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Comparison of Grading Practices across an Engineering Programme

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Abstract

A comparative analysis of the grading distributions in all first year courses in the four disciplines of the B.Eng. programme at Memorial University is presented. A search for deviations in various categories was conducted: among courses taken by the same cohort of students; between successive cohorts of students taking the same course; and between students of different disciplines taking a course common to some or all disciplines. The importance of various factors contributing to the variations in grading distributions is examined.

The aim is to provide a rational justification for such variations in grading standards as do occur and to encourage consistency in grading practices across the programme. Preliminary results are presented here.

1. Introduction

The Bachelor of Engineering programme at the Memorial University of Newfoundland has been a cooperative degree programme since the first class graduated in 1974. During the past decade students have entered the programme after two or more semesters of specified courses in the Arts and Science Faculties of the University (or equivalent experience elsewhere). The first year of engineering studies (consisting of two academic terms followed by the first work term) is common to all students. Thereafter the students divide into the four disciplines of Civil, Electrical, Mechanical and Naval Architectural & Ocean Engineering, with alternating academic and work terms to a total of eight academic and six work terms. Some courses in the higher terms remain common to two or more disciplines while others are restricted to just one discipline.

Once in the programme, each student must pass all six courses in each academic term, with an overall average of at least 60%, in order to continue to the next term in the programme. The Office of the Associate Dean (Undergraduate Studies) of the Faculty of Engineering and Applied Science has undertaken several studies (Keating 1992, Patey 1993, Robbins 1996) involving the grades of engineering courses.

One such study (Patey 1993, George, Moore and Patey, 1994) considered the use of the average grade in the common academic term 2 as a predictor of students' success in graduating from the programme on time. Among the conclusions was evidence that supported the current promotion threshold of 60%. That model continues to provide accurate predictions when tested against more recent data (Robbins 1996).

In this study we are interested in any significant variations in performance between students of the different disciplines in courses that are common to all disciplines. The courses in academic terms 1 and 2 are ideal for this purpose.

Another area of interest is the year-on-year variability in average grade for the same course. Anomalously low grades in a course can have severe effects on scholarships for a good student and on promotion for a marginal student.

We report here the results of a first analysis of the average grades received by students of each discipline in the common term 1 and 2 courses.

2. First Year Courses

With the present structure of the computerized database of student grades, it has been a fairly straightforward exercise to extract summary information on a discipline-by-discipline basis for the grades of students for courses taken since 1988 (the class of 1993). Although the curriculum has undergone numerous changes throughout its existence, since 1988 most of the courses in academic terms 1 and 2 have remained the same. The courses that have not changed significantly are:

Term 1	**Term** 2
1312 Mechanics 1	**2312** Mechanics 2
1502 Design 1	**2502** Design 2
	2205 Materials 1

The remaining courses have changed location in the programme and/or have experienced some modification of content since the class of 1993 took them in the academic year 1988-89:

1404 Linear Algebra
(1402 Vectors I for the classes of 1993,94)

2420 Programming
(term 1 for 95, 96;
1422 Computations for 93, 94)

1412 Intermed. Calculus
(term 2 for 95, 96;
1411 Calculus 3 for 93,94)

2421 Prob. & Statistics
(term 4 for 93)

1333 Circuits
(term 2 for 93, 94)

The sixth course in each term is a complementary studies elective (a humanities course chosen from a list of courses offered mostly by the Faculty of Arts). As there is a wide variety of courses chosen as the complementary studies elective, it is excluded from this first analysis.

When students are proceeding through academic terms 1 and 2, *they have not yet identified the engineering discipline that they wish to enter.* An outside observer might therefore anticipate that the average grades across all term 1 and 2 courses for each discipline group should be approximately the same, at least until the point where the students divide into their discipline groups. However, anecdotal evidence has for many years suggested that the students who subsequently choose to enter the electrical discipline perform significantly better than students who choose one of the other three disciplines.

A first look at the summary data (on the next page) clearly supports the latter hypothesis.

It is worth noting that the class sizes are large enough to support statistically significant results for seven year averages (classes of 1993 to 1999, taking term 1 courses over the period 1988 to 1994). In all disciplines except Naval Architectural and Ocean Engineering the class sizes remain large enough (from a minimum. of 25 to a maximum of 56) to analyze the year-on-year variability within the discipline also.

The numbers recorded as completing a course may vary from one course to another within the same discipline, as some students obtained exemptions from individual courses and some students joined their graduating class after the end of term 1.

Weighted Mean Scores in Term 1 and 2 Courses By Discipline for the Classes of 1993 -1999:

Course	Electr.	#	Mech.	#	Civil	#	Naval	#
1312	80.38	264	77.16	305	74.84	248	73.09	32
1502	73.44	264	71.39	304	70.81	248	66.69	32
1333 (2333)	74.93	266	66.07	302	65.84	250	60.69	32
1404 (1402)	74.26	263	67.33	305	68.11	248	66.56	32
1412 (2412/1411)	72.60	266	64.83	304	64.24	248	63.29	31
2205	70.05	275	65.21	309	64.96	254	62.10	31
2312	72.79	274	68.52	309	67.03	254	68.65	31
2502	75.52	275	73.69	309	73.07	254	70.97	31
2420 (1420/1422)	75.63	271	67.89	313	66.99	252	61.94	32
2421 (4421)	70.68	268	63.52	299	62.84	242	61.97	32
Overall First Year Average	**74.01**		**68.57**		**67.89**		**65.59**	

One hardly needs to apply any sophisticated statistical analysis to these results to realize that one group of students is consistently and significantly outperforming the others. Nevertheless a more careful analysis is warranted to remove the influence of unwanted factors such as grades received by the minority of students who are forced to repeat a term.

Future work will include an analysis of the variability of grades within the same course across the seven years and the variability of grades between courses, taking into account factors that may influence the usual grade distribution for each course.

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