Subjects My Teachers Never Taught Me

What to Learn in Graduate School: Biostatistics

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Overview

- Target audience: eventual doctorate in Biostatistics
- Brief advice without many details
- Identify the issues; solutions left to you

The Basics of Grad School

- Pre-requisites
    - English/Communication/Writing
    - Calculus, Linear Algebra, + More
    - Statistics
- Course material, grading
- Comp exam content
- Graduation requirements
- Job market

All obvious

What You Really Need To Know

- Information Intake
  - Read
  - Listen
- Information Creation: Research
- Information Output
  - Write
  - Speak

Not as obvious

Plus tools of the trade.

Learn

- Learning how to learn

- Not just 'be taught'

- Active participation in learning

- Teaching: guide to learning

- Life long learning
  - Work/Professional environment: constant change
  - Continue to learn after graduation
  - Use it or lose it

Learn: Required Courses

- Backbone of Statistics

- Basic, but old

- Does not use the modern language of statistics

- Does not cover everything

- Must be supplemented BY YOU
  - Books
  - Articles
  - Topic Courses
  - Seminars!
  - Conferences

Read: Books

Read as many textbooks and monographs as possible

- The more you know, the better
- Build on your interests
  - Material you like
  - Not necessary to follow through on every topic
- *Explore!*

Read: Journals

- Thick Rich Cheese Cake

- By end of first year doctoral

- Important journals (you choose)
  - JASA, JRSS-B, . . .
  - Biometrics, Stat in Med, . . .
  - Others: Applied Statistics, Bayesian Analysis, JCGS

- The art of reading journal articles

- Requires practice

- Start easy: American Stat, Stat Sci, Stat in Med, reviews, discussions

Steps to Reading a Journal Article

- Skip most articles

- Title. $<$Decide: Continue?$>$

- Authors & institutions, $<$Continue?$>$

- Abstract $<$Continue?$>$

- References (any you've noticed before?)

- Introduction (particularly if new to area) $<$Continue?$>$

- Section 2: methods

- Computing section: algorithms

- Examples?

- Simulation studies worthless?

Thinking About: Journal Articles

Think!

- Is it important?
- Did you like it?
- Did they do it right? best way?
- How can it be improved?
- Presented: Well? Poorly?
- How related to other work?

The Web of Knowledge

- All knowledge is interrelated
- Need to learn the structure of knowledge
- Not necessary to learn linearly
- Remember relationships of concepts
- Even if you don't understand either concept
- Important material gets filled in . . . eventually
- Articles & seminars
- You *will* make the connections

Listen: Seminars

- Language of statistics

- Frontiers of research

- Variety
  - Topics
  - Speakers
  - Styles
  - Approaches
  - Solutions

- Understand *something* not *everything*

- Start filling in your own web of knowledge

Research

- Discovering something new (Its yours!)

- Digging up material already discovered by someone else

- Asking the right questions

- The opposite of homework

- Examples of completed research:
  - Journal articles
  - Monographs
  - Theses

- Apprenticeship

Communication Skills: Writing

- Communication skills perhaps more important than math skills

- Work at them. All the time.

- Scientific Writing

- Efficiency: Information per word

- Inexperienced writers will improve rapidly

- Use words and sentences in writing up homework

Writing Practice

I work at my writing virtually every day

- Recently read:
  - *Strunk and White. (2000). The Elements of Style. 4th ed.
  - Truss, Lynne. (2004). Eats, Shoots & Leaves.
  - *Lebrun, Jean-Luc. (2007). Scientific Writing, A reader and writer's guide.
  - King, Stephen. (2000). On Writing
- READ: Anything. Fiction. News. More.
- Vocabulary: dictionary: expand
- Edit: Everything, HW, email, papers
- Word Games

Organize Your Writing

- Outline what you want to say

- Organize Hierarchically
  - Chapters (in a dissertation or book)
  - Sections (in a chapter or paper)
  - Subsections of a section
  - Paragraphs of a (sub)section
  - (Sentences in a paragraph)

- Good writing is bad writing edited
  - Rearrange: Like with like
  - Edit
  - Re-edit again – 10 or more times

Mathematics and Writing

- Each paper defines a new language
  - Define: Words, Symbols, Mathematics
  - At first use
  - Every symbol must be defined
- Keep the reader in mind
  - Readers must translate math (or learn it)
  - What does the reader know?
  - When does the reader know it?
  - Never use a symbol the reader does not know

Communication Skills: Speak

- English language

- Practice English (at home, with friends, at work)

- Rephrase to perfection

- Practice explanations

- Teaching

- Vocabulary

Giving Seminars

- Give good talks!

- One bad talk is remembered more than 10 good talks

- Practice important talks 10-20 times

- Audience
  - Remember the listener
  - What does the listener know?
  - Read the audience: bored or listening?

- Afifi's talk on talks

Tools

Know the tools of professional statisticians

- Journal research: Researching the past and present.
    - Current Index to Statistics (ASA)
    - Science Citation Index (`isiknowledge.com`)
    - Online journal access (Biomed library)
    - PubMed; NIH grant abstracts; citeseer; google scholar
- Writing math: LaTeX, $\mathcal{AMS}$-LaTeX
- Statistical Programming: R `www.r-project.org`, Matlab, Gauss, etc
- Learning how to learn a package

More Stuff

- Do I have the right stuff?

- Social & Health
  - Interacting with faculty, staff, students
  - Staying sane, healthy, and happy
  - Recreate

- Choosing an advisor and thesis topic

- How to do research

- Attending conferences; professional development,

- Jobs: what is required, expected; financial issues

- CV, hiring, job search

Summary: Things to Know

- How to
  - Take in information: reading and listening
  - Create information: research
  - Disseminate information: writing, speaking
- The tools: Latex, R, CIS, Science Citation Index, Search, …