

SC203 - Scientific Method

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Teaching Staff

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Disclaimer

Disclaimer: This curriculum have been inspired and adapted from materials created by:

- VNU-HCM University of Science, Pr. Vu N. Duong, for the APCS undergraduate course entitled *Scientific Method* © 2006-2009
- VNU-HCM University of Technology and University of Science faculty member, Pr. Vu N. Duong, for the course entitled *Methods and Models in Scientific Research* © 2003-2009
- MIT faculty members, Pr. Edward M. Greitzer & Pr. Earl Murman, Dept of Aeronautics and Astronautics, for the course entitled *Experimental Project I & II* © 2003.
- Cranfield University faculty member, Pr. Paul Burgess, for the course entitled *Nature and Practices of Science* © 2007 in which many points were referenced to Hugh Gauch of Cornell University, *Scientific Method in Practice*, Cambridge University Press, 2003.
- Linkopings University faculty member, Dr. Monica Tatvanti, for the document entitled *Introduction to Design of Experiments and Statistical Data Analysis* for the Innovative Research Unit, EUROCONTROL Experimental Center © 2003.



Welcome to SC203

- Today's topics:
 - Team selection plus photos,
 - Course goals and learning objectives,
 - How things work in SC203 and link to WR227,
 - Our expectations on your progress and achievements in SC203,
 - Preps for WR227,

Main Things (from SC203)

- To define an *experimental project*, invest on your capability to *observe*, develop a *hypothesis*, state project objective(s) and success criteria.
- Project Schedule:
 - Period 1:
 - Acquiring knowledge about scientific method,
 - Developing initial idea
 - Defining your project,
 - Period 2:
 - Developing your project,
 - Work (with your team mate), Work (with your TA), Work (with the Boss),
 - Period 3:
 - Mid-Term Report on your Project,
 - Critical Analysis,
 - Conduct your experimentations or surveys.
 - Period 4:
 - Final Oral Report (Final Grading for SC203)
 - Prepare for Written Reports.

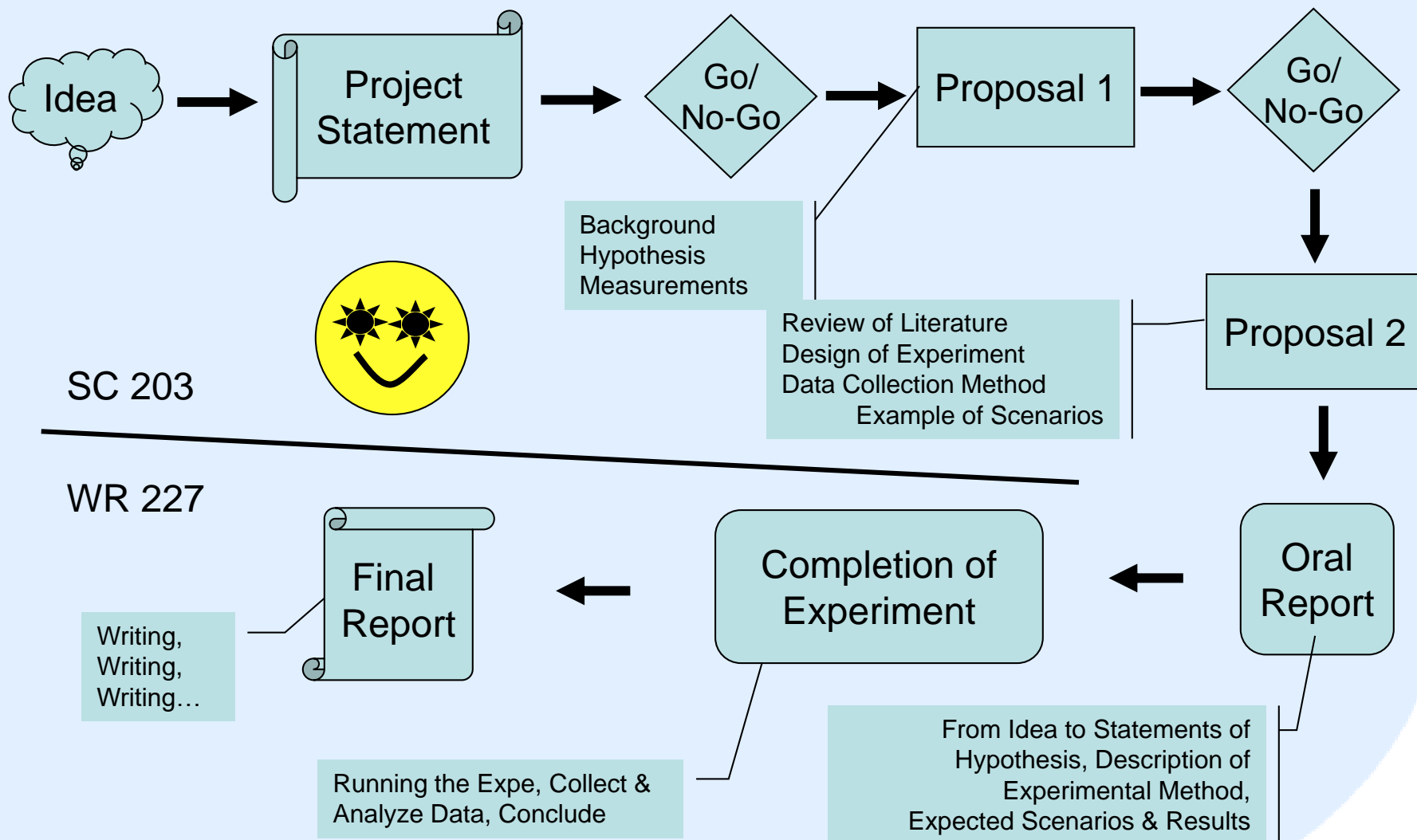
Pedagogy

- Through lectures and practical in-class exercises aiming at developing scientific aptitudes, students are exposed to relevant methods, processes and techniques for:
 - Reading and Analyzing scientific articles,
 - Raising a Hypothesis that reflects a Question to be answered,
 - Designing the experiments to test the raised hypothesis,
 - Implementing the experimentation,
 - Executing the tests and Analyzing the obtained data,
 - Documenting the obtained results,
- Course Staff:
 - Prof. DUONG Nguyen Vu
 - Assoc. Prof. TRAN Minh Triet

Course Objectives

- We expect that at the end of SC 203 and WR 277 you will (or must?) be able to:
 - 1) Read and Synthesize general scientific articles,
 - 2) Generate interrogations from any observations,
 - 3) Formulate overall objectives and success criteria for an experimental evaluation project aiming at finding answers to the raised questions (hypothesis or interrogation),
 - 4) Develop, as a two-person team, the strategy and tactics for the design of experiments and for the collection of experimental data,
 - 5) Setup and run the experiments and collect experimental data, and perform data analysis in the direction set out to achieve the above objectives,
 - 6) Effectively communicate, orally and in writing, the key aspects of the project, from the concept to the conclusion of the findings.

SC 203 & WR227





SC 203 Working Methods

- Your project must be documented during the course of its development into a “Notebook.”
- You are responsible for your project. Course staff will be there to help you out.

Notebooks

- Laboratory Notebook (idea from Prof. Greitzer et al. 2003):
 - Your notebook should be an accurate and definitive record of your work,
 - Notebooks are individual.

Be Aware That ...

- The project requires a **sustained consistent effort**,
- The deliverables (Project Statement, Proposal 1 and Proposal 2) will feed in directly to the final report, which is due for WR 227.
- It is virtually **impossible** to “do it all in the two weeks preceding the due date.”
- The course staff will help you with warnings on your progress
 - This is diagnostic, not punitive,
 - Green is good, Yellow is be careful, Red is to catch up.

Other Comments (Greitzer et al, 2003)

- The process you are engaged in has many similarities with real-world projects:
 - The need to have a clear **idea** and **vision** for what you are trying to do,
 - The **nature of the process** with specific checkpoints,
 - The **need for iteration** in both research and communication aspects,
 - The **need for teaming** in stepping up to project with high impact,
 - The opportunity to create something you can be **proud of** - and the chance to know how enjoyable that is.
- **It's your project. Have a great time with it.**

The Idea ...

- Observation
 - Curiosity
 - Creativity
 - Brainstorming
-
- Be sure the idea addresses something of value to the society and/or to explain the nature?
 - Physics,
 - Materialistic,
 - Automation?

Prof. Duong's recommendations

- Make sure that you and your partner have the same line of thoughts about things you guys see,
- Make sure that the topic is exciting for both,
- Make sure that your advisor be ready to support your work, and communicate, communicate, communicate with her/him.
- Be attentive to classroom discussions on others' topics.
- Don't be too ambitious given the time you'd have for project definition and planning in SC 203 and for project execution and writing in WR 277.

From Idea to Problem

- What's in a "Problem?"
 - Observe the fact or phenomena,
 - Observe similar fact or phenomena,
 - Raise the question "WHY?"
 - Figure out what is known and what is not known,
 - Develop Hypothesis about the relationship between inputs and outputs,
 - Design an experimentation procedure to illustrate the relationship,
 - Set up the experiment (apparatus and equipment?)
 - Collect data and analyze them (iteration is required)
 - Report report and report...