



A Year in the Life of First Year Physics

Academic Performance and Student Engagement

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Physics & Astronomy at the University of Glasgow

- Getting a degree in Physics.
- History and issues arising.
- New initiatives and results from 2007-08.
- 2008-09 and longitudinal studies.
- The future. . .

Faculty Entry

- Common amongst Scottish universities.
- Students accepted to a broad-based first year curriculum.
- Degree subject specialisation occurs at the start of second year.
- From the outset, only $\sim 50\%$ of first year Physics students intend to pursue the subject beyond first year.
- But what about the students who *did* intend to pursue a Physics degree at the start of first year?
 - And what about students who *did not* intend to pursue a Physics degree at the start of first year?

So you want to do a degree in Physics?

- Split your time equally between:
 - Level 1 Physics.
 - Level 1 Maths.
 - Another level 1 class.
- Achieve minimum requirements:
 - Get at least a D-grade in level 1 Physics *and* Maths.
 - Get at least a D-grade on *average* over *all* level 1 classes.
- Decide:
 - Physics on its own? Or with something else?

Level 1 Physics

- Two modules (P1X and P1Y), assessed in separate semesters.
- Minimum requirement in physics achieved (5-year averages):
 - P1X: 77.2% of class; P1Y: 72.4% of class
- Could we raise both 'pass' rates?
- Could we narrow the gap in performance between P1X and P1Y?

Retention & Progression

- Typically $\sim 37\%$ of students in Physics 1 progress to Physics 2 the following year.
 - $\sim 50\%$ *said* they intended to progress.
 - Multiply 50% by 77% to get an 'expected' progression rate: 38%
 - Could we raise this number too?

Physics 1X/1Y Course Requirements

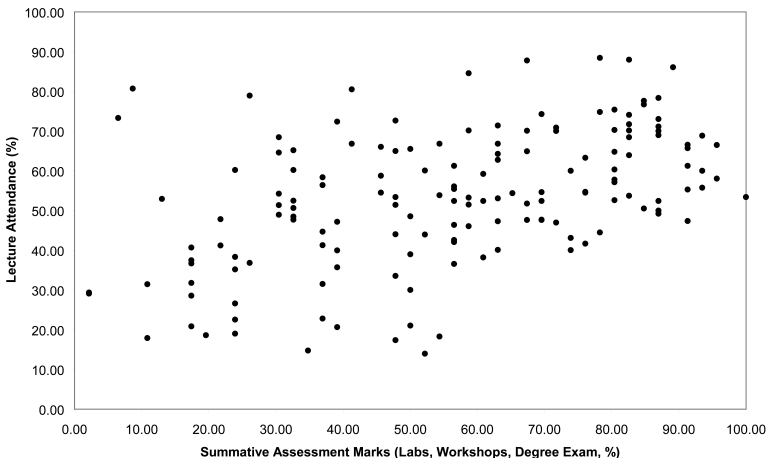
- Workshops-tests (4 per semester, 8 in total): 20% of final grade.
- Laboratory classes (both semesters): 20% of final grade.
- Degree Exam (2 papers in May): 60% of final grade.

Bar-codes and Attendance Lists

- A minimum 50% attendance is *required* at workshop-tests and laboratory classes. Lecture attendance does not contribute to final grade.
- So we took attendance:
 - Matriculation cards scanned electronically at *every* test and lecture.
 - Student signatures required at *every* lab class.

Attendance... or lack thereof

- Students don't attend everything they're supposed to!!
 - Labs and workshop-tests: attendance *is* compulsory and *will* affect final grade if missed.
 - Lectures: attendance does not count towards final grade but is there a correlation between performance and attendance?
- Students were contacted every time they missed a *compulsory* assessment component:
 - Informally in person -> by SMS -> by email -> by snail-mail.
 - The *order* of the contact methods represents an escalation of severity.

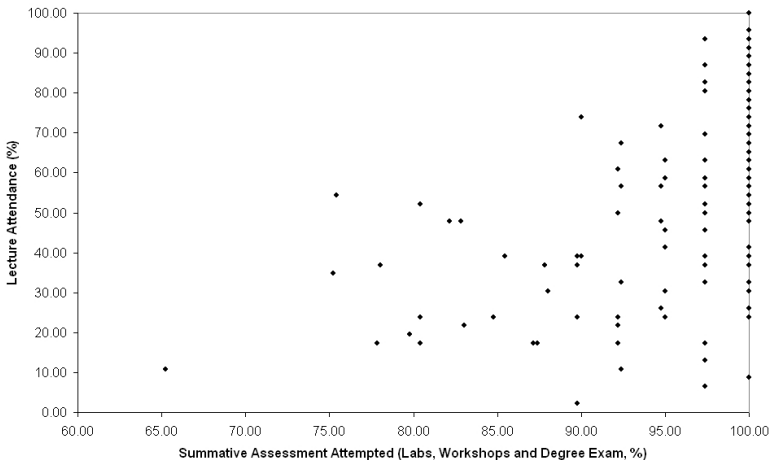


Contacting Students: 3 categories of student

- Group 1 (~90% of class): typically missed the odd labs or test due to illness or another temporary effect; *always* responded to attempts to contact them.
- Group 2 (~5% of class): regular non-attendance and/or non-completion of assessment tasks; attempts to contact them often went unanswered.
- Group 3 (~5% of class): persistent non-attendance and non-completion of assessment tasks; rarely responded to attempts to contact them.

Streamlining

- If students don't respond within 5 consecutive attempts to contact them, we stop and concentrate effort on those students who *are* in attendance.



Provision of Drop-in Tutorials

- Address the historic drop in pass-rate between P1X and P1Y.
- Improve the performance of the weaker students (C/D grades).
- Open to all students.
- Students falling into 'at-risk' categories were sent a personal invitation.

Attendance and Performance

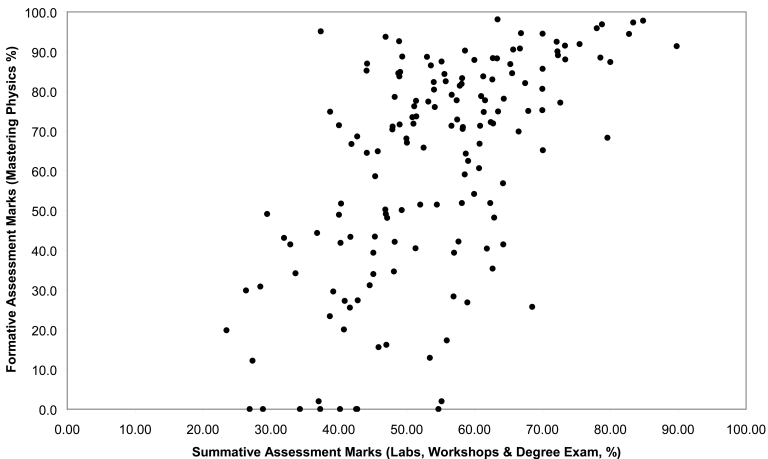
- Attendance was \sim 10% of the class, primarily B-D grade students.
- Small number statistics but, on average, students who attended the drop-in tutorials showed an improvement in performance between semesters.
- When asked, students who 'opted-in' said they had found the tutorials useful.
- *We could not* get the students identified as being 'at-risk' to attend (Group 2 and, especially, Group 3 students).

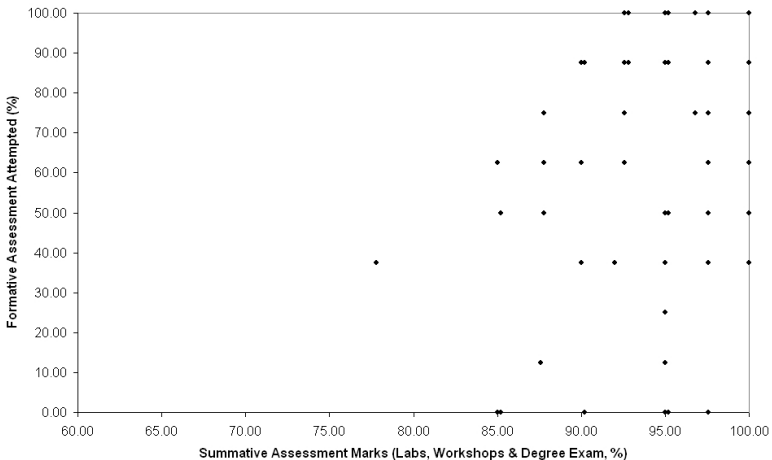
Introduction of Formative Assessment: *Mastering Physics*

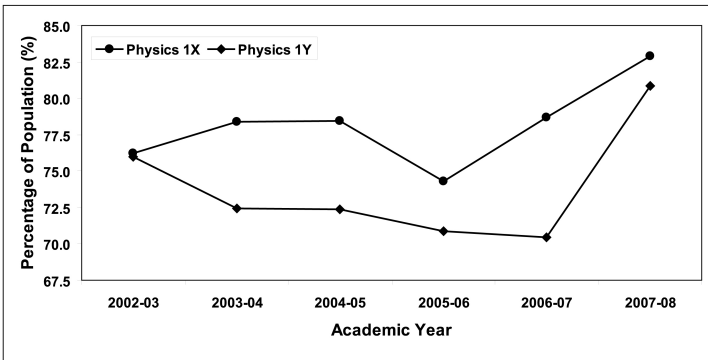
- Regular 'homework' exercises set in conjunction with course textbook.
- Online resource which contains a large bank of tutorial questions with accompanying hints, feedback and answers.
 - The interactive questions are auto-marked by computer (saving staff time).
- Students were set about 1 hour's worth of work every week; to be completed in their own time by regular weekly deadline.
- Academic performance was monitored but was formative.
- Minimum 50% completion required to gain credit in class.

Completion and Performance: *Mastering Physics*

- Performance in *Mastering Physics* was found to be a good predictor of performance in summative course components (especially workshops, degree exam).
- Students completion (or non-completion) of *Mastering Physics* exercises was generally associated with attendance (or otherwise) at summative assessment components (labs, workshops).
- When asked, almost all students reported that they had found *Mastering Physics* to be a useful resource to help with studying.







- 2007-08 pass rates:

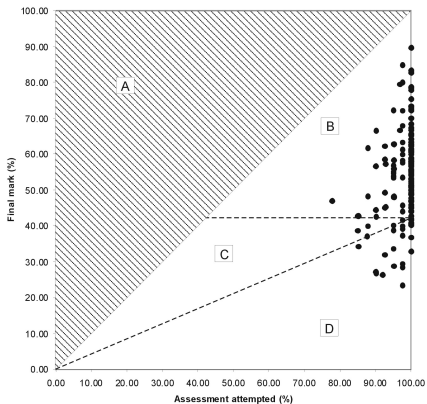
- P1X – 82.9% (cf 5-year statistics: $\mu_{P1X} = 77.2\%$, $\sigma_{P1X} = 1.9$)
- P1Y – 80.9% (cf 5-year statistics: $\mu_{P1Y} = 72.4\%$, $\sigma_{P1Y} = 2.2$)

Assessment Tasks in Each Module

- Workshop tests: 20% of final grade, 5% per test.
- Laboratory class: 20% of final grade, 2.6-4.4% per experiment.

Problem?

- Students slip grades at *all levels* due to missing the odd lab or workshop-test without accounting for it (by submitting an absence report, for example).



- Section A: Unpopulated
- Section B: Students who 'passed'
- Section C: Students who 'failed' but could have passed had they attended more.
- Section D: Students who 'failed' but could *not* have passed even with maximised attendance.

Grades attained by Physics 1X
class (154 students)

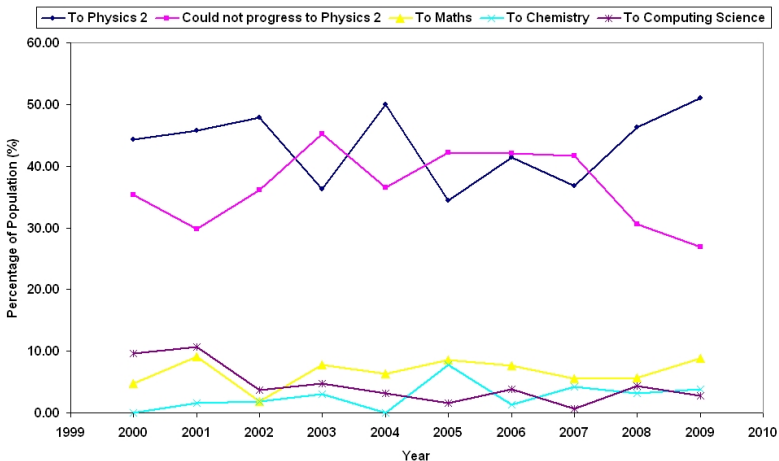
A	21					
B	3	29				
C	0	6	36			
D	0	1	8	32		
E	0	0	0	5	6	
F	0	0	0	0	4	3
A	B	C	D	E	F	

Projected grades for Physics 1X class
(154 students) assuming maximal
attendance at assessment tasks.

- Compare actual grades with projected grades.
- Example: 29 students got a B-grade, in line with projection.
- However, 6 students got a C-grade but could have got a B-grade.
- Worse, 1 person got a D-grade but could have got a B-grade.

Progression to Physics 2

- At the start of the year, $\sim 50\%$ of first year students self-identified an 'intention to progress' to Physics 2.
- Based on the pass rate, we should have expected a $\sim 40\%$ progression rate.
- In fact, we got $\sim 47\%$ in 2008-09, a significant improvement on the previous year.
- In 2009-10, this was further improved to $\sim 52\%$.



Tracking the Grade-Slippers *or* Did Intervention Work?

- Did the people who slipped grades in level 1 physics in 2007-08 do things any differently in level 2 physics in 2008-09?
 - 12/27 (45%) of people who slipped grades (3 through major grade boundaries) in level 1 Physics in 2007-08 also slipped grades in level 2 Physics in 2008-09 (4 through major boundaries).
 - The assessment data for 2009-10 classes is currently incomplete but appears to be following the same trend.
- The people who continued to slip grades in level 2 physics in 2008-09 were all in Group 2 (regular non-attendance or non-completion in spite of intervention $\sim 5\%$ of the class).

Summary

- Between 2007-08 and 2009-10:
 - Increased the pass rate by $\sim 10\%$ compared to historical average.
 - Increased the progression rate from Physics 1 to Physics 2 by $\sim 15\%$.
- Grade slippage through both major and minor grade boundaries continues to present challenges for a small percentage of the classes (Group 2 students).
- Although we've provided a student-centered learning environment in which the majority of students fulfil their potential, there are a small number who seem not to wish to take advantage.

Future Work

- Extend the existing longitudinal studies to level 3 and beyond.
- Investigate the effects of continuous assessment on academic performance in levels 1 and 2 physics.
 - If intervention is having a smaller effect than previously thought, what *is* driving up academic performance?
 - Does continuous assessment cause students to work harder and more regularly and so academic performance also increases (as we hope) or are the grades from it artificially inflating academic performance (which we prefer to avoid)?
- How can we quantify the effects of formative assessment (*Mastering Physics*) on academic performance?

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