RARA6014
KAEDAH PENYELIDIKAN
RESEARCH METHODOLOGY
(Science & Technology)

Peranan Penyelidik
Researcher's Role

by

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Institut Sel Fuel

Semester 1, 2018/2019

Before we start

- Log On to ‘Openlearning.com’
- Register new account
- Search this link:
- https://www.openlearning.com/courses/research-methodology-in-science-technology
- Use activation Code to enrol: **RARA6014UKM2**

Course Objectives

- Differentiate between researcher and scientists
- Define research and its objective
- Understand the motivation of researcher
- Understand the role of researcher

Outline

- Researcher vs Scientist
- Meaning of Research
- Objective of Research
- Role of Researchers
- Quiz

Researcher vs Scientist

Are they researcher OR scientist?

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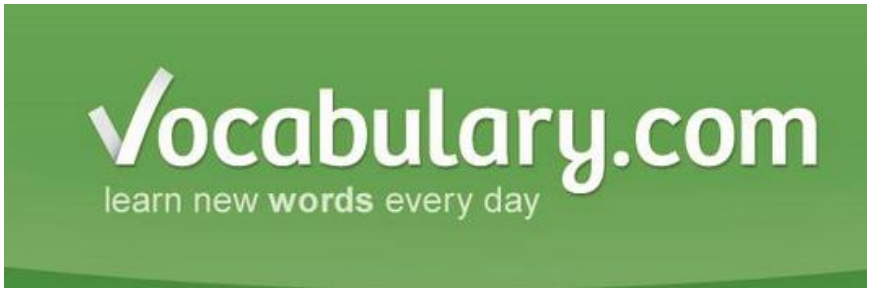
Who is the Creator?

Credit: North Carolina State University

Who is the Creator?

Researcher vs Scientist



A **researcher** is someone who conducts *research*, i.e., an organized and **systematic** investigation into something. Scientists are often described as *researchers*.

A **scientist** is a person with some kind of knowledge or expertise in any of the *sciences*, like biology or chemistry. See that guy in the white lab coat wearing pocket protectors and experimenting with chemicals? He's definitely a *scientist*.

Researcher vs Scientist

Scientist:

a person who is trained in a science and whose job involves doing scientific research or solving scientific problems

Research:

- careful or diligent search
- studious inquiry or examination; *especially* **:** investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws
- the collecting of information about a particular subject

Researcher vs Scientist

Is the man a researcher?

YES!

Are these researchers?

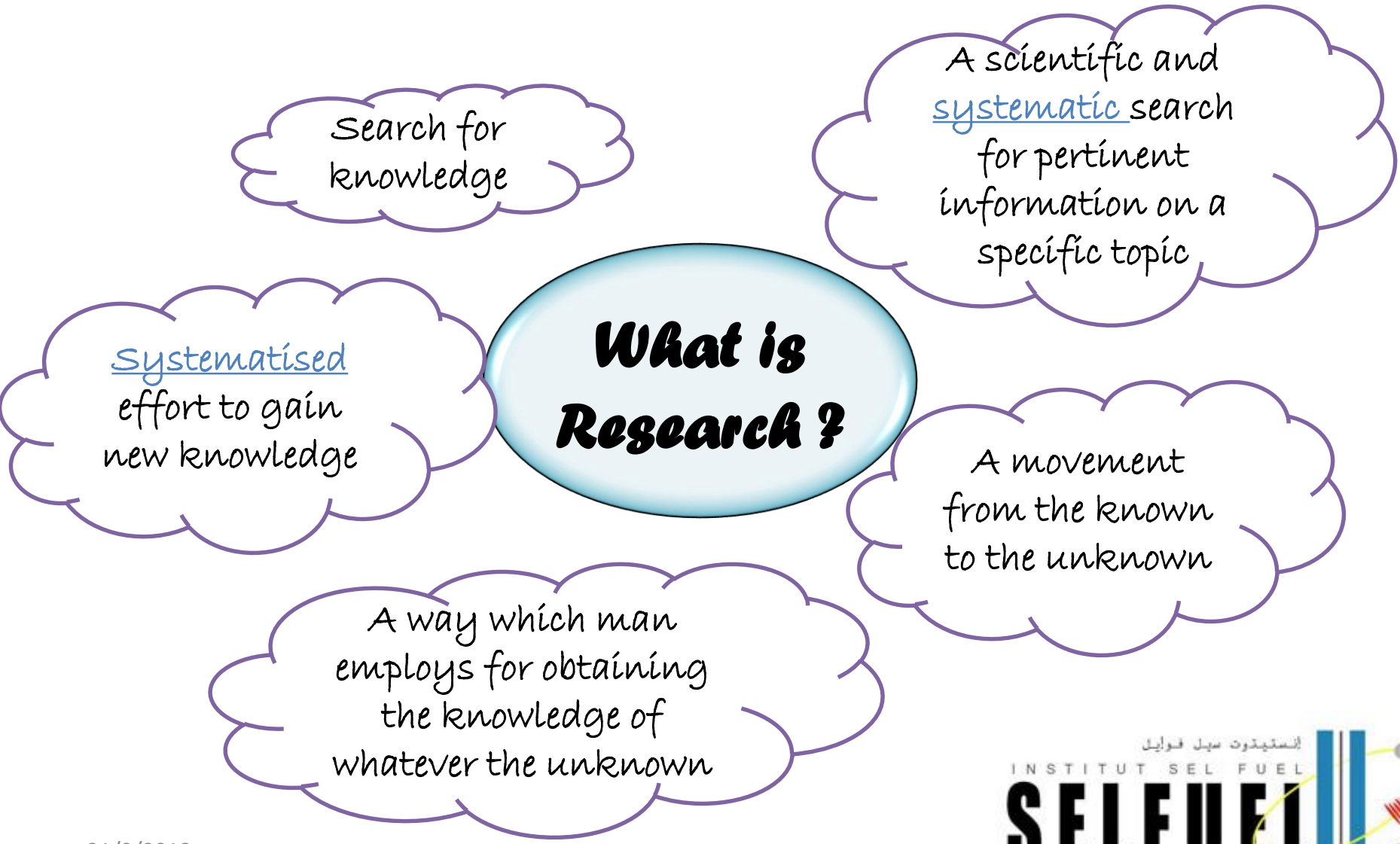
- Postgraduate – Master or Ph.D student
- Graduate Research Assistant
- Post Doctoral Research Fellow
- Research Fellow
- Research Associate

Who is Researcher?

- Knowledge person who has a good background in academic or scientific field with good written and communication skills
- An employee or scholar.. Employed to **advanced knowledge**… have to be “**Independent, honest and critical thought**”

GRADUATE RESEARCHER

Meaning of Research



Research

The word *research* is composed of two syllabes, *re* and *search*.

Definition in dictionary:

re: a prefix meaning again, anew or over again

search: to examine closely and carefully, to test and try, or to probe

Research: A noun describing a careful, **systematic**, patient study and investigation in some field of knowledge, undertaken to establish facts or principles (Grinnel 1993:4)

What other says about Research?

Burns (1997:2)

*A **systematic** investigation to find answers to a problem.*

Kerlinger (1986:10)

*Scientific research is a **systematic**, controlled empirical and critical investigation of propositions bout the presumed relationships about various phenomena.*

Concluding Meaning of Research

A systematic approach consisting of identifying the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solution(s) towards the concerned problem or in certain generalisations for some theoretical formulation.

Objectives of Research

- To discover answers to questions through the application of scientific procedure.
- To find out the truth which is hidden and yet to be discovered.
- **Example of Objective of Fuel Cell Research:**

  To find ways in lowering manufacturing cost, improving the performance and durability of fuel cell technology

Objectives of Research

- **Example of Objective of Research in Engineering:**

  To seek improvements in theory and practice in field such as power systems, computation, nanotechnology, construction etc.

- **Example of Objective of Research in Applied Science:**

  To study on how graphene-based materials can be used on various applications such as biosensors, heat transfer processes, solar cell etc.

- **Example of Objective of Research in Pure Science:**

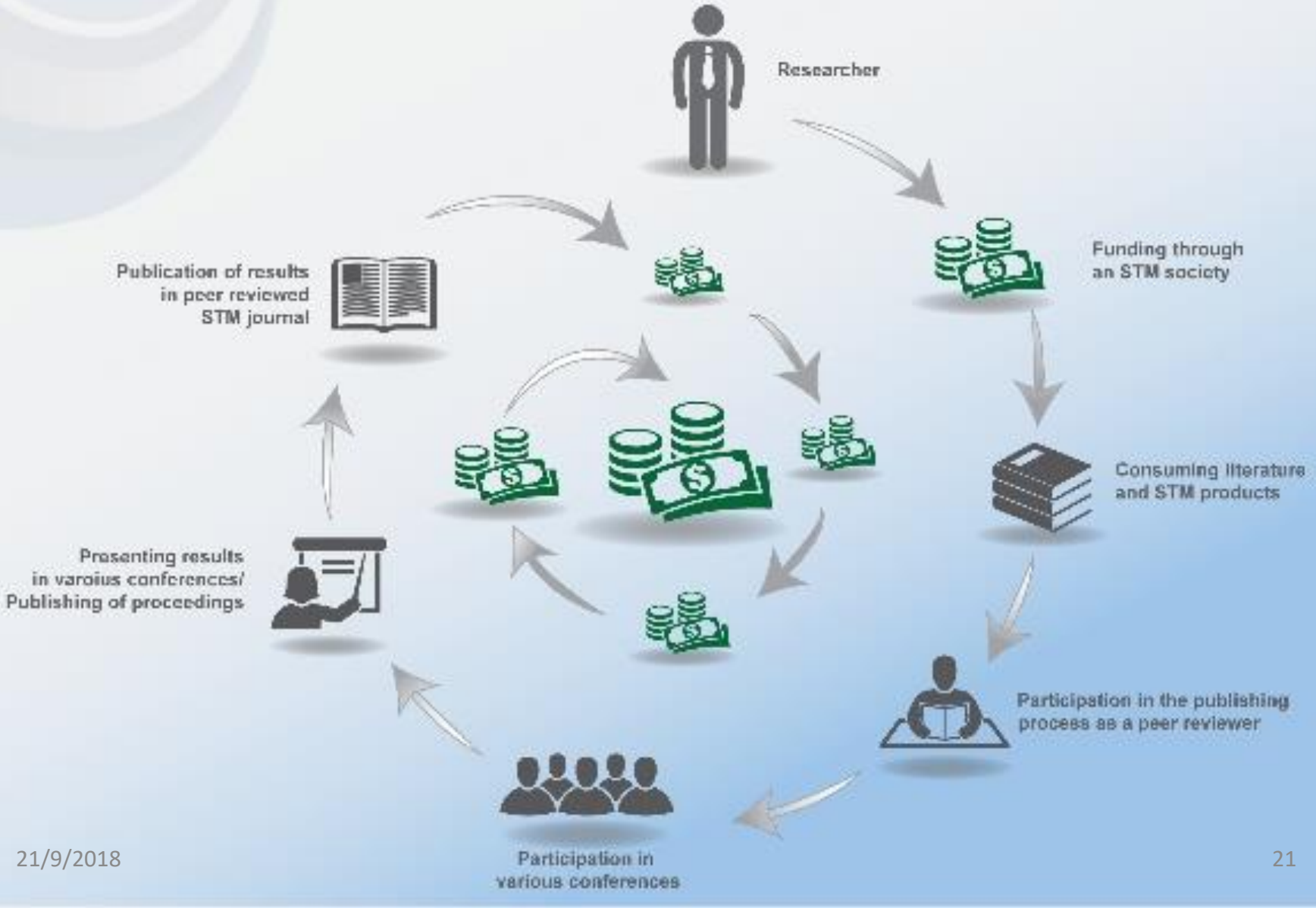
  To study on the quantum effect on graphene-based material.

Motivation in Research

What makes you undertake research?

- ? Desire to get a research degree
- ? Desire to face the challenge in solving the unsolved problems
- ? Desire to get intellectual joy of doing some creative work
- ? Desire to be of service to society
- ? Desire to get respectability
- ? **No DESIRE**
- ? **Desire to get $$$**

The Motivations of the Researcher

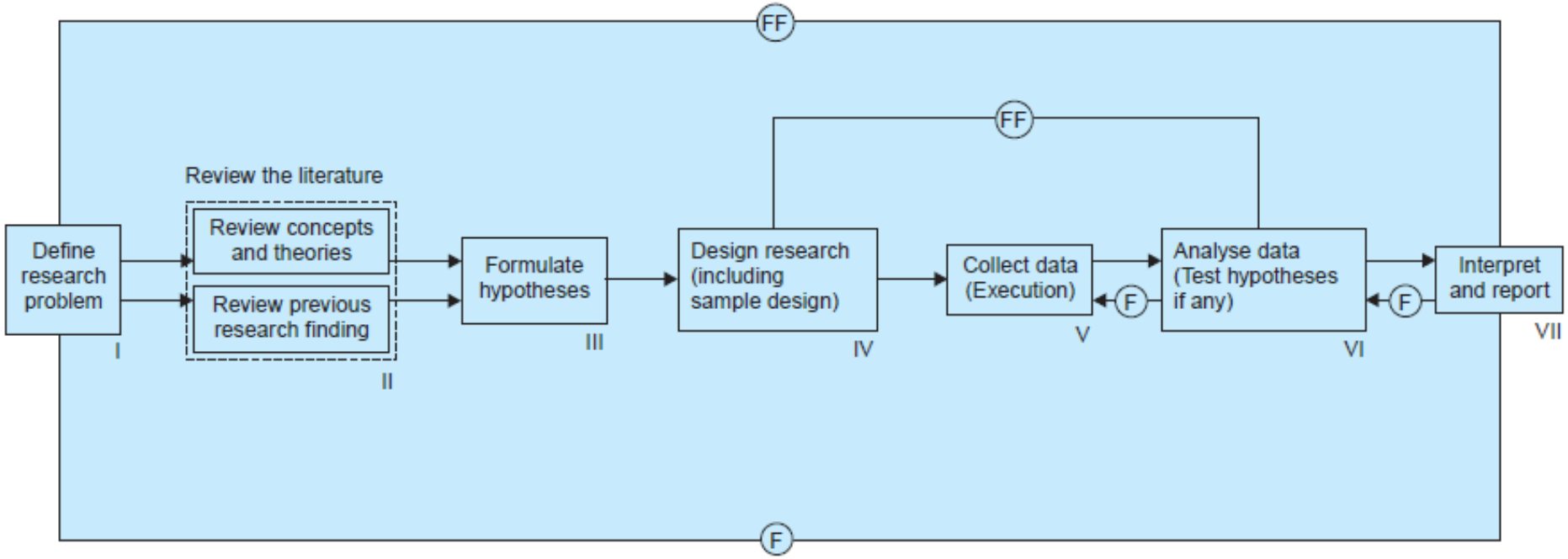


Roles of Researchers

Primary role:

- To conduct research using scientific method with the right research methodology and research techniques.
  - Researchers need to understand concisely the **research process** to effectively carry out research with conclusive results.

Research Process



Kothari, C.R. 2004. Research Methodology : Methods and Techniques. 2nd revised Ed. New Age International Publisher, India.

Research Process

I. Formulating the research problem

- What is your area of interest in general?
  - *Education background, self interest, current trend in research.*
- Where could you go to discover a specific research problem?
  - *Discuss with colleagues or experienced man, read articles from various sources*
- How could you narrow down your research problem?
  - *Examine all available literature and discuss further to put the problem in as specific terms as possible.*
  - *Care must be taken to verify the objectivity and validity of the background facts concerning the problem (know-how to select relevant information)*

Research Process

This is a sequential process!

A number of formulations are set up → each formulation is more specific than the proceeding one → each one phrased in more analytical terms → each more realistic in terms of the available data and resources.

Research Process

II. Literature survey

- Once problem is formulated, a synopsis of the topic is produced.
- How to start the research?
  - *Extensive literature survey related to the problem.*
  - *First place to go: abstracting and indexing journals including academic journals, conference proceedings, government reports, books etc.*
  - *Online information search sources needs to be familiarised.*
  - *ONE SOURCE WILL LEAD TO ANOTHER ONE!*
  - *The literature survey in the area of study similar to the defined problem should be carefully studied.*

Research Process

III. Formulate hypothesis

- Extensive literature survey should enable researcher to state the hypothesis in clear terms.
- Hypothesis: Tentative assumption made in order to draw out and test its logical or empirical consequences.
- Important as they provide focal point for research
- Must be very specific and limited to the piece of research in hand
- Allow the researcher to identify the type of data required and type of methods of data analysis to be used.

Research Process

- How to develop working hypothesis?
  - *Discuss with colleagues and experts about the problem, its origin and the objectives in seeking a solution*
  - *Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues*
  - *Review of similar studies in the area or of the studies on similar problems.*
  - *Many more…*

Research Process

IV. Design research

- After the research problem is formulated, the researcher will have to state the conceptual structure within which research would be conducted.
- This design is essential to facilitates research to be as efficient as possible to yield maximal information.
- Suitable design variables are required to test the working hypothesis.

Research Process

- What are the considerations in preparation of research design?
  - *The means of obtaining the information*
  - *The availability and skills of the researcher and people around*
  - *Explanation of the what in which selected means of obtaining information will be organised and the reasoning leading to the selection (ask why doing this?)*
  - *The time available for research*
  - *The cost factor relating to research (finance available for this purpose)*

Research Process

V. Collect Data

- Primary data can be collected either through experiment or through survey (if applicable).
- For experimental data, it consists of quantitative and qualitative data. The relevance of the data required to test the working hypothesis should be justified in step IV.
- Bear in mind that data collection should always consider the nature of investigations, objective and scope of the inquiry, financial resources, available time, and the desired degree of accuracy.

Research Process

VI. Analyse data

- Data are tabulated and summarised
- The relationships or differences supporting or conflicting with the original or new hypotheses should be validated by tying up the obtained data either quantitative or qualitative to indicate any conclusions.
- At time, statistical method could be one of the approach to draw the conclusions

Research Process

VII. Interpret and report

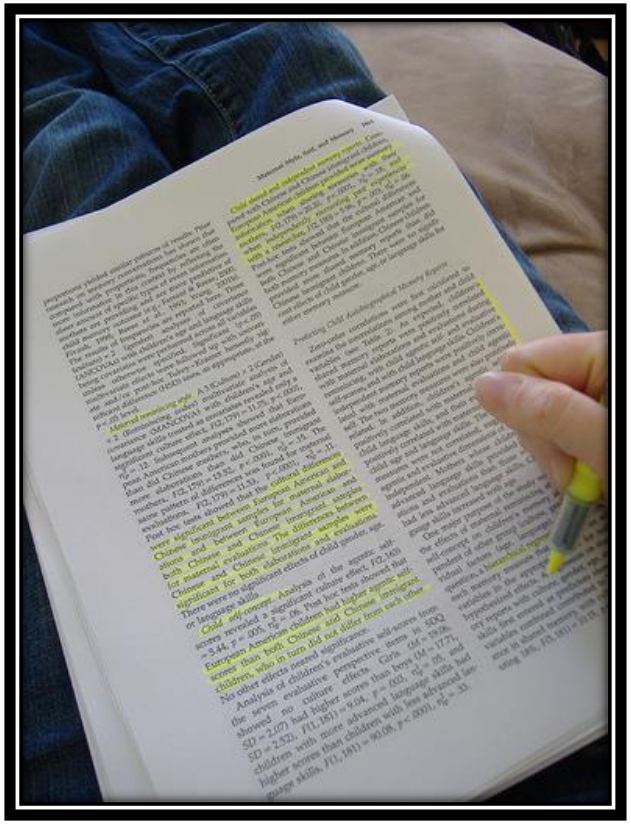
- The results are interpreted in the light of the hypothesis or the research problem.
- Contribution to the body of knowledge, error analysis, comparison with other research studies are reported and conclusion are drawn.
- Finally the researcher makes a piece of research report.

Roles of Researchers

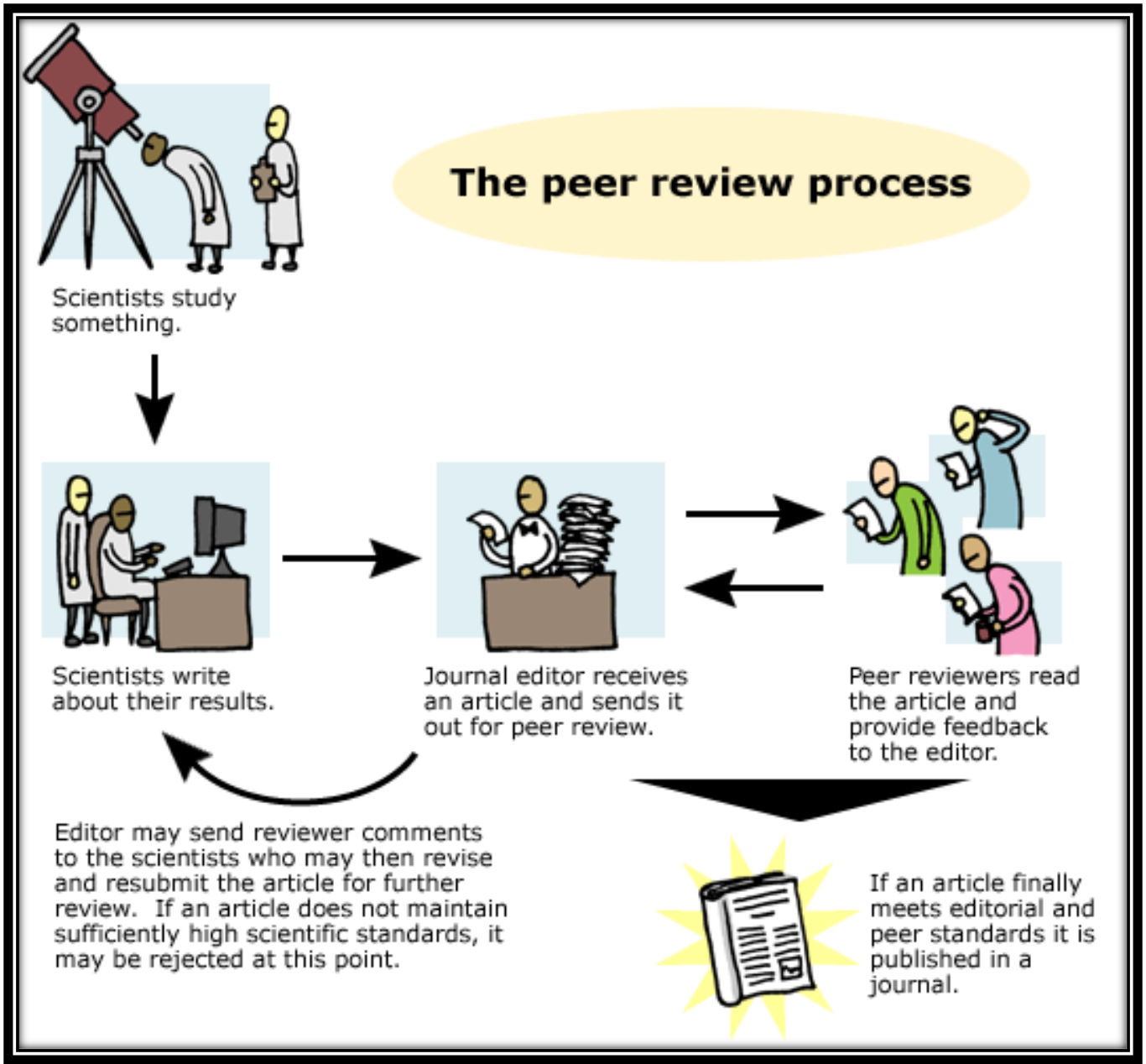
A researcher who is equipped with the research skill will be able to progress through the next phase in his/her career. The researcher would then have many other roles.

What are these roles?

Roles of Researchers



Roles of Researchers



Roles of Researchers

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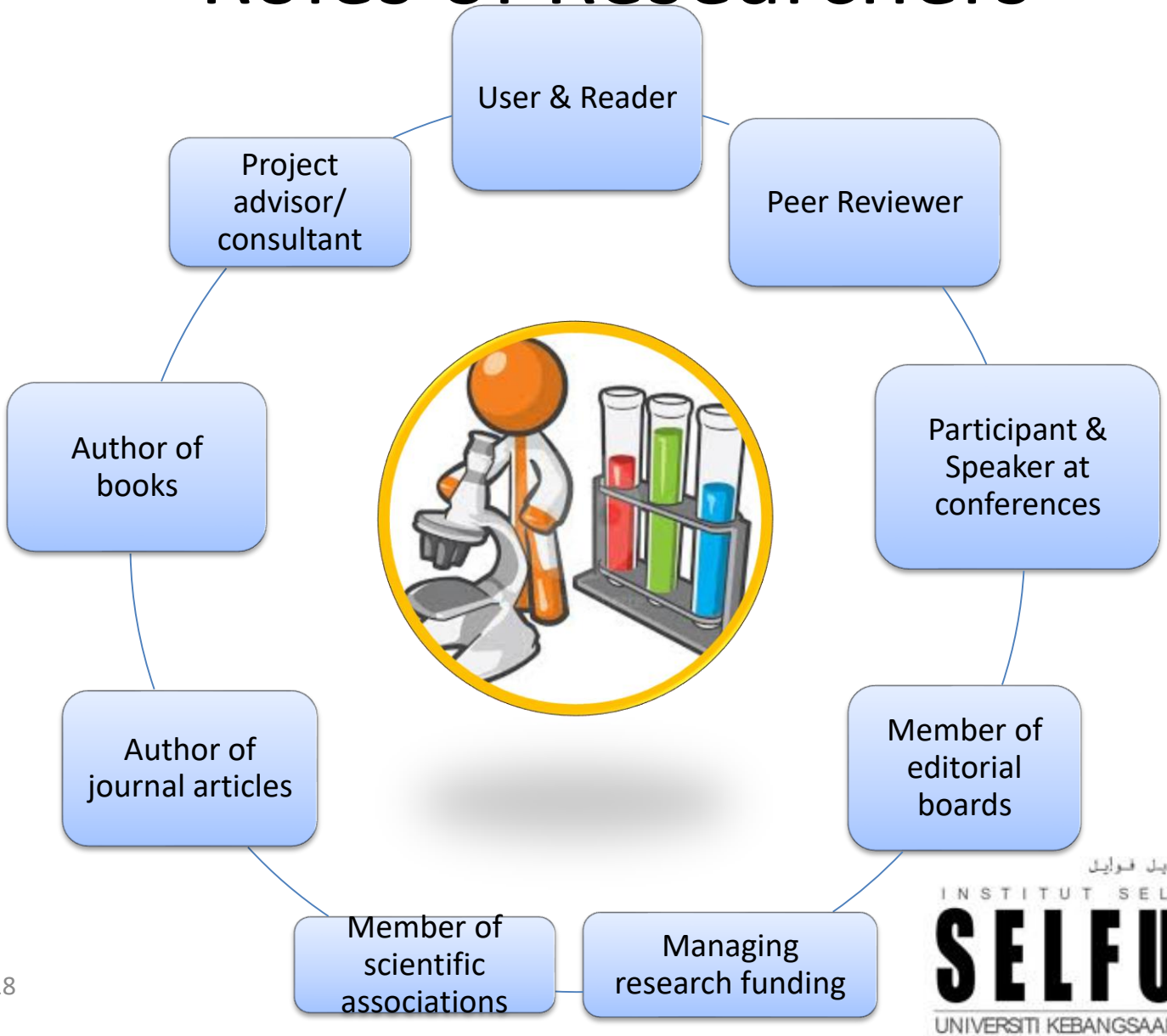
Roles of Researchers



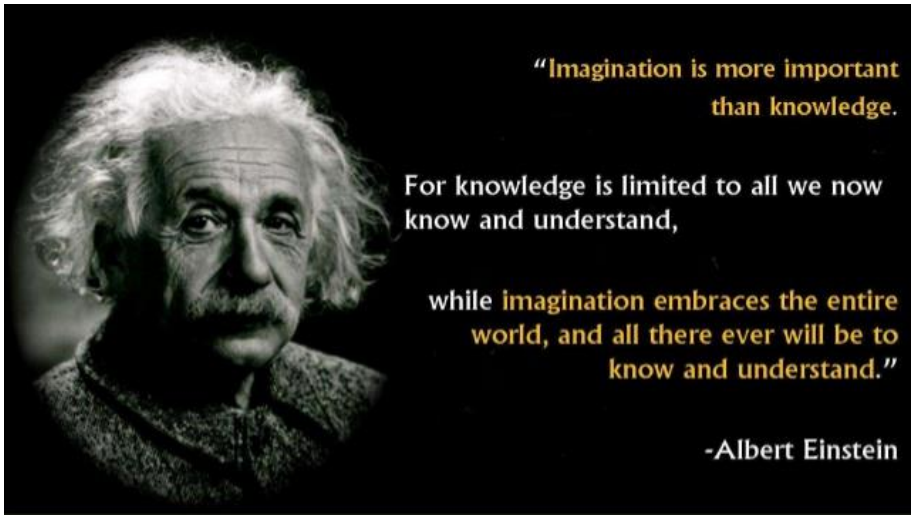
The Ability to Carry Out a Range of Professional Assignments

1. Define research subject
2. Gather information, techniques, studies from various literatures
3. Carries out experiments
4. Analyse & interpret research results
5. Prepare technical report
6. Take part in seminar or workshop

Requirement to be a Good Researcher

1. An analytical mind
   - Ability to constantly analying a variety of factors, reason for researching and find the appropriate methodology, when should this research take place? What are the appropriate questions to ask and how? What are the findings telling us? Why are they telling us that? How do I best communicate the findings?
   - Ability to work simultaneously
   - Good Imagination
2. Persistence

   - Persist when you believe in your ideas, and when others don't.



3. A people person
   - Teamwork skill
   - Friendly
4. The ability to stay calm
   - Problem with data set, deadlines, technical problem – keep focus and think logically
5. Intelligence
   - Critical analysis with common sense
   - Open minded and keep up with new information and techniques.
6. Curiosity
7. Quick thinker
   - Things don't always go with your plan so you need to be able to think fast
8. Commitment
   - Committed/ dedicated to the research

9. Excellent written and verbal communication skills
   - Ability to communicate/ sell your research
10. Sympathetic
   - Ability to listen respondents' moans and groans
11. Systematic
   - Ability to timely check the work
   - Working systematically
   - Ability to ensure that data is accurately presented and reported
12. Be positive
   - Do not afraid of failure
13. Ethics/moral
14. Self-motivation
15. Integrity
   - Keep your promises and agreements; act with sincerity; strive for consistency of thought and action.

16. Planning
17. Flexibility
18. Enthusiasm
19. Independent
20. Hopeful
21. Determination
22. Honest

Quiz 1

Log in to i-Folio to answer the quiz questions.

The attempt period is between 20th September 2018 to 4th October 2018

p/s: Please download and read the lecture note before answering the quiz questions. This quiz contributes to the overall marks for this course.

THE END