COMP320: Research Practice

1: Intro to the final year project

Learning outcomes

- **Explain** the aims and expectations of the final year project
- **Select** appropriate methodologies to conduct scholarly research
- **Recall** Falmouth University's policy on research ethics and the procedure for obtaining ethics approval

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Final year project

BCS guidelines

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- **critical self-evaluation** of the process

Final year project assignments

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  - Research review and proposal

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  - Research review and proposal
- In COMP360 (next study block):
  - Research artefact
  - Dissertation

Deliverables

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- Week 2: Brief project proposal

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- Week 4: Research ethics Approval Form

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- Week 13 (after xmas): Presentation on Proposal, Prototype, and Preliminary Results

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- Week 13 (after xmas): Presentation on Proposal, Prototype, and Preliminary Results
- Formative deadlines: check MyFalmouth

Note on Presentations

The submission of the literature review and proposal in **Week 10** is worth 70% of the module. Or, 11.6% of the overall degree classification. Please do not neglect it!

It will require considerable effort to read the literature, refine your question, and propose a sound research design!

Note on Presentations

Presentations will be delivered to `non-domain' experts. These are research-active staff who will be outside of your field. Present your materials as-if writing for a competent computing professional who is unfamiliar with your specific field.

Research Review and Proposal

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  - 6 pages $\approx$ 6000 words

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- Present any **preliminary results** you obtain this study block

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  - A tool to be evaluated
- Discuss with your supervisor to decide what is appropriate

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Research ethics

Research ethics

Research involving people is premised on a fundamental moral commitment to advancing human welfare, knowledge, and understanding, and to examining cultural dynamics

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- Privacy and data protection
- Promoting high quality research

Falmouth University research ethics policy

- Find and read the following documents on LearningSpace:
  - Falmouth University Research Ethics Policy
  - Research Ethics Approval Application Form

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- You **must** fill the form in, even if your project does **not** involve human subjects (though in this case it will be easy to fill in)

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- Bring a draft of your **ethics approval form** to the meeting in Week 4

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What is science?

"*Science and everyday life cannot and should not be separated.*"

Rosalind Franklin (1920 – 1958)

English Chemist and X-ray crystallographer

Image: https://commons.wikimedia.org/wiki/File:Rosalind_Franklin_CC-BY-SA.png

What is science?

Some common misconceptions

- Science is a collection of facts; ×
- Science is the creation of new gadgets; ×
- Scientific ideas are absolute and unchangeable; ×
- Scientific ideas are subject to change, therefore unreliable; ×
- Observations give answers directly to the scientists; ×
- Science **proves** stuff; ×
- Science can only **disprove** stuff; ×
- The scientist works to **show** that his/her theory is right; ×

- Facts *vs* hypotheses *vs* theories *vs* laws;

Essential reading: Common Misconceptions About Science: `http://goo.gl/TN7k9B`

Image: `http://xkcd.com`

What is science?

A good operational definition

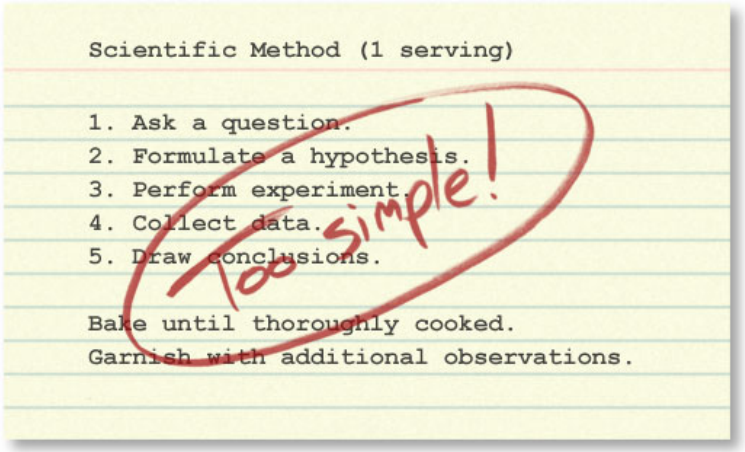
> *"What do you think science is?*
> *There's nothing magical about science.*
> *It is simply a systematic way for carefully*
> *and thoroughly observing nature and*
> *using consistent logic to evaluate results."*
>
> – Steven P. Novella

Image: http://www.relativelyinteresting.com/definition-science-steven-novella/

What is science?

The scientific process

- Normally shown as a flowchart or a sequence of steps;
- Oversimplification of a complex and iterative process;
- Suggests an “end” to the process.

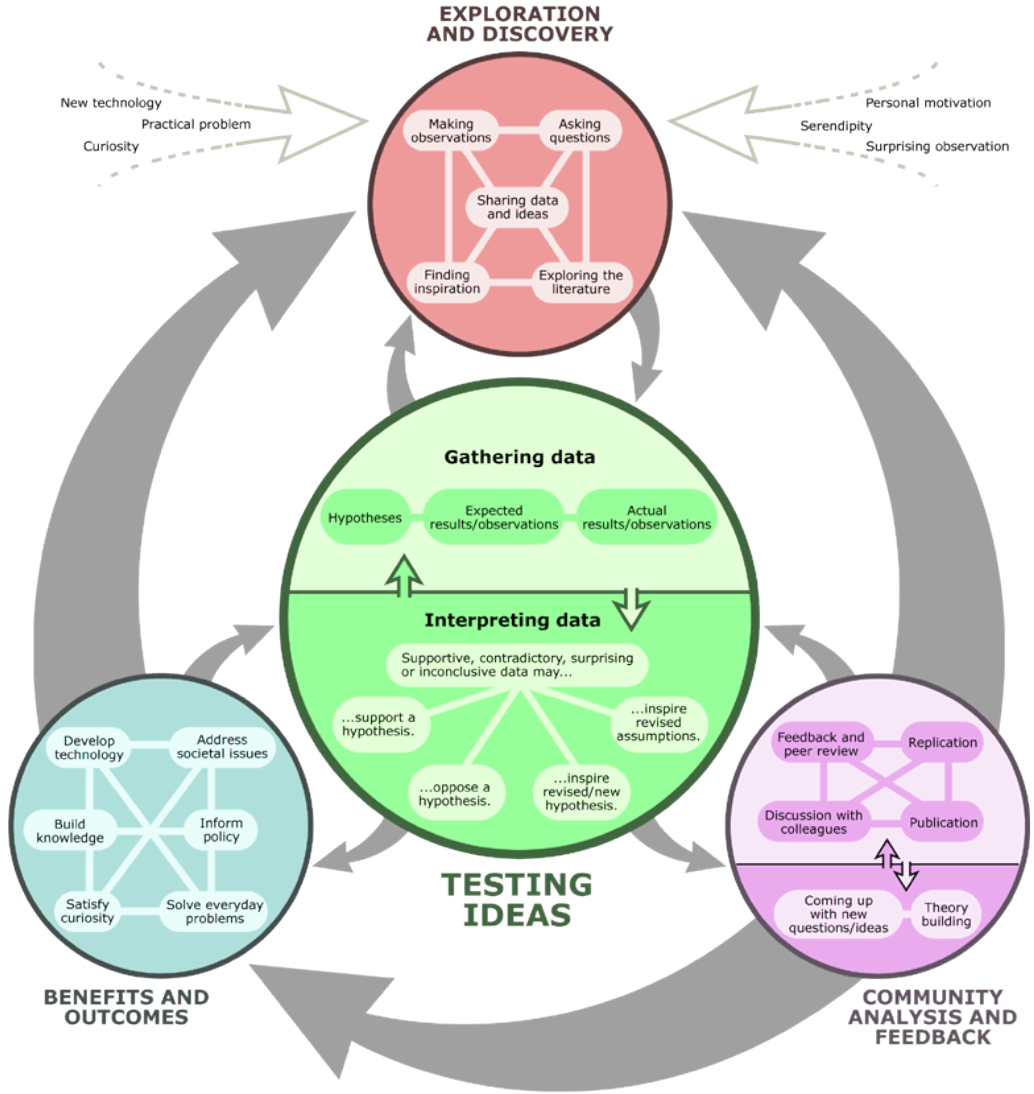


- Actually includes:
  - Several activities, performed at different stages;
  - Interaction with the scientific community;
  - Creative, “outside the box” thinking;
  - Preliminary conclusions, subject to revision as new and better data become available;
  - Learning from failures as much as from successes.

Image: `http://goo.gl/7cCGaz` - (c) Understanding Science, 2015. Used with permission.

What is science?

The scientific process



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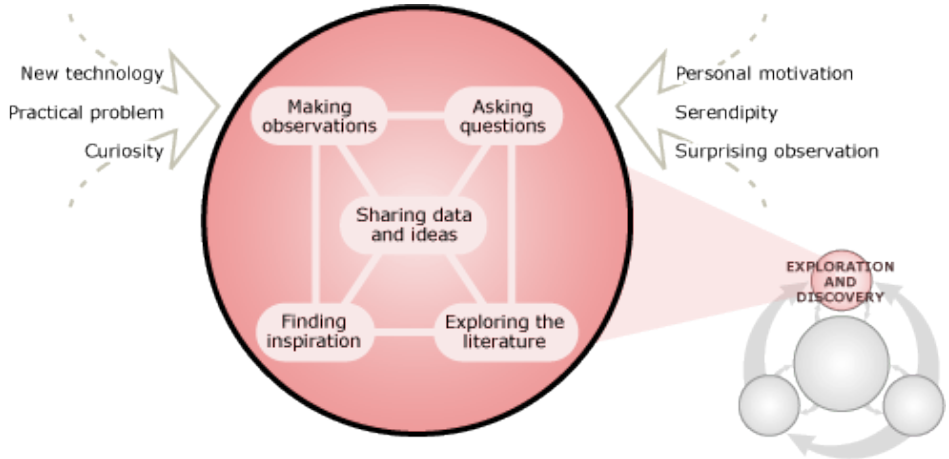
What is science?

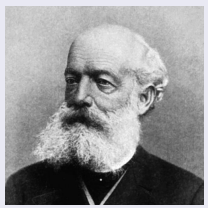
The scientific process

"*Dans les champs de l'observation le hasard ne favorise que les esprits préparés.*" – **Louis Pasteur** (Univ. Lille, France, 1854).

- Observations $\rightarrow$ **questions**;
- Exploratory experimentation;
- Preparation + serendipity.



Benzene (1865)

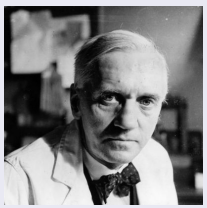


Kekule

Radioactivity (1896)

Becquerel

Penicillin (1928)



Fleming

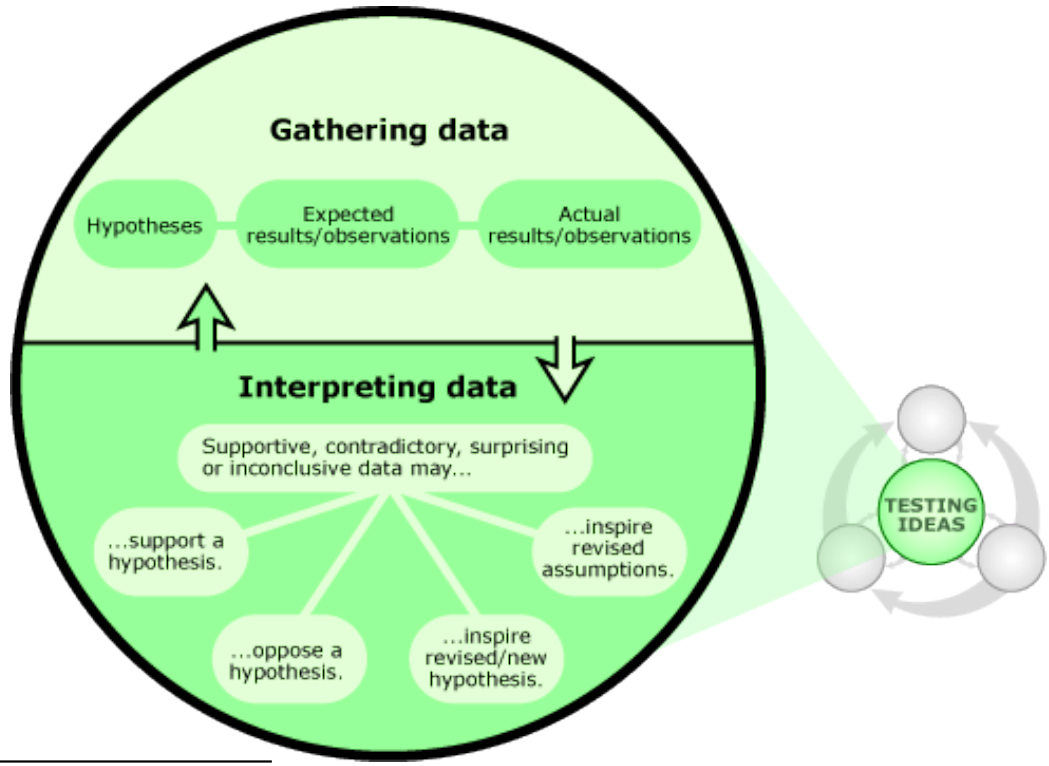
Top image: `http://goo.gl/fy8Glh` - (c) Understanding Science, 2015. Used with permission.

Scientists: `http://goo.gl/SG6sgp` | `http://goo.gl/rhLC9C` | `http://goo.gl/CFj8Ml`

What is science?

The scientific process

- Drawing and testing hypotheses;
- Comparing alternative explanations;
- Accepting / rejecting ideas based on **evidence**;
- **Predictions** *versus* **observation**: corroboration or refutation?



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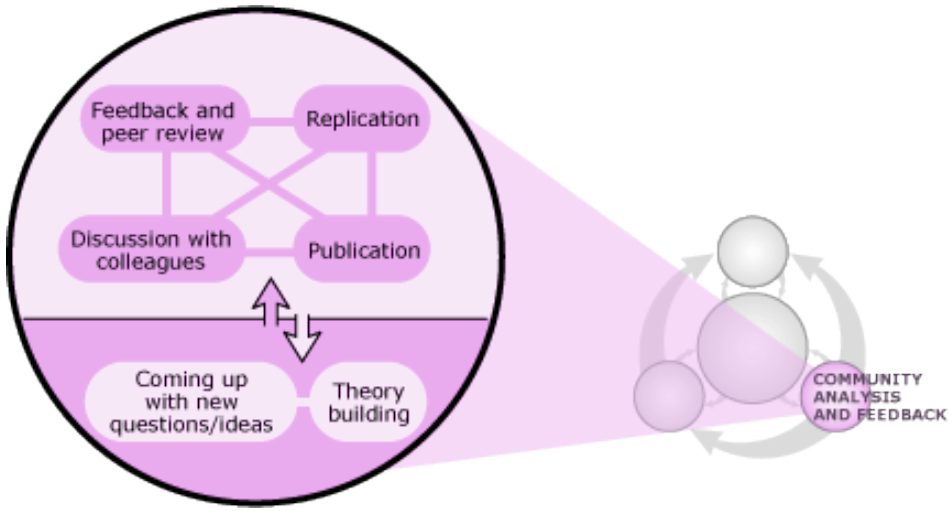
What is science?

The scientific process

Interaction with the scientific community is **fundamental**:

- Colleagues;
- Collaborators;
- Reviewers;
- Rivals;

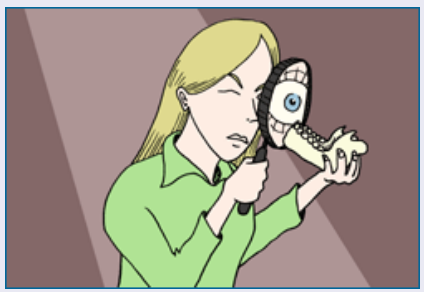


This interaction plays essential roles for the progress of research:

Criticism

Inspiration

Vigilance



Motivation

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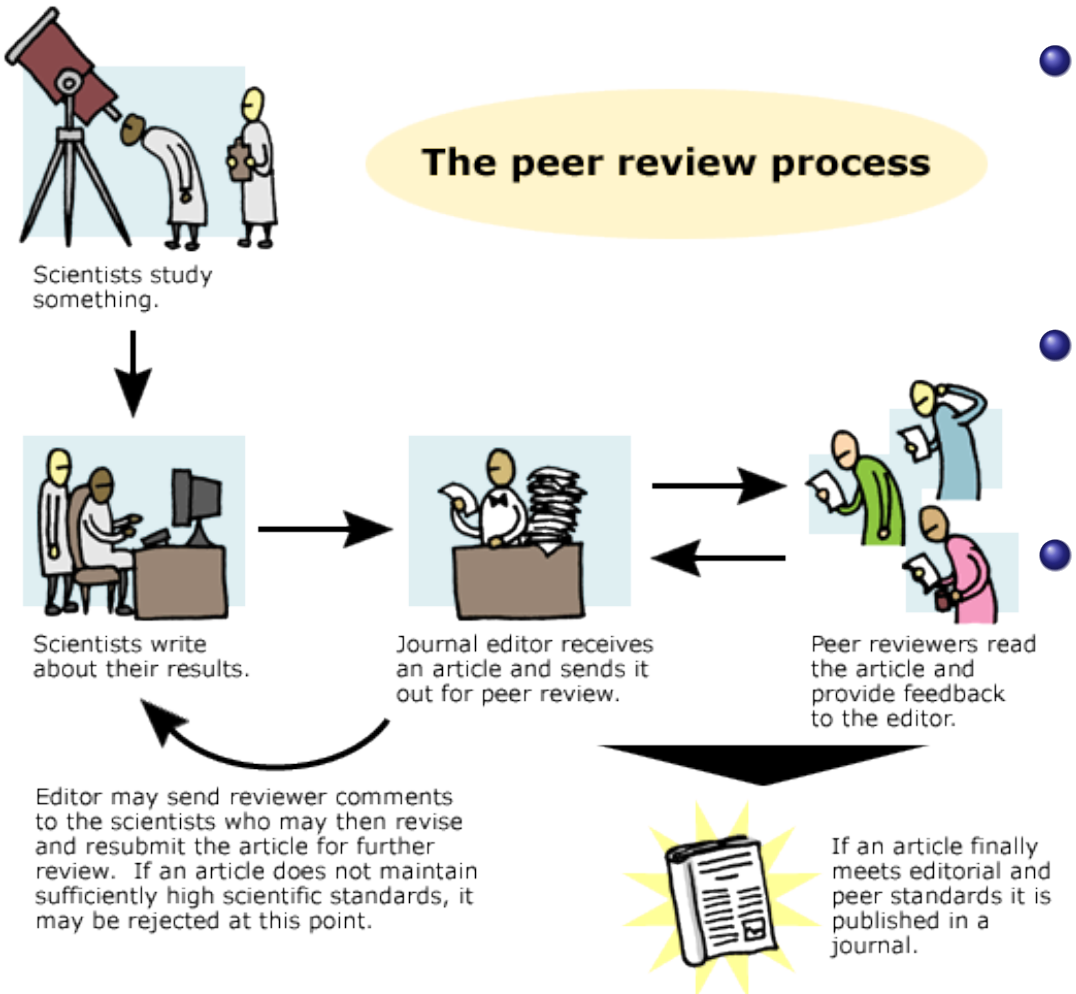
What is science?

The scientific process

Publication and peer review.



- Additionally, *post-publication review* by the wider scientific community;
- **Replication** and verification of results;
- **Reproducibility** is essential.

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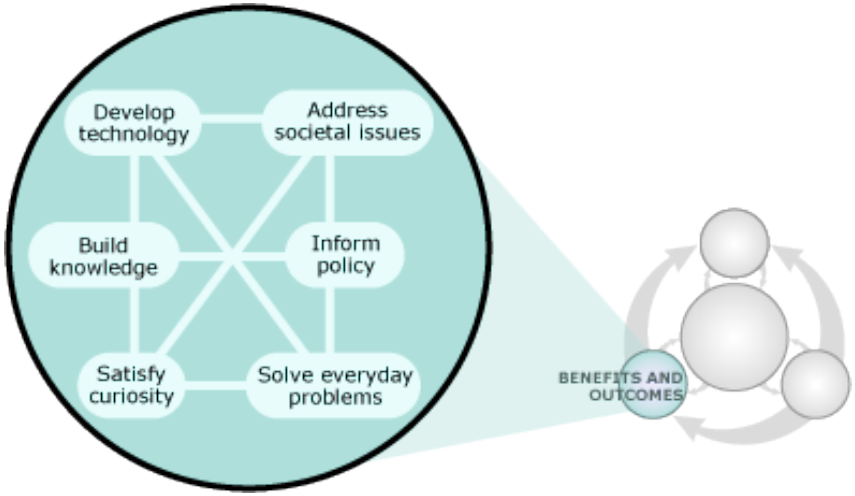
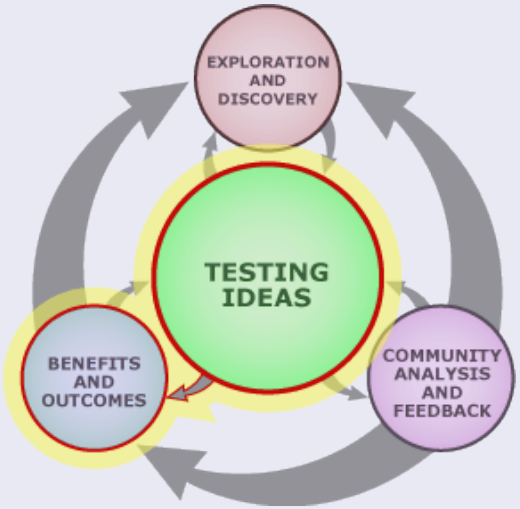
What is science?

The scientific process

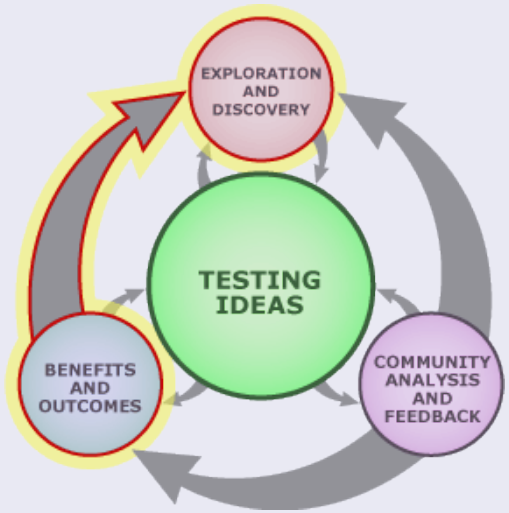
The scientific process is a way of building knowledge:

- Generate and test new ideas about how the world works;
- Iteratively increasing the reliability of the knowledge;

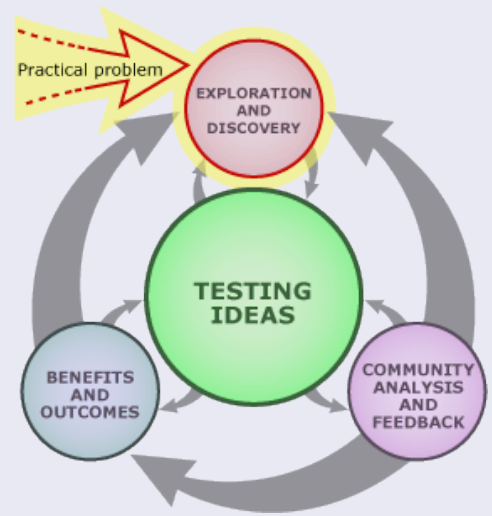




Knowledge→Applications



Technologies→Discovery



Applications→Investigation

All images: http://goo.gl/IBRSoQ - (c) Understanding Science, 2015. Used with permission.

Bibliography

Required reading

1. *Understanding Science*. 2014. University of California Museum of Paleontology. 3 January 2014. - `http://www.understandingscience.org`
2. F.L.H. Wolfs, *APPENDIX E: Introduction to the Scientific Method*. - `http://goo.gl/osGpU`

Recommended reading

1. Carl Sagan, *The demon-haunted world: science as a candle in the dark*, Random House, 1996.
2. The Skeptics Guide to the Universe. - `http://www.theskepticsguide.org`

About this material

Conditions of use and referencing

Please reference this work as:

Felipe Campelo (2018), *Lecture Notes on Design and Analysis of Experiments*.
Online: https://github.com/fcampelo/Design-and-Analysis-of-Experiments
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@Misc{Campelo2018,
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  author={Felipe Campelo},
  howPublished={\url{https://github.com/fcampelo/Design-and-Analysis-of-Experiments}},
  year={2018},
  note={Version 2.12. Creative Commons BY-NC-SA 4.0.},
}
```

Next Week

- **Locate and read** at least **TEN** academic papers from your research area (using ACM DL and IEEE eXplore)
- **Search** for potential gaps in the literature which you think your work could fill—try to articulate it explicitly
- **Refine** your research question into something clear and succinct
- **Setup** an IEEE-style document on Overleaf, and Slack the link to your supervisor
- **Prepare** a draft proposal of 500-or-so words to take to Ed's workshop next week