of Research by Purpose

**Exploratory research**

- Conducted into a research problem or issue when there are very few or no earlier studies to which we can refer for information about the issue or problem.
- Focus is on gaining insights and familiarity with the subject area for more rigorous investigation at a later stage.
- Aim of study is to look for patterns, ideas or hypotheses, rather than testing or confirming a hypothesis.
- Assess which existing theories and concepts can be applied to the problem or whether new ones should be developed.
  - A **hypothesis** is a proposition that can be tested for association or causality against empirical evidence.
  - **Empirical evidence** is data based on observation or experience.
  - **Data** are known facts or things used as a basis for inference or reckoning.


---

**Typical techniques include case studies, observation and historical analysis:**

- Can provide both quantitative and qualitative data.
- Very flexible as there are few constraints on the nature of activities employed or on the type of data collected.
- Approach is usually very open and concentrates on gathering a wide range of data and impressions.
- Rarely provides conclusive answers to problems or issues, but gives guidance on what future research, if any, should be conducted.

Descriptive research

- conducted to **describe phenomena as they exist**
- goes further in examining a problem than exploratory research
- undertaken to **ascertain and describe the characteristics of the pertinent issues**
- Research questions start with ‘what’ or ‘how’ because the aim is to describe something


---

**Some Typical Research Questions in Descriptive Study**

- **How do Malaysians typically cook their meals?**
- **What are the hygienic practices among Malaysian before a meal?**
- What is the absentee rate in particular offices?
- What are the feelings of workers faced with redundancy?
- What are the qualifications of different groups of employees?
- What type of packaging for a box of chocolates do consumers prefer?
- What information do consumers want shown on food labels?
- Which car advertisements on television do men and women of different ages prefer?
- How many students study accounting in China compared with students in Australia?
- How do commuters travel to work in capital cities?

**Correlational research**
- a continuation of descriptive research
- aims to understand phenomena by discovering causal relations among them.
- goes beyond merely describing the characteristics
- **Establish a relationship or interdependence 2 or more aspects of a situation/factors/variables**


---

**Explanatory or Analytical research**
- a continuation of descriptive research
- aims to understand phenomena by discovering and measuring causal relations among them.
- goes beyond merely describing the characteristics
- analysing and explaining why or how the phenomenon being studied is happening.
- identifies and, possibly, control the variables or factors in the research activities, as this permits the critical variables or the causal links between the characteristics to be better explained.
  - A variable is a characteristic of a phenomenon that can be observed or measured.
Research Methodology

Predictive research goes even further than explanatory research. It forecasts the likelihood of a similar situation occurring elsewhere. It aims to generalize from the analysis by predicting certain phenomena on the basis of hypothesized, general relationships. Solution to a problem in a particular study will be applicable to similar problems elsewhere, if solution is valid and robust, based on a clear understanding of the relevant causes.

Predictive research provides 'how', 'why' and 'where' answers to current events and also to similar events in the future. It is also helpful in situations where 'what if' questions are being asked.

Possible Research Questions

- In which city would it be most profitable to open a new retail outlet?
- Will the introduction of an employee bonus scheme lead to higher levels of productivity?
- What type of packaging will improve the sales of our products?
- How would an increase in interest rates affect our profit margins?
- Which stock market investments will be the most profitable over the next three months?
- What will happen to sales of our products if there is an economic downturn?


Food Safety News

Breaking news for everyone’s consumption

Science & Research

Kitchen Confusion: Food Workers Score Poorly on Safe Handling Test

Diners beware: some restaurant workers may not have a full grasp of what it takes to keep food safe from contamination.

That’s according to a recent study from the University of Illinois at Chicago, which posed a series of food safety questions to area food handlers and found that the average respondent was able to answer only 72 percent of them correctly - a rate that would earn them a C on most school grading scales.

Researchers surveyed 372 food service workers in order to test their familiarity with meat and poultry handling protocol. Of those surveyed, only half received a score of 70 percent or above.

Employees who were certified in safe food handling - usually a manager or supervisor - scored slightly higher than other participants, averaging 77 percent, however, 35 percent of this group still scored under 70 percent.

And while those scores might mean a passing grade in school, in the restaurant industry they raise red flags, says Mark Dworkin, associate professor of epidemiology at UIC and lead researcher of the study.

**Epidemiologic research** looks at the way things affect an entire population of people. In this type of study, researchers simply observe "what's going on." For example, "what's going on" could involve a disease and how often that disease was occurring. Researchers don't actively try out any particular approach to health when they conduct an epidemiologic study.

**Clinical trials** are a type of research design that does involve trying out a particular approach to health. Clinical trials look at specialized groups of people rather than whole populations, and they seek to determine whether a particular approach to health might have benefits for a particular group of people.

For example, researchers conducting a clinical trial might want to evaluate the possible benefits of high-fiber snacks for digestion and overall health in a group of teenage girls, or a group of adult males at risk for colon cancer.

In vitro studies encompass other basic approaches to research that do not involve people at all. Instead, various aspects of food, nutrition, and health can be studied at a tissue or organ level, or even at the level of individual cellular activity.

Particularly when a researcher is trying to understand a biochemical process inside the body, which is very important in the study of food and nutrition, it can be almost impossible to develop a precise understanding unless a large number of factors can be carefully isolated and controlled.

Real, living people with trillions of cells and thousands of biochemical reactions taking place inside each cell are simply too complicated to analyze to draw insights into very specialized events occurring with the body's biochemistry.


The research process is similar to undertaking a journey. For a research journey there are two important decisions to make:

1) What you want to find out about
2) How to go about finding their answers.
If you are, you breath.
If you breath, you talk.

If you learn, you grow.
If you grow, you wish.
If you wish, you find.

If you find, you doubt.
If you doubt, you question.
If you question, you understand.

If you understand, you know.
If you know, you want to know more...
And if you want to know more, you are alive.

Figure 1: Conceptual Map of the Problem-Based Research Cycle


C. A model of Scientific Inquiry (Salkind, 2003)

A Research Methodology/Cycle

The Scientific Method

13/09/2011
Generally, research is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher, the following steps are usually part of most formal research, both basic and applied:

1. Observations and Formation of the topic –GOAL & Statement of the Problem
2. Refining Goals via Research Questions or Hypothesis
3. Conceptual definitions
4. Operational definition
5. Gathering of data
6. Analysis of data
7. Test, revising of hypothesis
8. Conclusion, reiteration if necessary

Source: http://en.wikipedia.org/wiki/Research
Rudyard Kipling's "The Elephant's Child" poem
"I Keep Six Honest Serving Men..."

I KEEP six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.
I send them over land and sea,
I send them east and west;
But after they have worked for me,
I give them all a rest.


The Research Process

From Research Question to Hypothesis

Specific Aims - the steps you are going to take to test hypothesis

Research Question - Broad based inquiry

Hypothesis

Hypothesis

Hypothesis

The Research Process
Creating Resources for Drug Abuse Researchers

Currently, there are few on-line resources available to new and minority drug abuse researchers.

Research Question
What resources would be helpful to new and minority drug abuse researchers?

Hypothesis
A grant writing tutorial would be helpful to new and minority drug abuse researchers. Those researchers who utilize an on-line grant writing tutorial will have higher priority scores on their next grant application than those who do not.

Specific Aim
Conduct a rigorous empirical evaluation of the on-line grant writing tutorial, comparing outcome and process measures from two groups—those with exposure to the tutorial, and those without.

Source: The Relationship Between the Research Question, Hypotheses, Specific Aims, and Long-Term Goals of the Project

Food Safety
Integrated Research Themes

1. The Public Health Impact of Pre-harvest Food-safety Pathogens
2. Microbial Ecology of Pre-harvest Food-safety Pathogens
3. Detection, Surveillance and Risk Assessment of Pre-harvest Food-safety Pathogens
4. The Development of Cost-Effective Intervention Strategies For Pre-harvest Food-safety Pathogens

Research goals

- detail what the research study intends to do in order to address the problem, thereby answering the question: “What will this study do?”
- goals are operationalized by one or more research questions.
- Research questions narrow the purpose [or goal] into specific questions that the researcher would like answered or addressed in the study.
- answers to those research questions will meet the study goals & contribute towards solving the problem.
- Meaningful research entails having identifiable connection between the answers to the research questions and the research problem inspiring the study.


Writing Problem Statements

A problem statement is a clear concise description of the issue(s) that need(s) to be addressed by a problem solving team. It is used to center and focus the team at the beginning, keep the team on track during the effort, and is used to validate that the effort delivered an outcome that solves the problem statement. It has a specific form:

- Vision - what does the world look like if we solve the problem?
- Issue Statement - one or two sentences that describe the problem using specific issues. It is not a "lack of a solution" statement. For example, our problem is that we don't have an ERP system.
- Method - the process that will get followed to solve the problem.

Read existing literature and identify gaps or suggestions for further study.

A Problem Statement is..

- **Concise.** The essence of your problem needs to be condensed down to a single sentence. A reader of your assignment should be able to point to the PS and say “AHA! Now I understand the problem addressed by this inquiry.”

- **Specific.** The PS focuses your thinking, research, and solutions toward a single population or issue.

- **Measurable.** Think of the PS as a description of the discrepancy between what is and what should be. The goal of the inquiry is to lessen this discrepancy by the careful research and implementation of effective solutions. The only way to know if this has been accomplished is to measure the results and compare them with the initial discrepancy.

  - Problems can be measured in terms of degree and frequency. The strongest problem statements incorporate measurable aspects of both the degree and frequency of the problem as it exists (see examples below).
  - The problem statement should also identify the population affected by the problem and any potential solutions.


---

A Problem Statement is NOT..

A problem statement is not a solution

Describe the problem rather than a solution you have in mind. The solutions come from the research, not the other way around.

A problem statement is not a symptom

If the concern is how much time the students spend talking instead of listening, this could be indicative of a more essential problem, namely that the students are not engaged in the lesson itself.

**Examples of Problem Statement**

- 45% of the middle school students are off task 50% of the time during direct instruction.
- 90% of the time, only 10% of the 4th grade students complete their homework assignments on time.
- 60% of the choir students are not actively engaged in rehearsal activities 80% of the time.

Writing Problem Statement

- **Who** - Who does the problem affect? Specific groups, organizations, customers, etc.
- **What** - What are the boundaries of the problem, e.g. organizational, work flow, geographic, customer, segments, etc. - 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?
- **When** - When does the issue occur? - When does it need to be fixed?
- **Where** - Where is the issue occurring? Only in certain locations, processes, products, etc.
- **Why** - 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. 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.


---

A topic of interest

Look → Read → Synthesize → Seek Feedback

No → Research-Worthy Problem?

Yes → May propose a study to address it

Figure 3: Process of Finding a Research-Worthy Problem

Consider a software development and hosted data services company that supplies products and services to wireless carriers. They had issues deploying new software releases into the production environment. Deployment in this case is the work necessary for taking a production ready binary and installing, testing and releasing it into the production environment. The company failed to deploy the releases on schedule over 50% of the time.

**Problem Statement:**
We want all of our software releases to go to production seamlessly, without defects, where everyone is aware and informed of the outcomes and status. **(Vision)** Today we have too many release failures that result in too many rollback failures. If we ignore this problem; resources will need to increase to handle the cascading problems, and we may miss critical customer deadlines which could result in lost revenue, SLA penalties, lost business, and further damage to our quality reputation. **(Issue Statement)**

We will use our Kaizen Blitz methodology in evaluating the last release to help us improve our processes. **(Method)**

---

**Problem Statement Template**

1. **What:** In no more than two sentences, what is the problem that the research will address? Remember, a problem is, essentially, something that is ‘going wrong’.

   **Who:** List three current, peer-reviewed references that support the presence of that problem and briefly describe the nature of that support.

2. **How, Where, and When:** Again, in no more than two sentences, describe the impact of the problem. How are people or researchers’ understanding negatively impacted by the problem? When and where is the problem evident?

   **Who:** List three current, peer-reviewed references that support the impact of the problem that the research proposes addressing and briefly describe the nature of that support.

3. **Why:** In no more than two sentences, identify the conceptual basis for the problem. That is, what does the literature outline as the cause of the problem?

   **Who:** List three current, peer-reviewed references that support the conceptual basis of the problem and briefly describe the nature of that support.

---

“One main obstacle of knowledge management is the lack of developed culture in an organization to ensure the acceptance of a knowledge management system (Becerra-Fernandez & Sabherwal, 2001; Bossen & Palsgaard, 2005; Kruizinga, van Heijst, & van der Spek, 1996; Swan, Newell, & Robertson, 2000). Non-acceptance of knowledge management system occurs with limited or no support when the proper culture for utilizing knowledge management is not practiced in the organization (Gottschalk, 2000; Kruizinga, van Heijst, & van der Spek, 1996; Swan, Newell, & Robertson, 2000). The basis for the problem is the lack of aligning knowledge management systems with the business strategy in order to develop knowledge management culture in the organization (Braganza & Mollenkramer, 2002; Chua & Lam, 2005; Storey & Barnett, 2000).”


Example of A Faulty Problem Statement

Example of A Viable Problem Statement
Example of A Viable Problem Statement

Wong, Crowder, Wills, and Shadbolt (2006) found that KMS implementation reduces product development time, while Beis, Loucopoulos, Pyrgiotis, and Zografos (2006) found that such implementation creates complex models to facilitate organizational change. However, KMS implementation coupled with the costs associated with failed attempts like lost revenues and reduced employee confidence make effective implementation of KM efforts vital (Braganza & Mollenkramer, 2002). Although a number of factors have been suggested as important elements in impacting the success of a KMS, the impact of organizational culture appears as a common thread (Bossen & Palsgaard; Kaweevisultraipn & Chan; Pumareja & Sikkel). Unfortunately, very little attention has been given in literature to exactly what constitutes the optimal organizational culture for an effective KMS and how to foster that culture."


Research Questions

- are the essence of most research conducted
- acts as the guiding plan for the investigation.
- specific questions that researchers seek to answer
- state what you want to learn.
- point the researcher to the information that will lead him/her to understand what he/she set forth to investigate.
- connects answers from the questions to the research problem
- are not created in a vacuum, but are strongly influenced by quality literature about the phenomena
- determine the methodology to be used from the accuracy and appropriateness of the research questions via its exact wording.
- depends on the type of study being conducted.
- that are confirmatory and predictive nature will generally involve quantitative data.
- that are of exploratory and interpretive nature will likely involve qualitative data.

Quantitative Research Questions

- To what extent does users’ perceived usefulness increases the odds of their e-commerce usage?
- Do computer self-efficacy and computer anxiety have a significant difference for males and females when using e-learning systems?
- What are the contributions of users’ systems trust, deterrent severity, and motivation to their misuse of biometrics technology?
- To what degree do team communication and team cohesiveness predict productivity of system development by virtual teams?


Qualitative Research Questions

- How does training help the implementation success of enterprise-wide information systems?
- Why do user involvement and user resistance help in the systems’ requirement gathering process?
- What are the systems characteristics that are valuable to users when using e-learning systems?
- How do e-commerce users define information privacy?

Examples of Research Questions

General Research Question:
➢ ‘Why are the forest resources declining in the Amazon rainforest?’

More Specific Research Questions
➢ ‘Is intensive agriculture the major cause of deforestation in the Amazon?’
➢ ‘Is the logging industry the major cause of deforestation in the Amazon?’
➢ ‘Is Global Warming the major cause of deforestation in the Amazon?’

Activity-Learning Task

Group Activity

YOUR TASK

1. Individually, think of a problem that requires solution in your profession. Write down the problem statement. Following that suggest at least 2 research questions you want to answer.

2. Look to your nearest neighbour & say out cheerfully HELLO NEIGHBOUR.. Introduce yourself.. Then take turns to explain your problem statement and research question to your neighbour.

3. The role of the other is to probe by asking questions until you have a more focused problem statement & research questions. Use the 5Ws & 1H to evaluate. You could also use the questions on the ensuing slide. The purpose of the assessor is to make the research question more focused.

4. Be sure to record the important debate/argument/suggestions leading to making the RQ more focused.


Research Question Learning Task

1. **What**: In no more than two sentences, what is the problem that the research will address? Remember, a problem is, essentially, something that is "going wrong".

   **Who**: List three current, peer-reviewed references that support the presence of that problem and briefly describe the nature of that support.

2. **How, Where, and When**: Again, in no more than two sentences, describe the impact of the problem. How are people or researchers' understanding negatively impacted by the problem? When and where is the problem evident?

   **Who**: List three current, peer-reviewed references that support the impact of the problem that the research proposes addressing and briefly describe the nature of that support.

3. **Why**: In no more than two sentences, identify the conceptual basis for the problem. That is, what does the literature outline as the cause of the problem?

   **Who**: List three current, peer-reviewed references that support the conceptual basis of the problem and briefly describe the nature of that support.

**Figure 4: Problem Statement Template**

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Activity-Learning Task

**Group Activity**

Here are some examples of questions that the assessor can ask:

- What topic / area interests you?
- What exactly is in it (the topic)? What specific points interest you in that topic?
- How is the info going to be collected? How is it going to be analysed? What methods?
- What material / source are you going to use? Have you checked it?
- What sample?
- Any specific time frame? Any specific location/region/country? Any specific group of people/institutions?
- Is it realistic? Are you looking at too many things?
- Is it too general of an idea?

A Hypothesis is..

- a "logical supposition, a reasonable guess, an educated conjecture" about some aspect of daily life
- a “prediction” or “conjecture” about the outcome of a relationship among attributes or characteristics (when applied to scientific research)
- Must be testable and falsifiable so that it can be accepted or rejected
  - expressed in either null terms or alternative term (with +ve or −ve direction).
  - For example, if a study were to examine the impact interactive multimedia animations have on the average amount of a purchase at an e-commerce site, the hypothesis would be stated: The average amount of purchase on an e-commerce site enhanced with interactive animations will not be different that the average amount of purchase on the same e-commerce site that is not enhanced with interactive animations.
- commonly tested with quantitative data


A Hypothesis is a tentative statement that proposes a possible explanation to some phenomenon or event. A useful hypothesis is a testable statement which may include a prediction. A hypotheses should not be confused with a theory. Theories are general explanations based on a large amount of data.


A hypothesis is a proposed explanation for a phenomenon. For a hypothesis to be put forward as a scientific hypothesis, the scientific method requires that one can test it. Scientists generally base scientific hypotheses on previous observations that cannot satisfactorily be explained with the available scientific theories. Even though the words "hypothesis" and "theory" are often used synonymously, a scientific hypothesis is not the same as a scientific theory. A working hypothesis is a provisionally accepted hypothesis proposed for further research.
Common misunderstanding about hypothesis is that it could be proven or tested. **Generally a hypothesis is used to make predictions that can be tested by observing the outcome of an experiment.** If the outcome is inconsistent with the hypothesis, then the hypothesis is rejected. **However,** if the outcome is consistent with the hypothesis, the experiment is said to support the hypothesis.

This careful language is used because researchers recognize that alternative hypotheses may also be consistent with the observations. In this sense, a hypothesis can never be proven, but rather only supported by surviving rounds of scientific testing and, eventually, becoming widely thought of as true. A useful hypothesis allows prediction and within the accuracy of observation of the time, the prediction will be verified. **As the accuracy of observation improves with time, the hypothesis may no longer provide an accurate prediction.** In this case a new hypothesis will arise to challenge the old, and to the extent that the new hypothesis makes more accurate predictions than the old, the new will supplant it.


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**Simple Example of Testable & Falsifiable Hypothesis**

**Problem:** My flashlight is not working. **Research Questions:** Is the bulb broken? Is the battery dead?

**Hypotheses:**
1. Replacing the bulb will result in the torch working.
2. Battery is dead.

**Testable:** We can then test this prediction by changing the bulb and seeing if the torch works. If the torch then works this would suggest that our hypothesis was correct and the bulb truly was broken.

**Falsifiable:** Replacing the bulb & making the torch work only falsified other possible hypothesis such as bulb connection was just loose or the connecting points were bad or the battery was leaking.

Examples of Hypothesis

**NOT SO GOOD HYPOTHESIS?? But WHY??**

- Children **grow more quickly** if they eat **vegetables**.
- Chocolate may cause pimples.
- Salt in soil may affect plant growth.
- Plant growth may be affected by the color of the light.
- Bacterial growth may be affected by temperature.
- Ultra violet light may cause skin cancer.
- Temperature may cause leaves to change color.


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Examples of Hypothesis

The problem question might be ‘**Why are the numbers of Cod in the North Atlantic declining?**

**ACCEPTABLE HYPOTHESIS. WHY??**

- Is over-fishing causing a decline in the stocks of Cod in the North Atlantic?
- Over-fishing affects the stocks of cod.
- If over-fishing is causing a decline in the numbers of Cod, reducing the amount of trawlers will increase cod stocks.

A worker on a fish-farm notices that his trout seem to have more fish lice in the summer, when the water levels are low, and wants to find out why. His research leads him to believe that the amount of oxygen is the reason – fish that are oxygen stressed tend to be more susceptible to disease and parasites. He proposes a general hypothesis.

“Water levels affect the amount of lice suffered by rainbow trout.”

This is a good general hypothesis, but it gives no guide to how to design the research or experiment. The hypothesis must be refined to give a little direction.

“Rainbow trout suffers more lice when water levels are low.”

Now there is some directionality, but the hypothesis is not really testable, so the final stage is to design an experiment around which research can be designed, a testable hypothesis.

“Rainbow trout suffers more lice in low water conditions because there is less oxygen in the water.”

Research Methods

In brief, all research methods must provide a detailed, step-by-step description of how the study will be conducted, answering the vital “who, what, where, when, why, and how” questions.

1. What is going to be done
2. Who is going to do each thing to be done
3. How will each thing to be done be accomplished
4. When, and in what order, will the things to be accomplished actually be done
5. Where will those things be done
6. Why – supported by the literature – for the answers to the What, Who, How, When, and Where


Food Safety Integrated Research Themes
Examples of Projects

Title: Quantifying the Potential Association of Pathogen Load in Animals with Pathogen Load in Retail Meat Products

PI: Julie Funk (The Ohio State University), Co-PIs: Wondwossen Gebreyes (North Carolina State University), Randall Singer and Richard Isaacson (University of Minnesota), Tom Wittum (The Ohio State University).

Specific Aims include:
1. Standardizing techniques for on-farm pathogen quantification;
2. Quantifying pathogen loads at the farm, after lairage, at processing and after preparation for retail sale;
3. Comparing pathogen loads at each point in the farm to retail product continuum;
4. Contrasting relative changes in pathogen load in two different livestock commodities, cattle and swine.

Title: Systematic Review of Pre-harvest Food-safety Interventions

PI: Jan Sargeant (McMasters University), Co-PIs: Robert Wills, R. Hart Bailey (Mississippi State University), James McKeane, A. O’Connor (Iowa State University).

Specific Aims include:
1. Conducting a systematic review of potential intervention strategies for mitigating the presence of Campylobacter spp. in broilers and Salmonella spp. in swine;
2. Ranking intervention strategies and making specific recommendations for future research and mitigation activities by producers;
3. Conducting a cost-effective analysis of identified intervention strategies.


YOUR TASK

1. Individually, write down the at least 2 hypothesis based on the problem statements/research questions from the first activity.
2. Look to your nearest neighbour & say out cheerfully HELLO NEIGHBOUR. Introduce yourself.. Then take turns to explain your hypothesis to your neighbour.
3. The role of the other is to put questions until you have a testable/falsifiable hypothesis.
4. Be sure to record the important debate/argument/suggestions leading a testable & falsifiable hypothesis.

A literature review is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper to establish why you are pursuing this particular research program. A good literature review expands upon the reasons behind selecting a particular research question.


A literature review is an account of what has been published on a topic by accredited scholars and researchers.

- is a part of the introduction to an essay, research report, or thesis.
- it conveys to your reader what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are.
- defined by a guiding concept (e.g., your research objective, the problem or issue you are discussing, or your argumentative thesis).
- is not just a descriptive list of the material available, or a set of summaries
- lets you gain and demonstrate skills in two areas
  - information seeking: the ability to scan the literature efficiently, using manual or computerized methods, to identify a set of useful articles and books
  - critical appraisal: the ability to apply principles of analysis to identify unbiased and valid studies

What is Literature Review??

A literature review must do these things:

- be organized around and related directly to the thesis or research question you are developing
- synthesize results into a summary of what is and is not known
- identify areas of controversy in the literature
- formulate questions that need further research


How To Do the Review??

Ask yourself questions like these:

1. What is the **specific thesis, problem, or research question** that my literature review helps to define?
2. What **type** of literature review am I conducting?
   - Am I looking at issues of theory? methodology? policy? quantitative research (e.g. on the effectiveness of a new procedure)? qualitative research (e.g., studies)?
3. What is the **scope** of my literature review?
   - What types of publications am I using (e.g., journals, books, government documents, popular media)?
   - What discipline am I working in (e.g., nursing psychology, sociology, medicine)?
4. How good was my **information seeking**?
   - Has my search been wide enough to ensure I’ve found all the relevant material?
   - Has it been narrow enough to exclude irrelevant material?
   - Is the number of sources I’ve used appropriate for the length of my paper?

Ask yourself questions like these: (continue)
5. Have I critically analysed the literature I used?
   - Do I follow through a set of concepts and questions, comparing items to each other in the ways they deal with them?
   - Instead of just listing and summarizing items, do I assess them, discussing strengths and weaknesses?
6. Have I cited and discussed studies contrary to my perspective?
7. Will the reader find my literature review relevant, appropriate, and useful?


Ask yourself questions like these about each book or article you include:
1. Has the author formulated a problem/issue?
2. Is it clearly defined? Is its significance (scope, severity, relevance) clearly established?
3. Could the problem have been approached more effectively from another perspective?
4. What is the author's research orientation (e.g., interpretive, critical science, combination)?
5. What is the author's theoretical framework (e.g., psychological, developmental, feminist)?
6. What is the relationship between the theoretical and research perspectives?
7. Has the author evaluated the literature relevant to the problem/issue? Does the author include literature taking positions she or he does not agree with?

How To Do the Review??

Ask yourself questions like these about each book or article you include:

8. In a research study, how good are the basic components of the study design (e.g., population, intervention, outcome)? How accurate and valid are the measurements? Is the analysis of the data accurate and relevant to the research question? Are the conclusions validly based upon the data and analysis?

9. In material written for a popular readership, does the author use appeals to emotion, one-sided examples, or rhetorically-charged language and tone? Is there an objective basis to the reasoning, or is the author merely "proving" what he or she already believes?

10. How does the author structure the argument? Can you "deconstruct" the flow of the argument to see whether or where it breaks down logically (e.g., in establishing cause-effect relationships)?

11. In what ways does this book or article contribute to our understanding of the problem under study, and in what ways is it useful for practice? What are the strengths and limitations?

12. How does this book or article relate to the specific thesis or question I am developing?


How To Do the Review??

➢ The easiest way is to scan the work, using the abstract and introduction as guides. This helps to eliminate the non-relevant work and also some of the lower quality research.

➢ If it sets off alarm bells, there may be something wrong, and the paper is probably of a low quality. Be very careful not to fall into the trap of rejecting research just because it conflicts with your hypothesis. Failure to do this will completely invalidate the literature review and potentially undermine the research project. Any research that may be relevant should be moved to the shortlist folder.

➢ The next stage is to critically evaluate the paper and decide if the research is sufficient quality. Think about it this way: The temptation is to try to include as many sources as possible, because it is easy to fall into the trap of thinking that a long bibliography equates to a good paper. A smaller number of quality sources is far preferable than a long list of irrelevance.

How To Do the Review??

- Check into the credentials of any source upon which you rely heavily for the literature review. The reputation of the University or organization is a factor, as is the experience of the researcher. If their name keeps cropping up, and they have written many papers, the source is usually OK.
- Look for agreements. Good research should have been replicated by other independent researchers, with similar results, showing that the information is usually fairly safe to use.
- If the process is proving to be difficult, and in some fields, like medicine and environmental research, there is a lot of poor science, do not be afraid to ask a supervisor for a few tips. They should know some good and reputable sources to look at. It may be a little extra work for them, but there will be even more work if they have to tear apart a review because it is built upon shaky evidence.


Reflections

"Education, we see, is not merely gaining knowledge or skills helpful toward productive work, though certainly that is a part of it. Rather it is a replenishment and an expansion of the natural thirst of the mind and soul. Learning is a gradual process of growth, each step building upon the other. It is a process whereby the learner organizes and integrates not only facts but attitudes and values. The Lord has told us that we must open our minds and our hearts to learn. There is a Chinese proverb: Wisdom is as the moon rises, perceptible not in progress but in result. As our knowledge is converted to wisdom, the door to opportunity is unlocked."

Barbara W. Winder
You can know the name of a bird (or element) in all the languages of the world, but when you're finished, you'll know absolutely nothing whatever about the bird (or element)... So let's look at the bird to see what it's doing—that's what counts. I've learned very early the difference between knowing the name of something and knowing something.

—Richard Feynman