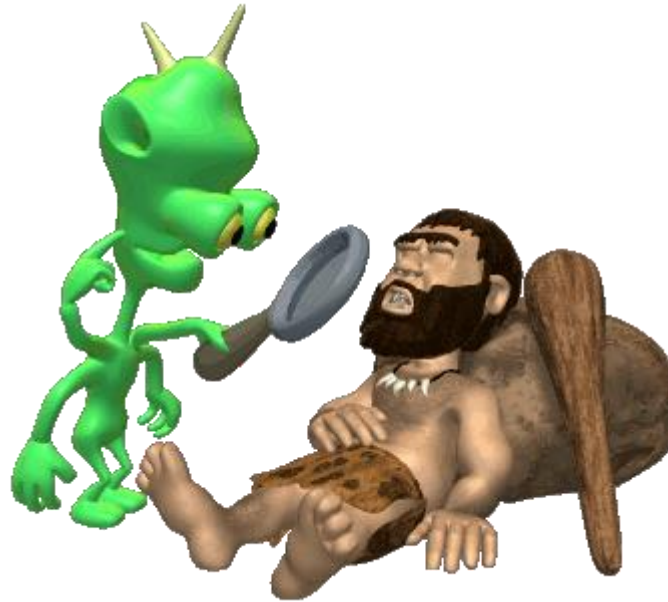


Research Methodology

Dr. Lway Faisal, IEEE, BScEng, MEng, PhD



- It is actually way more exciting than it sounds!!!!

Lecture on Scientific Research– 3rd year, academic year 2014-15



Aztec Pyramide

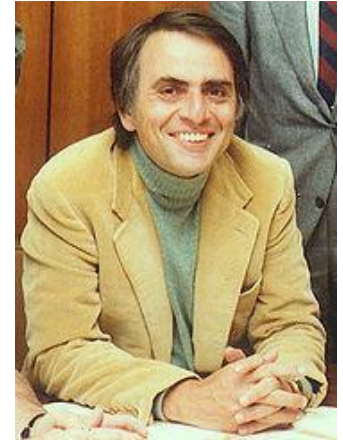


Researcher's work in graphic form

Rresearch - Definition

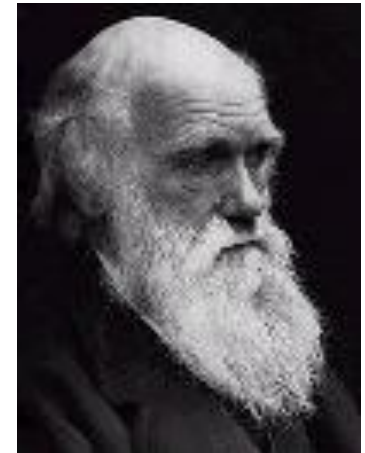
It is understood as systematic, controlled, and critical investigation of hypothetic statements on supposed relationships among phenomenon.

Carl Sagan (astronomies)



Science is composed of aggregated facts from which one can create general laws and conclusions

Charles Darwin



Definitions of Research

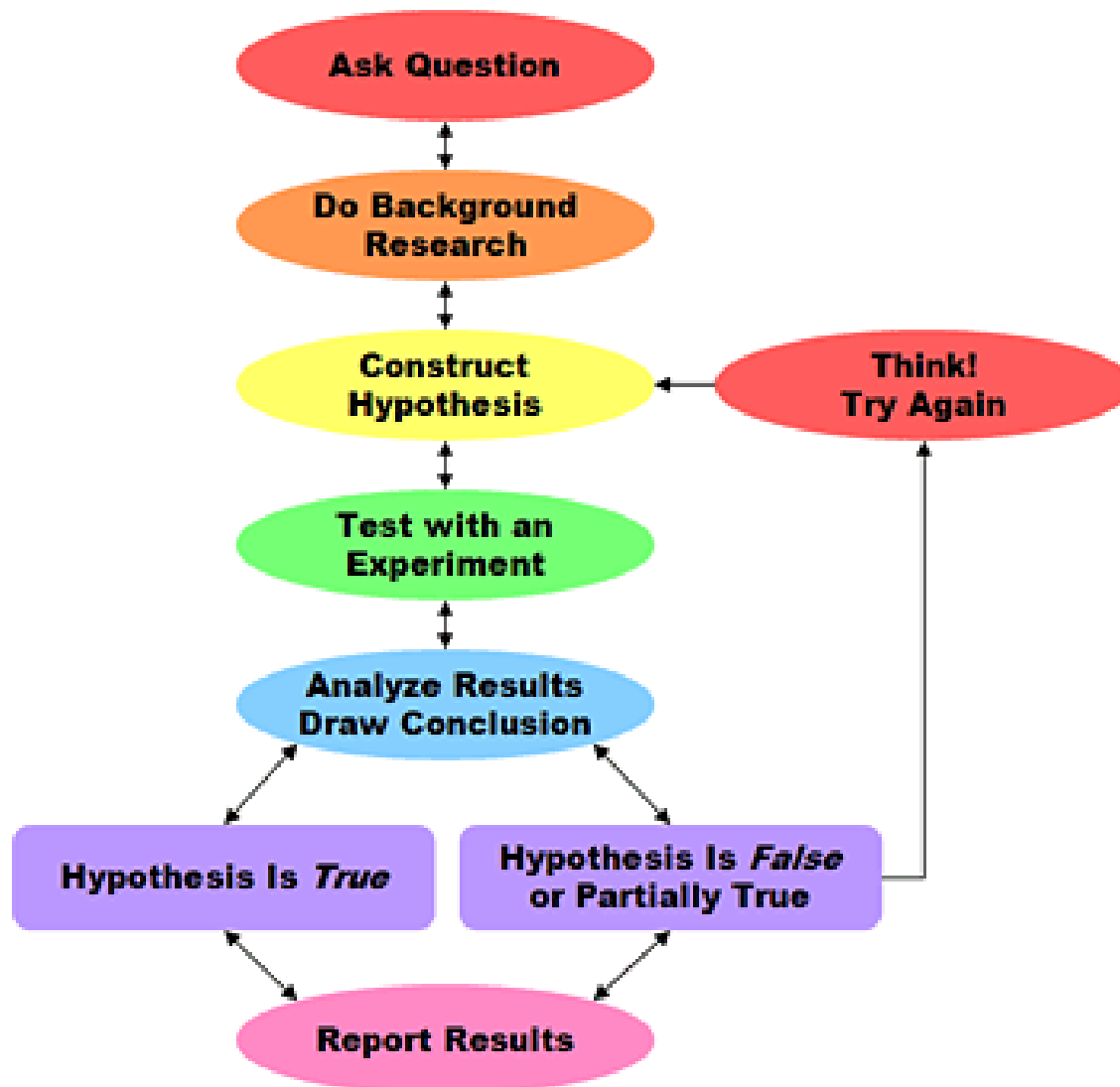
- The main goal of research is the gathering and interpreting of information to answer questions (Hyllegard, Mood, and Morrow, 1996).
- Research is a systematic attempt to provide answers to questions (Tuckman, 1999).
- Research is a systematic way of asking questions, a systematic method of inquiry (Drew, Hardman, and Hart, 1996).

Phases of research process

I. Phase of concepcion

- 1st phase of research process
 - phase in which **content and structure** of research are created
- Conceptualisation refers to the process of developing refining abstract ideas.
 - It is composed of 4 steps:
 - 1) Formulation and set bounds of research problem
 - 2) Searching and review the literature
 - 3) Development of theoretical construction of the future research
 - 4) Creation of hypothesis





Activity Plan

Activity	Month/ week/Days											
	1	2	3	4	5	6	7	8	9	10	11	12
1	X	X										
2		X		X		X		X		X		
3			X	X	X							
4				X	X	X	X	X				
5							X	X	X	X		
6										X	X	X



Where to search?

Sources:

- Books
- Journals
- Electronic resources: online and offline

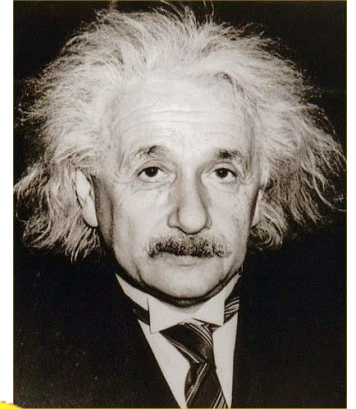
How to write the literature review

- Write under themes
- Some may follow chronological order
- Highlight your arguments
- Provide references

1st step: Formulation and set framework of research problem

Einstein:

If I have one hour for solving the problem, than I will devote 40 minutes to study the problem, 15 minutes to analyse it, and only 5 minutes to solve it



1. How the research problem is formulated

- accidental observation of phenomenon which we are not able to explain → **curiosity**
 - formulation of questions (why and how the phenomenon originated) →
 - considerations on possible cause(es) of the phenomenon:
 - **study of literature**
 - **personal experience of researcher**
- Refinement of research problem
- formulation of first draft of research problem
 - considerations whether the research problem is solvable:
 - if yes – than **what kind of methods should be used**
 - if no – it is necessary to go back and start to think by another way



2.Looking for informations related to research problem in literature

The aim of this step:

- to find the „older“ and current informations related to the research problem

Result of this process is more precisely defined research problem or the research problem is rejected



3. Development of the theoretical construction for solving the research problem

Main aims: Thinking – on the content of future research
– on its timing and structure
– on the necessary conditions

Good virtual model of future research will save time, money and decreases probability of stress and mistakes during research

Necessary conditions:

- the research problem is clearly defined
- the technical and personal conditions are available
- the social, legal and ethical views are known
- the main aims are defined

Result of this step: - clear framework for solving the research problem

4) Formulation of hypothesis

A well-thought-out and focused research question leads directly into hypothesis

- Creation of rational assumption on the possible cause(es) of the observed phenomenon
- Creation of the questions focused to the essence of the research problem

Characteristics of good hypothesis:

- gives insight into research questions
- is testable and measured by the proposed research
- springs logically from the experience of the staff

The goal of science is to find an explanation for why the facts are as they are. Such an explanation is a hypothesis



One of the most exciting events in science is to predict the results of an experiment not yet performed if the hypothesis is valid and then to perform the experiment

The hypothesis that the experimental treatment had no effect is called the null hypothesis

II. Constructing an instrument for data collection

Data collection methods:

- *Primary sources*
- Observation
- Interview
- Questionnaire
- *Establish the validity of the selected instrument*

Selecting a sample

- “Process of selecting a few from a bigger group”
- Bigger group is the population and the selected few is the sample
- Larger the sample size the more accurate will be the findings



Empiric phase

The aim of this phase is production of results, collection of data, and their preparation for next analysis

The results are produced by:

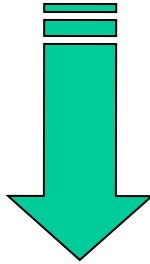
- experiment on animals
- by clinical study
- by using questionnaire, interview, observation
- by using models - biological, electronic, mathematic....



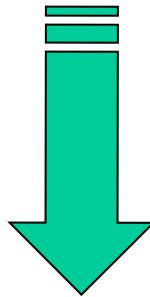
Theory vs. Hypothesis

- Hypothesis
 - A belief or prediction of the eventual outcome of the research
 - A concrete, specific statement about the relationships between phenomena
 - Based on deductive reasoning
- Theory
 - A belief or assumption about how things relate to each other
 - A theory establishes a cause-and-effect relationship between variables with a purpose of explaining and predicting phenomena
 - Based on inductive reasoning

Hypotheses



Theories



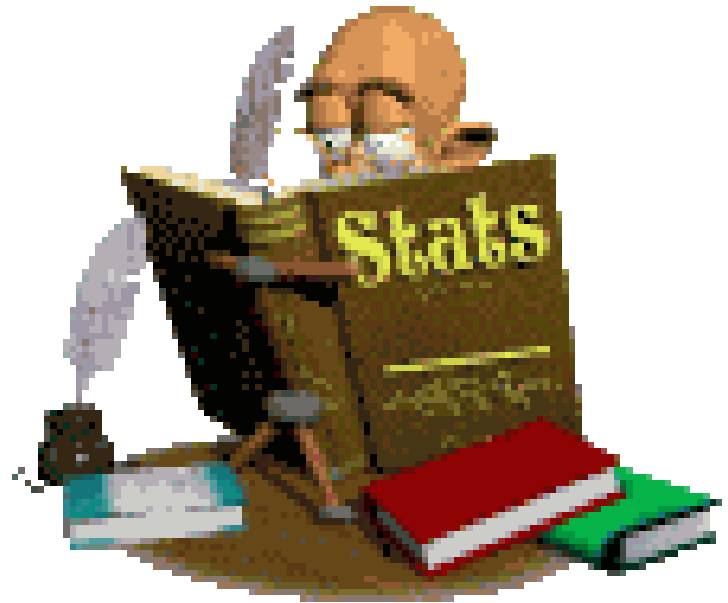
Laws

In an ideal world...



Research Classifications

- System #1:
 - Basic research
 - Applied research
- System #2:
 - Quantitative research
 - Qualitative research
- System #3:
 - Experimental research
 - Nonexperimental research



Basic vs. Applied Research

- Basic
 - Pure, fundamental research
 - Discovery of new knowledge; theoretical in nature
 - Takes many years for the results of basic research to find some practical utility
- Applied
 - Central purpose to solve an immediate problem
 - Improved products or processes
 - Infers beyond the group or situation studied
 - Interpretation of results relies upon Basic research

Quantitative vs. Qualitative

- Quantitative
 - Numerical, measurable data
 - Traditional or positivist approach
 - Clearly stated questions
 - Rational hypotheses
 - Developed research procedures
 - Extraneous variable controls
 - Large samples
 - Traditional, statistical analyses
- Qualitative
 - Generally non-numerical data
 - Typically anthropological and sociological research methods
 - Observations of a “natural” setting
 - In-depth descriptions of situations
 - Interpretive and descriptive

Experimental vs. Nonexperimental

- Experimental
 - Cause-and-effect
 - Extraneous variable controls
 - 3 fundamental characteristics
- Nonexperimental
 1. Causal-comparative
 2. Descriptive
 3. Correlational
 4. Historical

Descriptive Statistics



- Just describes sets of data.
- You might create a frequency distribution.
- Frequency polygons or histograms.

Central Tendency

- Mean, Median and Mode.
- Watch out for extreme scores or outliers.

Let's look at the salaries of the employees at Dunder Mifflin Paper in Scranton:

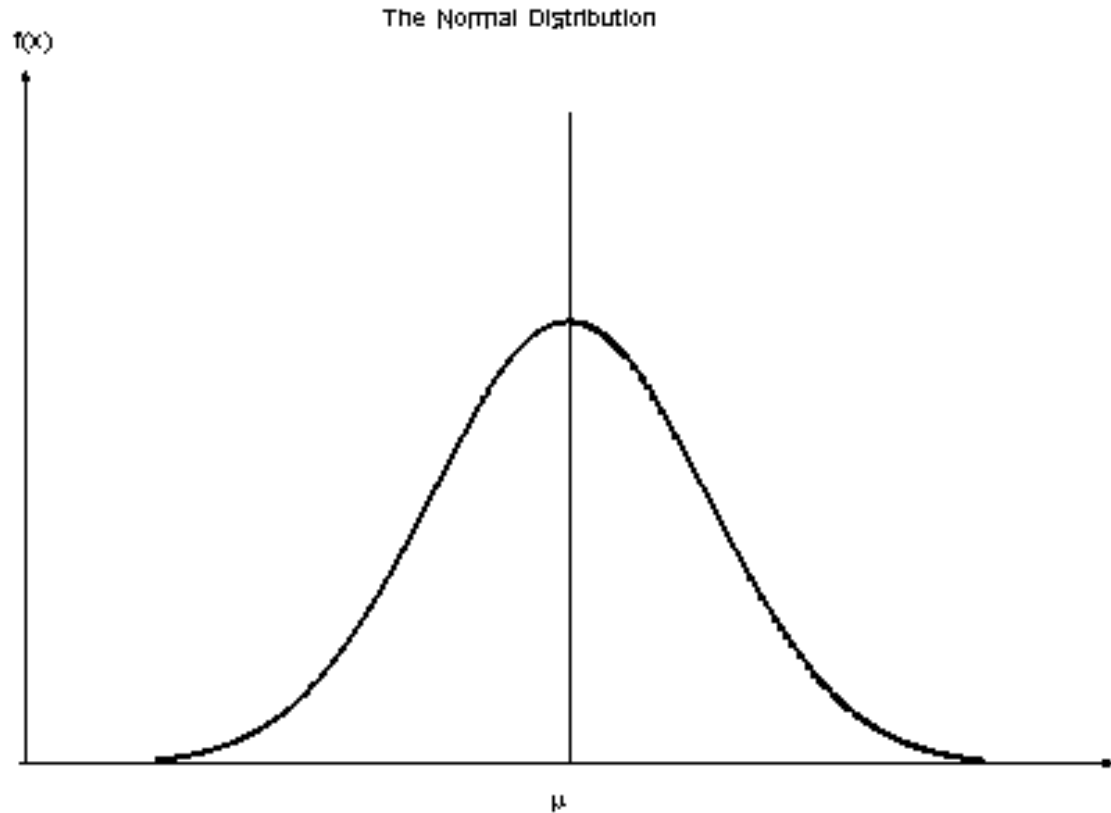
\$25,000- Pam
\$25,000- Kevin
\$25,000- Angela
\$100,000- Andy
\$100,000- Dwight
\$200,000- Jim
\$300,000- Michael

The median salary looks good at \$100,000.
The mean salary also looks good at about \$110,000.
But the mode salary is only \$25,000.
Maybe not the best place to work.
Then again living in Scranton is kind of cheap.



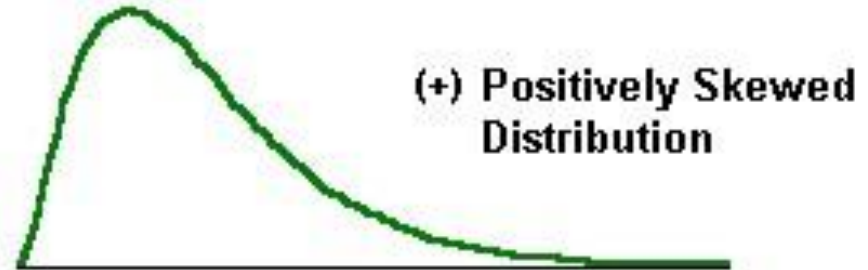
Normal Distribution

- In a normal distribution, the mean, median and mode are all the same.



Distributions

- Outliers skew distributions.
- If group has one high score, the curve has a positive skew (contains more low scores)
- If a group has a low outlier, the curve has a negative skew (contains more high scores)



Other measures of variability

- **Range:** distance from highest to lowest scores.
- **Standard Deviation:** the variance of scores around the mean.
- The higher the variance or SD, the more spread out the distribution is.

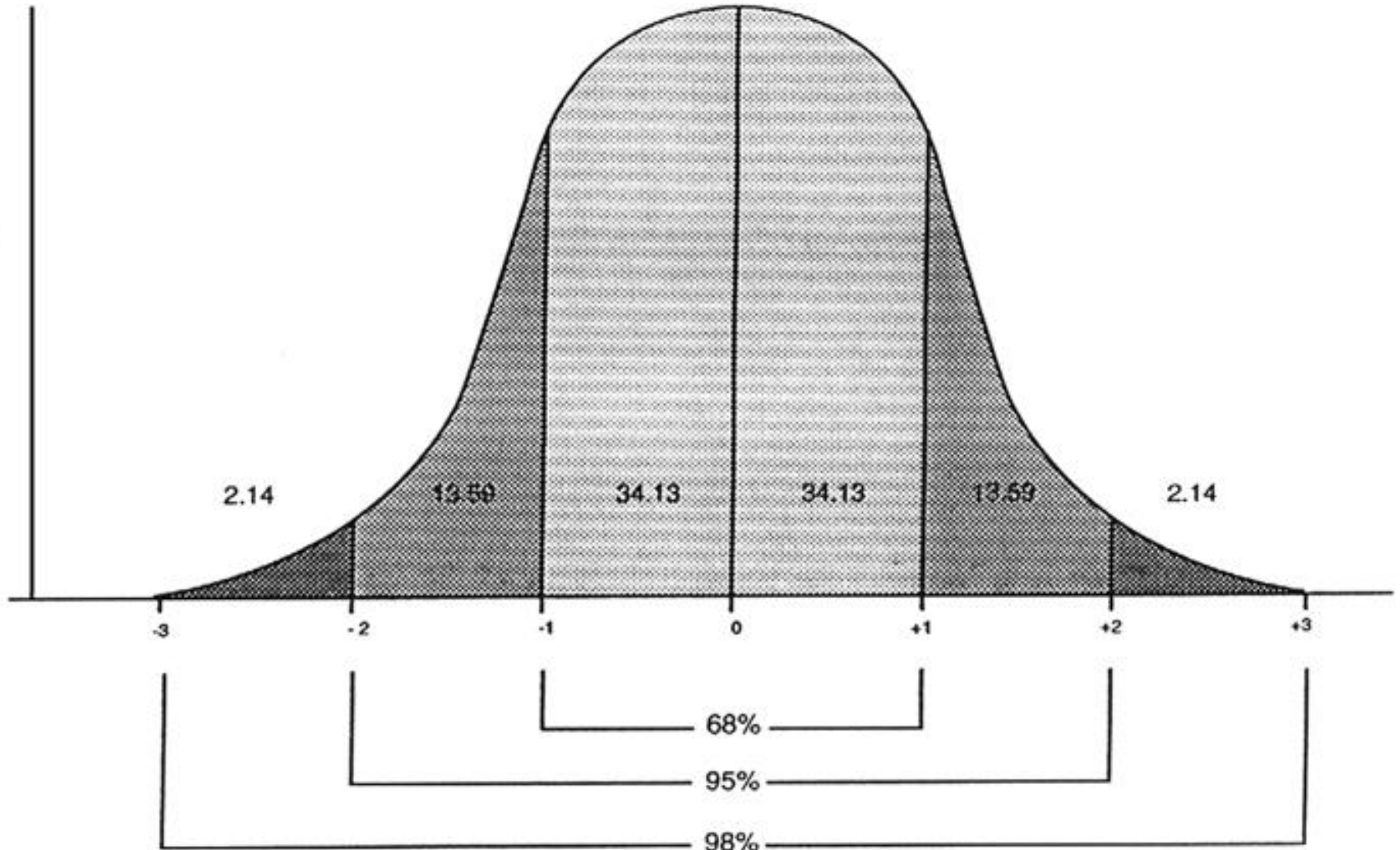


Z Scores



- A unit that measures the distance of one score from the mean.
- A positive z score means a number above the mean.
- A negative z score means a number below the mean.

Normal Distribution





Role of your academic advisor
Dr. Lway Faisal

Your
teacher
can
open
the
door,
but
you
must
enter
by
yourself