# The Research Process: Systems Development vs Research

Sandra Khan

7th September, 2018

Department of Computer Science
University of Guyana

# Outline

CSE/ISY/ITE 4100 – Course Learning Outcomes

Knowledge & Knowing

Research and the Research Process

# CSE/ISY/ITE 4100 – Research Project Course

What is the difference between:

- your Applied Project course
- your Research Project course?

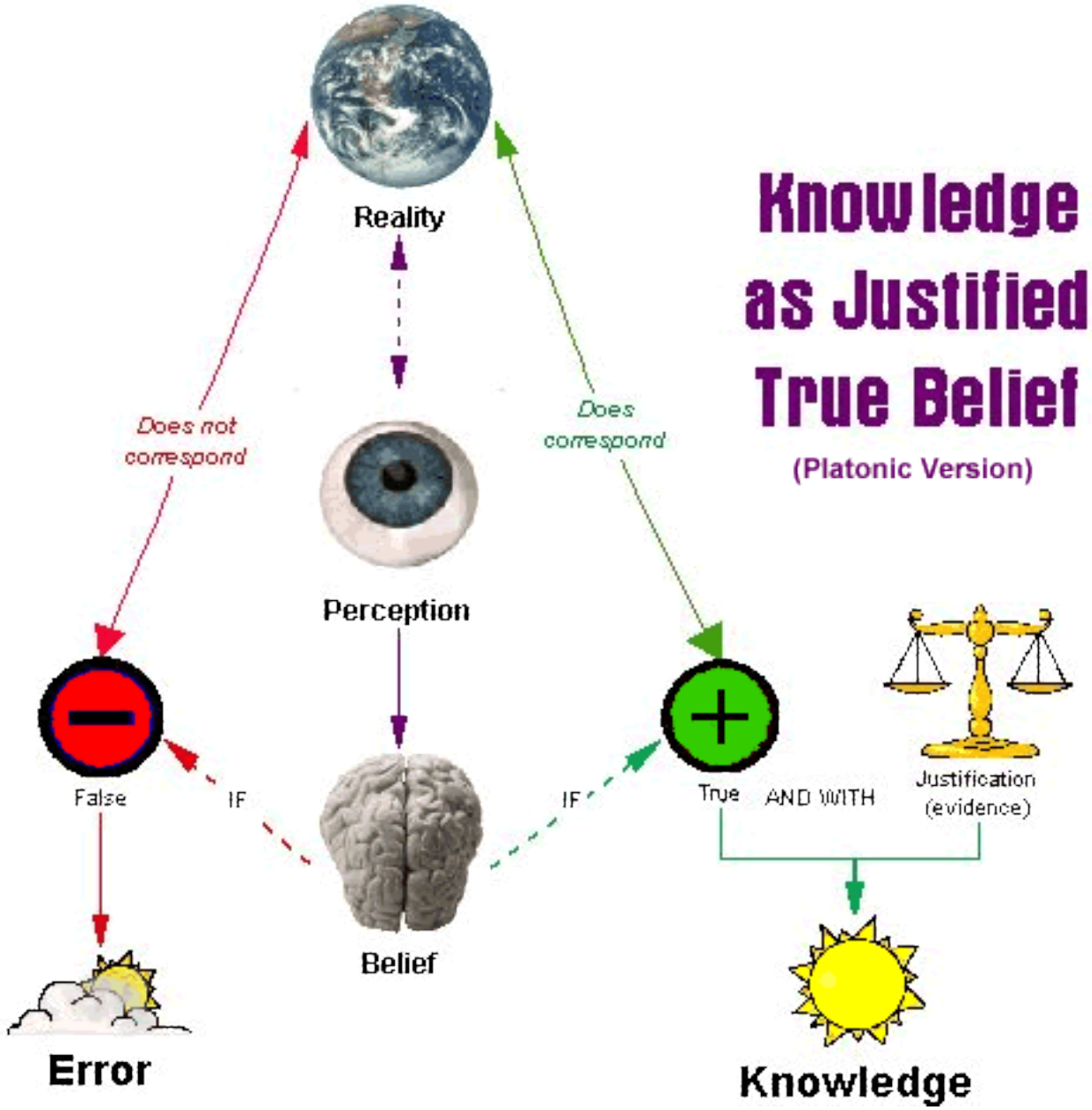
# CSE/ISY/ITE 4100 Learning Outcomes

By the end of this course students will be able to:

1. Describe the research process.
2. Critically analyse and review published literature in a chosen subject area
3. Document a detailed literature review in a chosen area of computer science
4. Prepare and present a detailed project proposal

# Knowledge

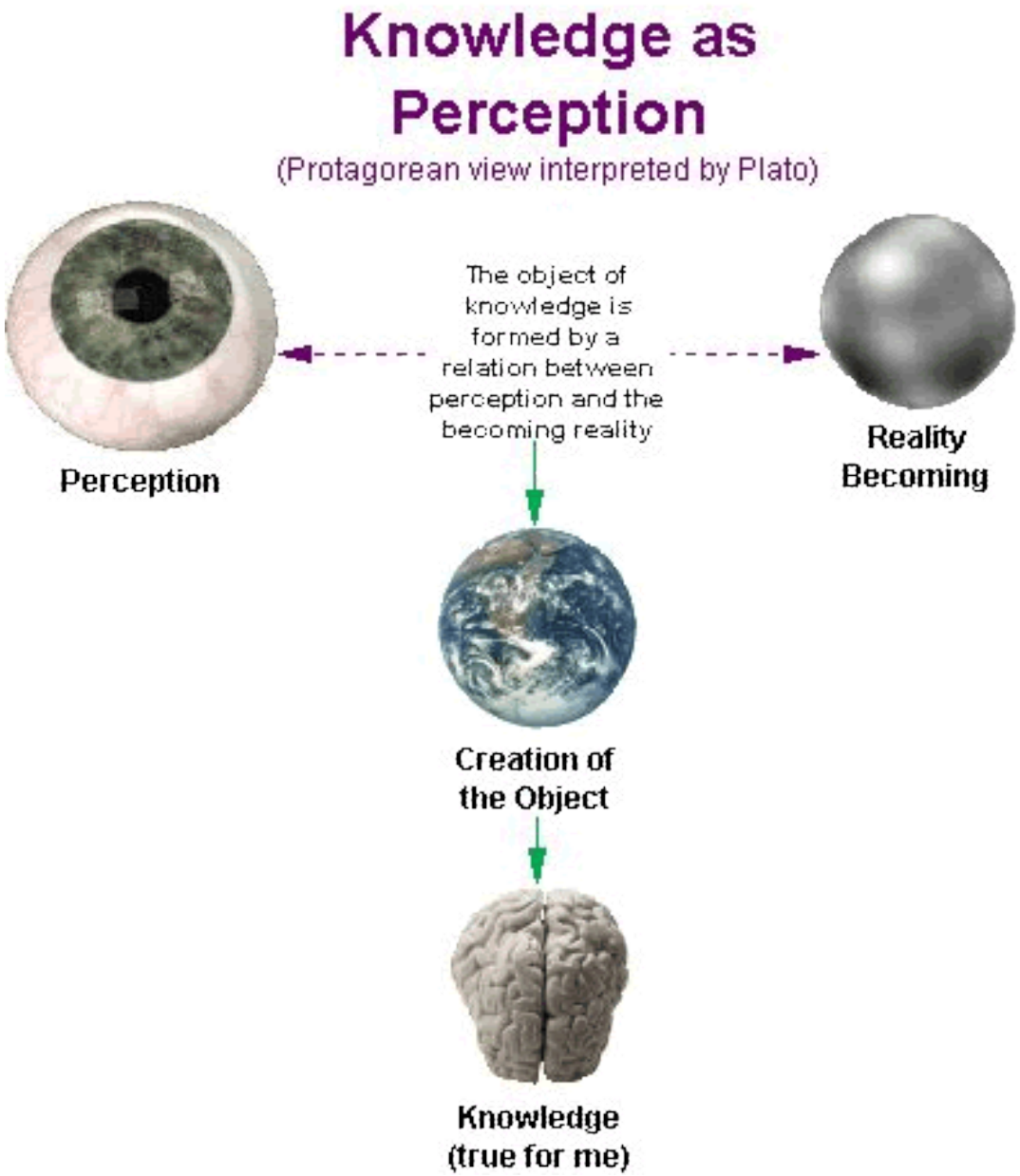
- What is knowledge?
  - Plato's definition of knowledge – Justified, true belief
- What is truth?




(Oregon State University, 2003)

# Knowledge

- How do we know?
  - Perception
  - Experience
  - Reason
- Can we rely on our senses? Beliefs?
- What do we really know?



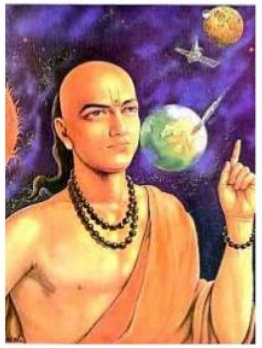

(Oregon State University, 2003)


# Nature of Knowledge

## Knowledge is Progressive

- Constantly changing
- Not static

## *Aryabhata*



- **Place value system and zero**

The place-value system, was clearly in place in Aryabhata's work. While he did not use a symbol for zero, the French mathematician Georges Ifrah argues that knowledge of zero was suggested in Aryabhata's place-value system as a place holder for the powers of ten with null coefficients.

- **Approximation of π**

Aryabhata worked on the approximation for **pi** (**π**), and may have come to the conclusion that it is irrational.

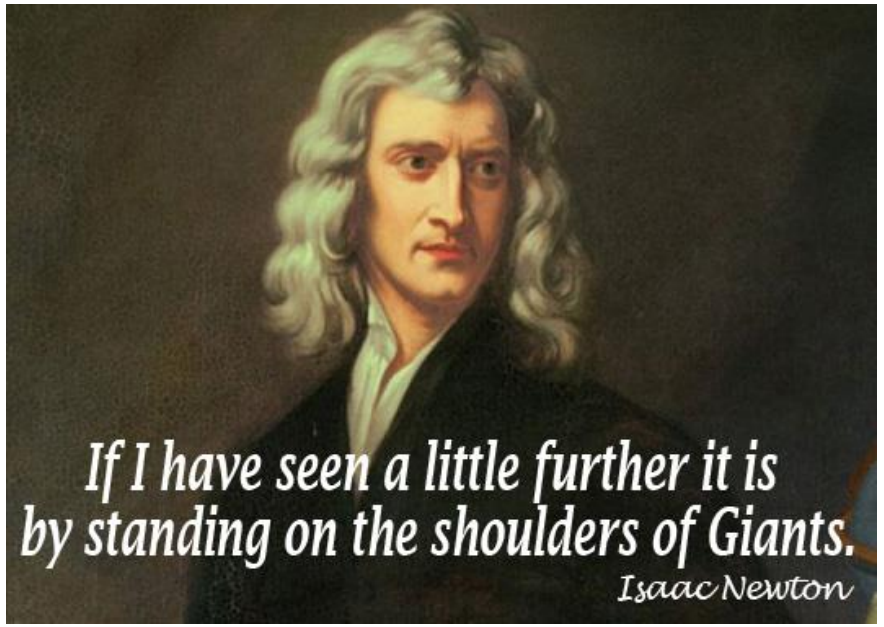
- **Trigonometry**

Aryabhata gave the area of a triangle as ***"for a triangle, the result of a perpendicular with the half-side is the area."***

# Nature of Knowledge – Knowledge is cumulative

- Indian Mathematics is the basis for the decimal counting system.
- Arabic Mathematics built upon the work of Indian mathematicians.
- And the European Renaissance was triggered by inflow of knowledge from the Baghdad House of Wisdom.

# Knowledge is cumulative



# Research

What is Research?

Why do we do Research?

How do we do Research?

# What is research?

- Research is a systematic investigation into a phenomenon of interest.

# Why Research?

# House of Wisdo

- IN the 830's the Abbasids opened "House of Wisdom" in Baghdad to meet the demand for knowledge
  - Housed books on subjects from all over the world
  - Translated works from the Greek philosophers Plato and Aristotle
  - Served as a center for

WHY: The Research Process generates knowledge

# Why Research?

1. Research is the means through which human civilisation advances its knowledge.

2. All industries, from healthcare to housing to transportation rely on research and experimentation to stimulate development in human lives.

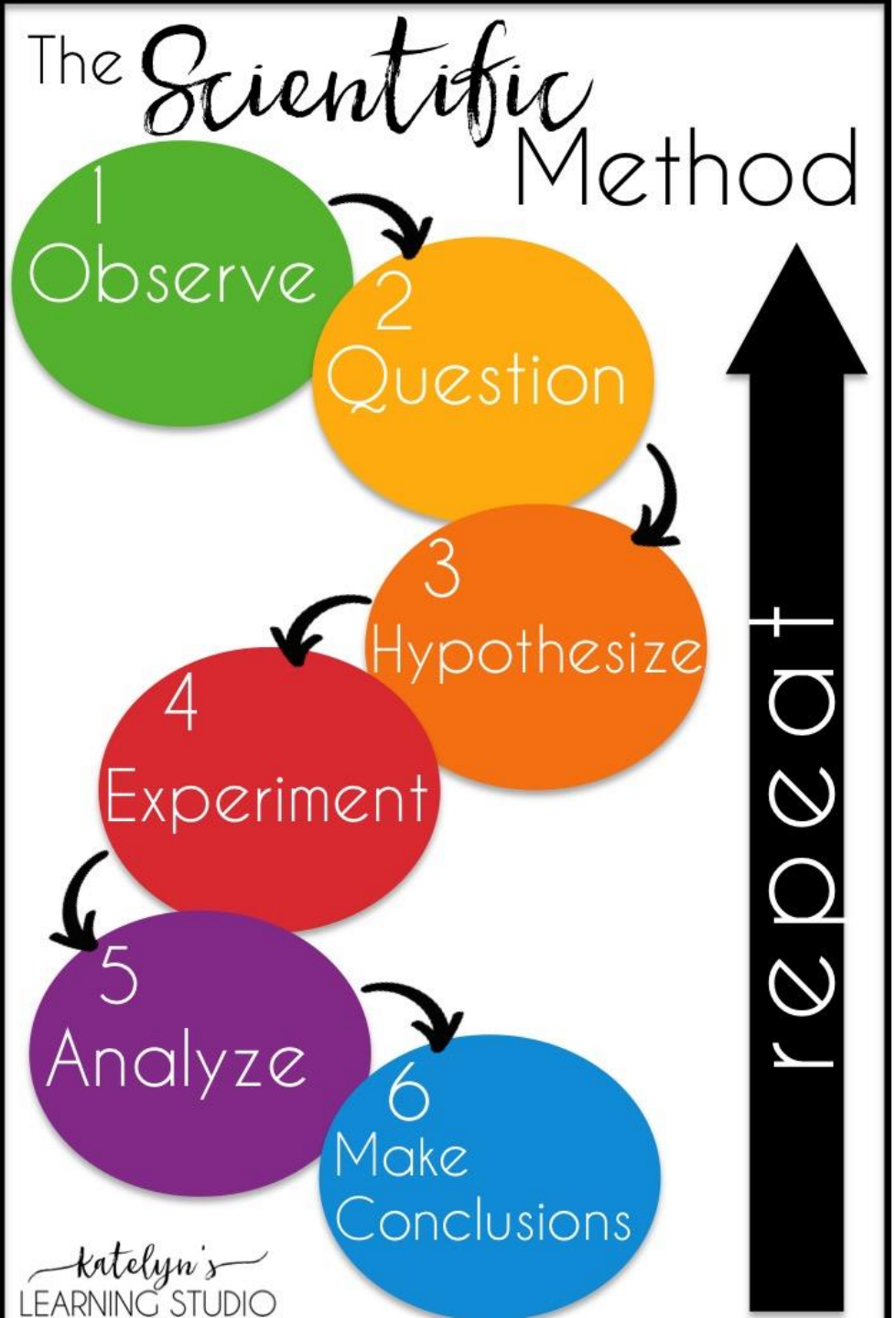
3. **New knowledge** leads to progress.

# How do we do research?

Academic Research, in all disciplines, is influenced by the Scientific Method

- scientific method
- *noun*
- **Scientific method** is an empirical method of knowledge acquisition, which has characterized the development of natural science since at least the 17th century, involving careful observation, which includes rigorous skepticism about what is observed

https://en.wikipedia.org/wiki/Scientific_method




# The Scientific Method

- Applied to Computer Science Research, Information Systems Research and Information Technology Research projects. Other approaches are used also eg Interpretive Research
- Design Science Research - Design science research involves two primary activities to improve and understand the behavior of aspects of Information Systems:

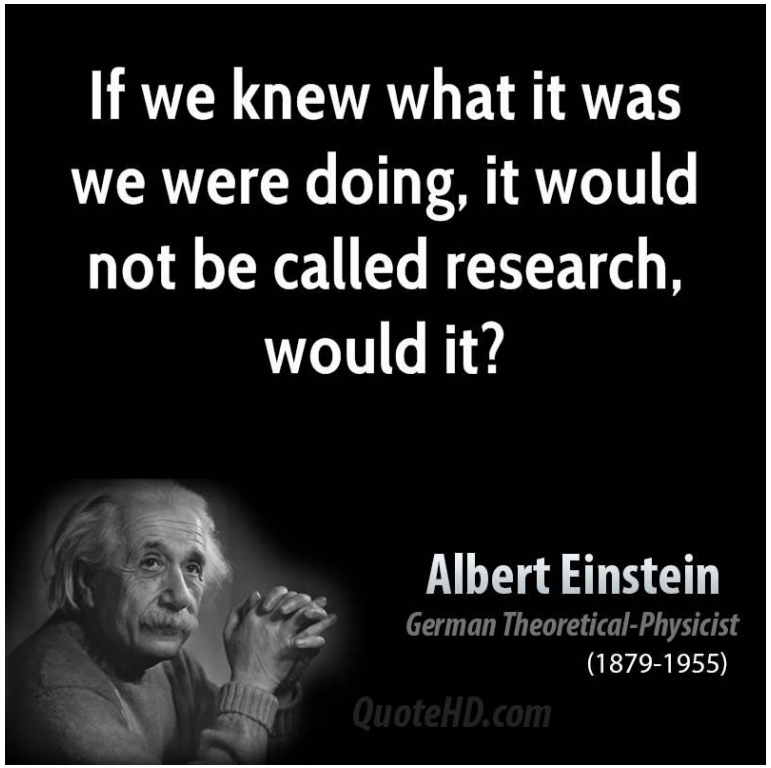
  (1) the creation of new knowledge through design of novel or innovative artifacts (things or processes) and

  (2) the analysis of the artifact's use and/or performance with reflection and abstraction.

  The artifacts created in the design science research process include, but are not limited to, algorithms, human/computer interfaces, and system design methodologies or languages.

(Vaishnavi, Kuechler & Petter, 2004/17)

# Nature of research work




Uncertainty is a major characteristic of the research process – feeling confused is normal

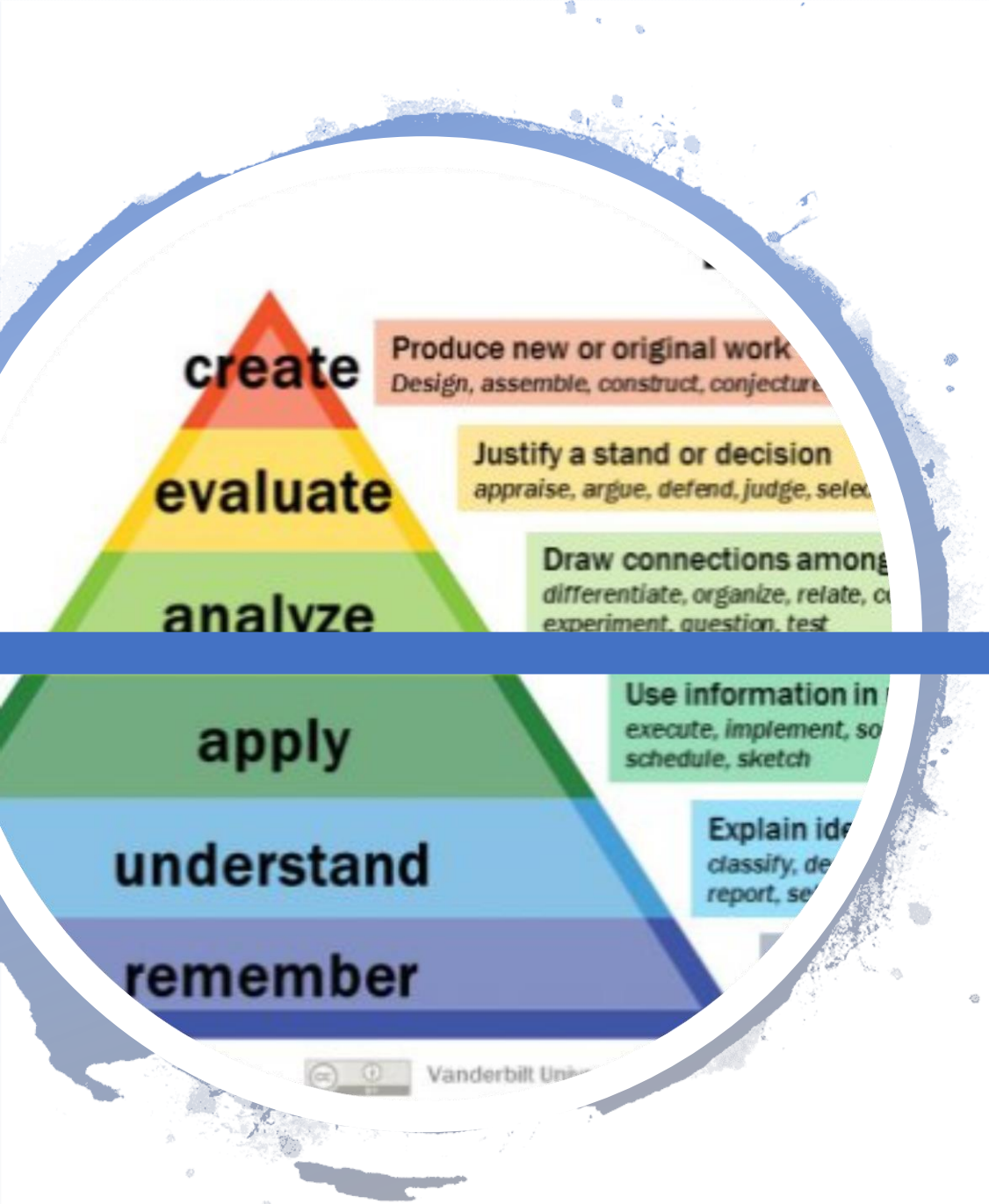
- Certainty, clarity and breakthroughs on the frontiers of knowledge are the rewards of the process.

# Research Process

1. Selecting your research area
2. Formulating research aim, objectives and research questions or developing hypotheses.
3. Conducting the Literature Review
4. Selecting the Methods of Data Collection
5. Collecting the Primary Data
6. Analysis of Data
7. Reaching Conclusions
8. Completing the Research

The choice between formulating research questions and the development of hypotheses depends on your research approach (positivist, interpretive or hybrid)

(Research-Methodology.net, 2018)




(Vanderbilt University, 2018)

Research operates at the higher levels of the taxonomy – Analyze, Evaluate, Create

Systems Development is application of knowledge.

# Summary

## Research

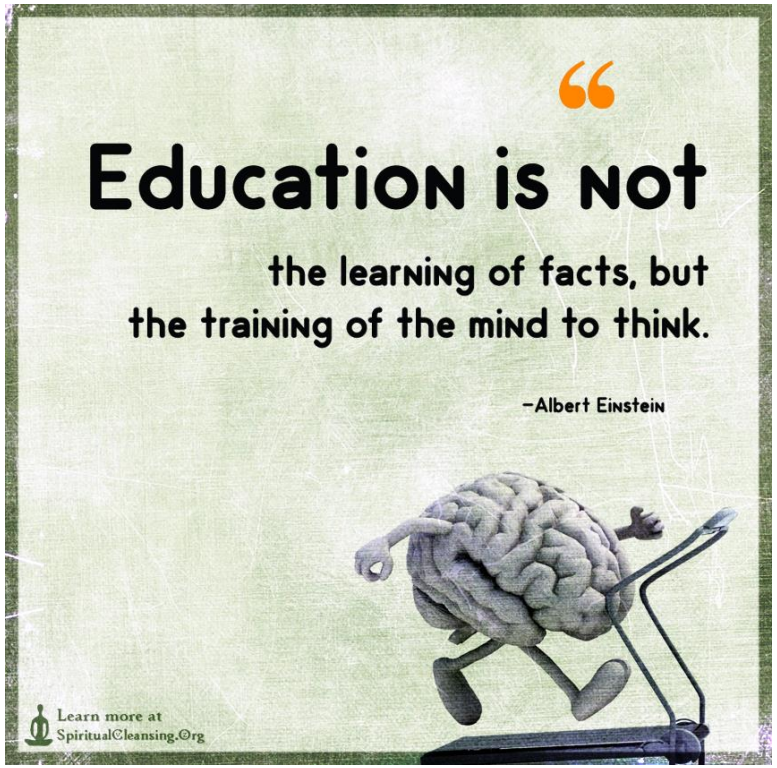
- Uncertainty – begins with questions
- Requires higher levels of learning, thinking
- Working on the frontiers of knowledge, adding knowledge
- May include a systems design and/or development effort

## Systems Development

- More certainty – begins with requirements
- Requires application level of thinking, learning
- Application of Body of Knowledge Areas to process data or generate information.

# References


- Bloom's Taxonomy. 2018. Vanderbilt University. Retrieved on 5th September, 2018 from https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/
- Oregon State Univerity, (2003). Protagoras of Plato. Retrieved on 7th September, 2018 from https://oregonstate.edu/instruct/phl201/modules/Philosophers/Protagoras/protagoras_plato_knowledge.htm
- Research Process. 2018. Retrieved on 5th September, 2018 from https://research-methodology.net/research-methodology/research-process/
- Scientific Method explained using Monty Python's "We Found A Witch" Retrieved on 4th September, 2018 from https://www.youtube.com/watch?v=zdVOZ8Gbf-c
- Vaishnavi, V., Kuechler, W., and Petter, S. (Eds.) (2004/17). "Design Science Research in Information Systems" January 20, 2004 (created in 2004 and updated until 2015 by Vaishnavi, V. and Kuechler, W.); last updated (by Vaishnavi, V. and Petter, S.), December 20, 2017. URL: http://www.desrist.org/design-research-in-information-systems/.




*Thank you. Enjoy the course.*