Statistical Methods for Engineers

Developing a Flipped Pedagogy
15 years before its invention

Marc Bourdeau
Professor Emeritus
PolytechniqueMontréal
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(For the slides, see wikistat.quebec: 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’ exercices: 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)

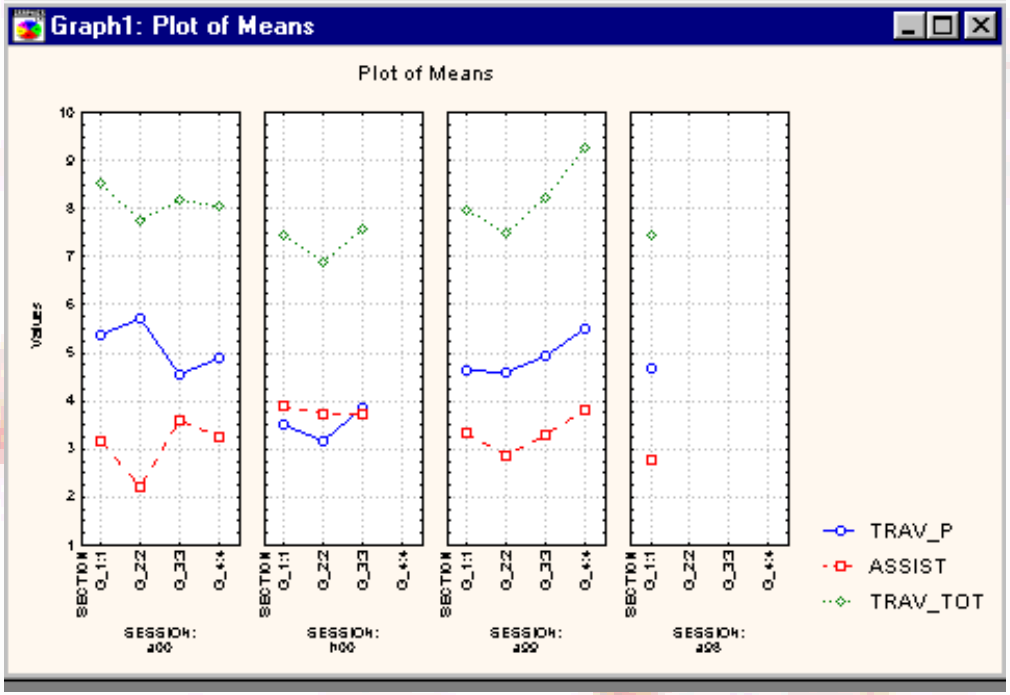
Situation *ante*: (1,5; 0,25; 1,0)
_____*post*: (3,5; 1 ; 4)

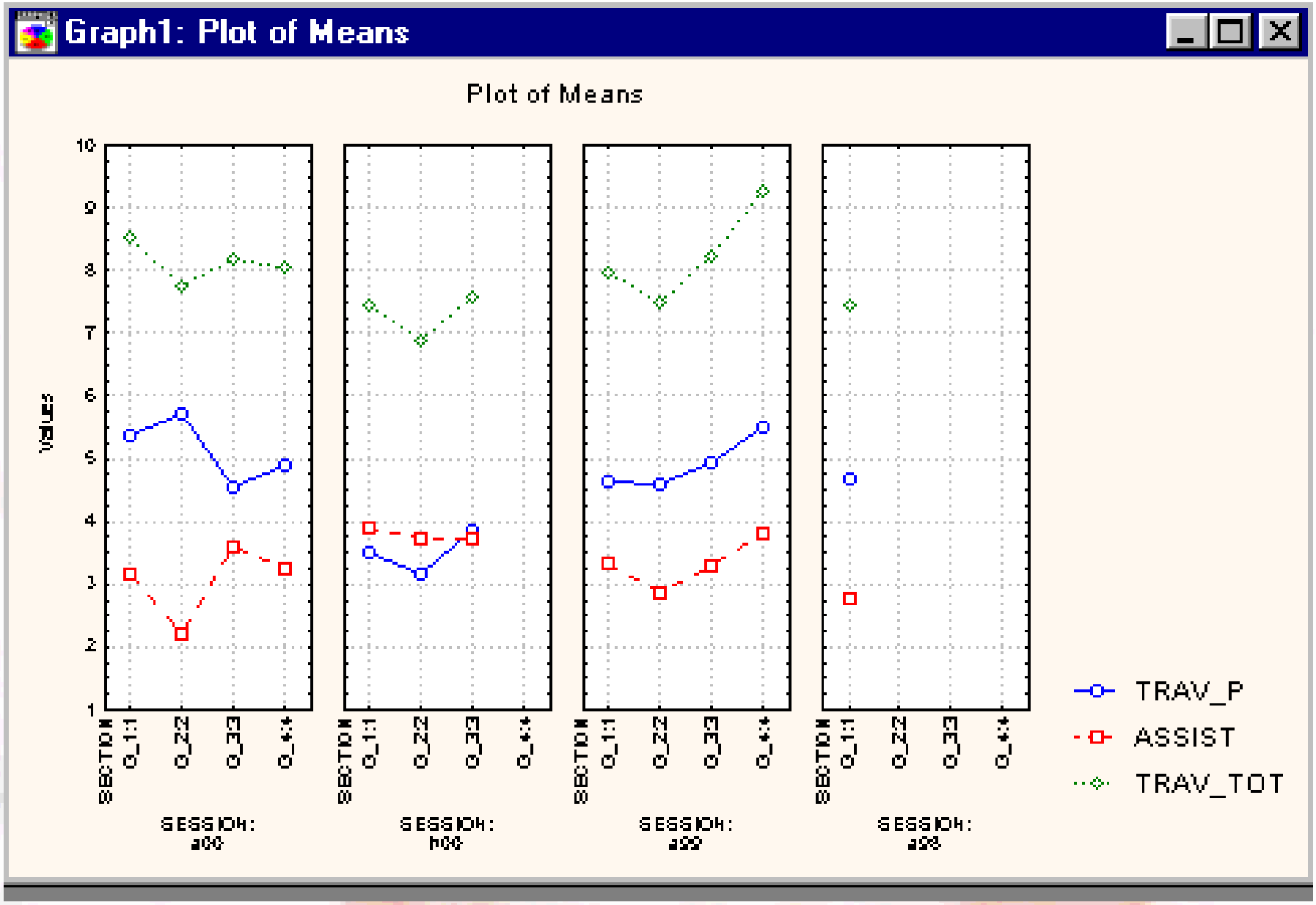
___'Assist': class attendance (noted 4)
'Trav_P' : personal study (noted 4)
Trav_Tot': Total workload
Failure rate: close to 0%

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

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

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




Graph1: Plot of Means
Plot of Means
Values
10
9
8
7
6
5
4
3
2
1
SECTION
0_1:1
0_2:2
0_3:3
0_4:4
SESSION:
a00
SESSION:
b00
SESSION:
a99
SESSION:
a98
TRAV_P
ASSIST
TRAV_TOT

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 enthousiastic 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