



# Statistical Methods for Engineers

Developing a Flipped Pedagogy  
15 years before its invention

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(For the slides, see [WikiStat.ca](http://WikiStat.ca): last line of the page)

# **Every term**

**3 to 4 sections  
of around 60 students**

**A coordinating professor**

**Other professors**

**One TA for each group**

# Weekly theoretical workload

(4; 1; 4)



(Lectures, Labs, Personal study)

...In practice

(1,5; 0,25; 1)

One mid-term, one final; Fail rate: 20%  
(unacceptable for our administration)

Decreasing level of the course over the years  
2 homeworks (teams of 4) widely copied;  
grade inflation



**In brief, at the turn of the century**

**Students show no interest  
...as well as the staff!**

**Dying course**

**«Hopeless !»**

# **New pedagogy for the course**

**«Reading maketh a full man;  
conference, a ready man;  
writing, an exact man.»**  
*(Of Studies, Francis Bacon [1561-1626])*

**Real data, team work, project based learning  
wall to wall work 'within' the software**

**Simulating the work in an industrial context**

# **A website**

**For the students to get information on  
the course**

**and express themselves**

**their own grades, extra documents,  
their own evaluations of the course,  
etc.**



# **Student evaluation of the course**

## **Crucial Innovation**

**the pedagogical relation is based on confidence**

**Mostly open questions**

**Closed questions on the  
student's workload**

# Rigorous Protocol

- The [evaluation form](#) is given to the students *with* their marked mid-term copies
- Which they hand in to 2 ‘reporters’, fellow class mates, who count them put their initials on the page, and give their [report](#) with the evaluation forms to the professor
- The professor compiles the students’ evaluations, reports to the students at the following meeting of the class, gives them back to the students who can annotate, comment, discuss them
- The whole process again during the last period of the course



# Developing a 'new' pedagogy

## Reading

### A new textbook

Only one adapted to our needs: Ostle & al. (1996)  
«Engineering Statistics. The industrial  
experience.»

Term after term, I write, rewrite a new one (Pdf-Latex) with hyperlinks, historical notes, animations, simulations, lots of simple exercices

# Professors and TAs

less and less sages on the stage  
more and more guides in the aisles

Beginning of the course: lectures on the elements,  
then an experiment in data collecting: variation

All along the course: less and less lectures  
The professor is less and less a 'sage on the stage'

For the students, more and more: *reading* the textbook,  
*writing* and *discussing* simple problems (labs) *with team mates*,  
Homeworks are case studies that introduce new material  
Report *writing* with team mates

Students attend classes to discuss their work with the professor and  
fellow class mates, ask questions; most attend

**Reading, meeting & writing**



# 10 labs, 20-25% of the final grade

- Teams of 2, both teammates hand in *their* copy
- 10-12 'short' exercises: weekly suggestions
- At the start of the lab (1hr): 3 «are chosen at random»: writing
- One, «randomly chosen», is carefully marked
- The staff and the TAs serve as guides

**Reading, meeting & writing**

## 2 case studies (35%)

- The closest we can get to the type of work practised in the industry
- 15-20 pages of definition: *statistical questioning and reasoning*; all in the computer.
- Teams of 4
- 20-30hr from each teammate: study/report **writing**, approx. 20 pages: ***hard teamwork***
- Students come in class for discussion, questions (*they all come!*)

**Reading, meeting, writing**

# **Course validation (40%)**

A mid-term exam 15% (2h)

A final exam 25% (2h30)

Individual work

## **Reading & writing**

# Post-hoc situation

Course 'triplet': (4; 1; 4)

Situation *ante*: (1,5; 0,25; 1,0)  
*post*: (3,5; 1; 4)

'Assist': class attendance (noted 4)

'Trav\_P': personal study (noted 4)

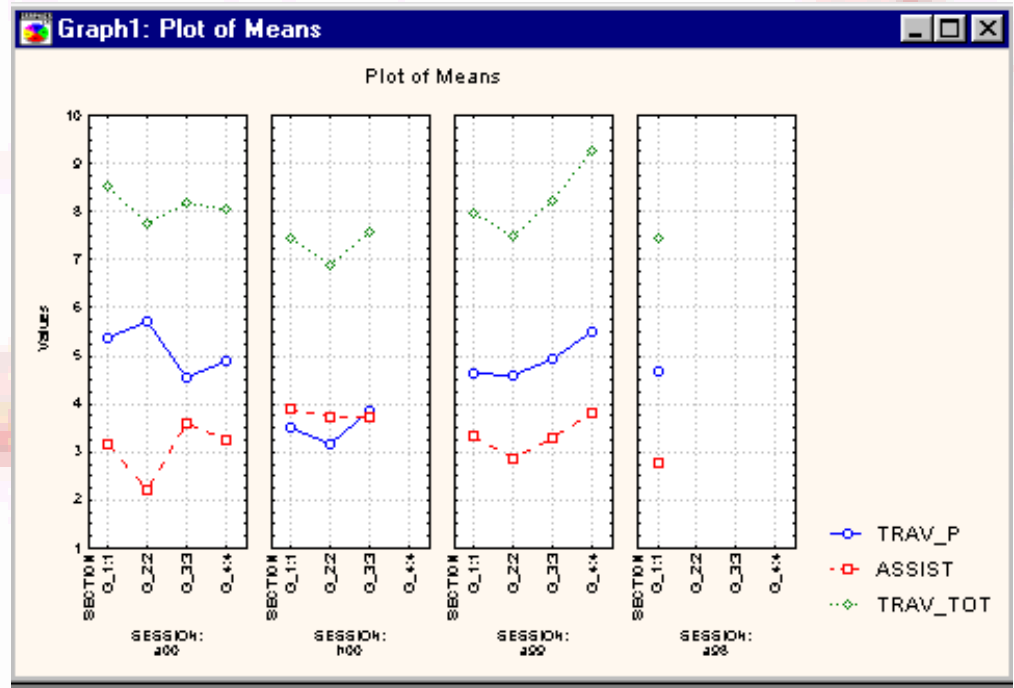
Trav\_Tot': Total workload

Failure rate: close to 0%

All the students attend the labs  
(worth 25%...)

Students (not all) are enthusiastic: «We are learning something usefull.»

The staff (not all) are enthusiastic: «We are proud of our students, feeling of usefulness»

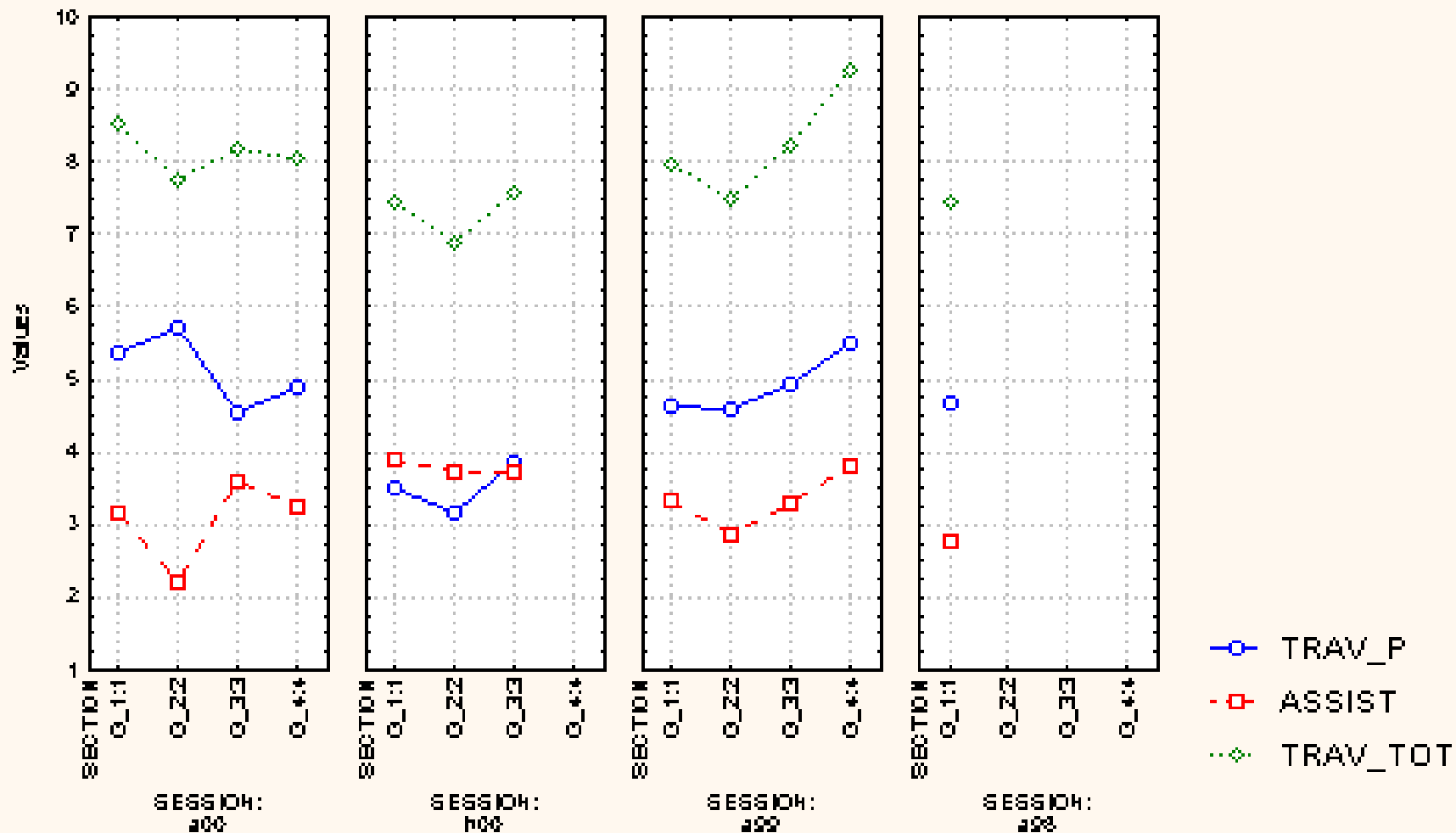




# Graph1: Plot of Means



## Plot of Means



# Drawbacks 1

‘Large’ workload for the students

...old habits

‘Huge’ workload for the staff

...old habits!



# Drawbacks 2

Really too much work for the professors  
Lack of institutional resources (\$\$)

The case studies cannot be reused nor recycled:  
the students have their own websites!

The 'other' workload of professors (research, etc.)

**Annoyances with**

...certain students (very tenacious and well organized),  
...certain colleagues (very tenacious and ...envious),  
...certain administrators (very tenacious, side in with  
students)

**« I don't want no bothering »**



# All in all

## We have shown that

- The students are not stupid, on the contrary!
- Many can be made to be enthusiastic for Statistics
- Pedagogy is crucial
  - Reading, meeting, writing; decent evaluation*
- No cheating, no grade inflation, increasing levels...
- Professors can be proud of their students!
- More resources should be given to the teaching sector in colleges and universities

# PrixPoly1873 for outstanding merit (2001)

## For pedagogical efficiency

This experiment has lasted 5 terms, 1999-2001  
Sabbatical leave... My successor went back to our old textbook, old slides  
...old ways, same effect

Offered etching: «L'oiseau rare»



# Some references

The literature is very vast...

A personal view



Recent and modern [textbooks](#)

Some [articles](#)