Mathematics, Statistics and the University of Guelph

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• Mathematics and Statistics are important

“Et harum scientiarum porta et clavis est mathematica”
Roger Bacon (∼ 1214–1292)
• Mathematics and Statistics are important for science

"Et harum scientiarum porta et clavis est mathematica”
The door and key to the sciences is mathematics

– In all other sciences we use mathematical examples, because they illustrate the point without confusing complication
– In mathematics demonstration is more complete: its cogency has the force of necessity
– Finally, we are confirmed by the experience of all who have most distinguished themselves in science. They owe their results to the mathematical foundation of their studies

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Roger Bacon (∼ 1214–1292)

– Bacon was somewhat of an odd-ball in his days ... let’s ask the father of modern science, 300 years later
• Mathematics and Statistics are important for science

The door and key to the sciences is Mathematics
Roger Bacon (∼ 1214–1292)

Galileo Galilei (1564-1642)

- Mathematics is the language in which scientific theories are written
- **add:** Statistics is the language in which scientific theories are tested

The language of scientific theories is Mathematics
• Mathematics and Statistics are important for science

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The language of scientific theories is Mathematics
Galileo Galilei (1564-1642)
• **Mathematics and Statistics are important for science**

The door and key to the sciences is Mathematics  
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Galileo Galilei (1564-1642)

Nothing is more practical than a good theory  
Ludwig Boltzmann (1844-1906)
• Mathematics and Statistics are important for engineering

The door and key to the sciences is Mathematics
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The language of scientific theories is Mathematics
Galileo Galilei (1564-1642)

Nothing is more practical than a good theory
Todor Karman (1881-1963)
• **Mathematics and Statistics are important: Society Counts**
  (British Academy for Humanities and Social Sciences)

  – **Research and policy.** Quantitative methods underpin both blue skies research and effective evidence-based policy.... underpin the deciphering of social patterns and trends, and evaluation of the impact of social interventions.

  – **Employability.** In a wide range of businesses, quantitative skills are now essential... are integral to such tasks as costing, risk assessment and quality control, as well as in coping with everyday problems.... The value of quantitative skills for future employment needs to be actively communicated to students.

  – **Citizenry.** Providing citizens with the means to understand, analyse and criticise data becomes ever more integral to the functioning of a democracy.
• Math and Stats are important: Mathematical Needs
(Advisory Cttee on Mathematics Education)

– Employers emphasized the importance of people having studied mathematics at a higher level than they will actually use. That provides them with the confidence and versatility to use mathematics in the many unfamiliar situations that occur at work. ... Many of the employers we interviewed ... [recognized] that mathematics is a subject of intellectual power and that the best interests of their companies would not be served by an education system restricting young people to a diet of the particular techniques they were likely to use in their day-to-day work.
• **Maths and Stats are important: Mathematical Transitions.**
  (Higher Education Academy)

  – All the disciplines demand some level of Mathematics and/or Statistics from their students. There were no departments mentioned in any of the discipline reports that were running degree programmes that are purely qualitative in nature.

  – Many universities already provide additional support in Mathematics and Statistics at institutional level, which resides outside the structure of any individual degree programme.
• Mathematics and Statistics are important at Universities. Period.
• **Mathematics and Statistics at the University of Guelph: Research**

  - **the research operation overall runs well**, despite losses of some very research active faculty

  - emphasis on Applied Mathematics and Statistics: Biomath, Biostats, Quantum Information, Industrial Mathematics

  - **80% of tenure track faculty hold NSERC Discovery Grants**, most in EG1508, but also in EG1507, EG1505

  - amongst math departments in Canada we are the one with the second most NSERC Engage grants ... more than Waterloo, SFU, UBC

  - Canadian Dairy Network, Canpolin, AFMNET, MITACS/MPRIME, NSERC CRD, OMAF/MRA New Directions, OMAF/MRA Research Agreement, CIFAR; CIHR, SSHRC
Mathematics and Statistics at the University of Guelph: Graduate Training: State of Affairs

- MSc/PhD in Mathematics and in Statistics
- MSc/PhD in Biophysics
- M.Binf/M.Sc/PhD in Bioinformatics

- average student:supervisor ratio high for the discipline

- IQAP: ”Meets most expectations”
• Mathematics and Statistics at the University of Guelph: Graduate Training: Limitations

  – low faculty number limits number of students we can accommodate
  – low faculty number limits number of courses we can offer
  – high competition between Ontario universities
  – need to rethink recruitment, funding model, positioning
• **Mathematics and Statistics at the University of Guelph: Service Teaching**

  - 9,000/yr ~ 10,000/yr in the last three years
  - 5% of all course enrolments at UoG in 2011/12 were serviced by our department (4th highest of all departments)
  - students in more than 60 majors
Mathematics and Statistics at the University of Guelph: Service Teaching cont’ed

- IQAP consultants:

“Service teaching, in particular, garnered high praise ... does an excellent job of meeting this responsibility.”

”... in comparison to other departments of mathematics and statistics nationally, the number of students taught in service classes is very high relative to the faculty complement ...”

”At the same time, this service teaching takes resources away from the departments ability to provide quality undergraduate and graduate training in the mathematical sciences”

”In order to maintain adequate feedback and assessment in courses, we recommend that university administration attempt to restore GTA budgets to an academically appropriate level.”
Mathematics and Statistics at the University of Guelph: Undergraduate Program

- the number of undergraduate majors declined in recent years ... there might be several reasons for this

- currently intake into these programs is suspended

- for many years resourcing problems were addressed by deleting courses
  ◦ we started with the smaller 4th yr courses
  ◦ then \textit{ad hoc} course offerings
  ◦ now 2nd yr courses are merged with service courses

- we have now fewer courses, not different courses
  "beat the patient until he feels better"
- Mathematics and Statistics at the University of Guelph: Undergraduate Program

- last year department put together an innovative proposal
  - flexible: Mathematics ⇔ Statistics
  - flexible: slim pre-requisite model increases the number of courses students can **choose** from and to find their own focus
  - flexible: via wide range of *areas of emphasis* of applications
  - new courses, including some not offered in many other undergrad programs
  - lends itself to emphasizing computation and marketable skill

- but had to settle for less:
  - smaller number of course offerings
  - BSc 1st year core
  - no new but fewer courses
  - more restrictive in *areas of emphasis*

- it is good to get the new program rolling, but this is the beginning from which to build, not the end
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Roger Bacon (\(\sim 1214–1292\))

– how do we improve this? how do we move forward?
• Mathematics and Statistics at the University of Guelph: Ways Forward

- our undergraduate proposal had some fresh, innovative, outside-the-box ideas ... I am not giving up on them yet ... they should guide the way forward

- we are short resources for 8 courses (63 vs 71):
  ◊ fill 1 tenure track position to make up for lost positions
  ◊ keep the CRC position in the department and refill next year
    ... and thus we are up to 68.

- some modifications to our proposal need to be made though:
  ◊ first year core
  ◊ maybe re-focus areas of emphasis
  ◊ and upper year courses
• Mathematics and Statistics at the University of Guelph: Ways Forward

- (CPES) Engineering Science
  - interdepartmental
  - new courses
  - will need new faculty to be able to partake

- other, similar interdepartmental possibilities?
• Mathematics and Statistics at the University of Guelph: Ways Forward

– (IQAP) ”We recommend that the department explore teaching additional courses over the summer. These would need to be net-new sections, not given at the expense of current offerings.”

– (IQAP) ”If the new undergraduate programme succeeds in attracting students, we propose that resources for upper-year courses be re-examined.”

– (IQAP) ”We recommend the department consider enhancing the role of computation in selected statistics and numerical methods courses.”

– (IQAP) ”We suggest that the department consider applying for SSC accreditation of its undergraduate statistics stream.”
• Mathematics and Statistics at the University of Guelph: Ways Forward (Graduate Training)

- new domestic student funding model is very good news: more flexibility to do things different

- need to revisit course offerings, minimize overlap between graduate and undergraduate courses, limit it to topics courses that are not offered regularly

- let’s brainstorm the idea of a course based Masters degree in Mathematical Sciences that better prepares students to join the work force ... would like to discuss this also with SOCS

- MOST IMPORTANT: hire grantable research tenure track faculty
Mathematics and Statistics at the University of Guelph: Ways Forward

- questions?
- comments?
- complaints?