AN ANALYSIS OF FINAL YEAR STUDENT PROJECT PERFORMANCE IN MECHANICAL ENGINEERING

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ABSTRACT

This paper describes a statistical analysis of the students' results in mechanical engineering Final Year Project (FYP) at undergraduate level eight. Project marks of the final year students obtained over the past six years (2002-2008) were recorded and analysed. A detailed and comprehensive assessment of the marks achieved was examined. This included assessment of the presentation, report and progress results. This study provided an interesting insight into the trends of assessors' marking and students' performance. A gradual statistically significant reduction in student marks over these six years was noted. Reduced student performance over the last 10 years in Leaving Certificate mathematics along with the general fall of in the numbers of engineering students are discussed as possible contributing factors. Care must also be taken to ensure that marking is consistent and standard such that it fully and fairly expresses student performance.

INTRODUCTION

The School of Mechanical and Manufacturing Engineering at Dublin City University currently runs four undergraduate degrees programmes [1]. The (FYP) is a major component of most undergraduate engineering programmes of study. This project is designed to provide experience in practical project work and assess student's competency in this area. A statistical analysis of the FYP marks in the Department of Electronic Engineering at the City University of Hong Kong was conducted in 2001. The purpose of this statistical analysis was to find the existence of discrepancy between the supervisor and second assessor in project assessment. It is found that the reason for the discrepancy is due to the excessively low marks given by one of the assessors. The outcome of this systematic approach using statistical analysis helped to identify those projects that needed to be reassessed [2]. FYP assessment has always been an important issue in the engineering undergraduate program. Teo and Ho developed a computerized system to manage project allocation and mark calculation [3]. It also contained a supporting system that can identify any discrepancy between supervisor and assessor. This systematic approach using statistical analysis used by Teo and Ho can highlight the staff members who have consistently given excessively high marks or extremely low marks [2, 3]. Tariq et al. introduced a more objective, criterion-referenced project assessment scheme to replace the old subjective assessment scheme [4]. The reliability of the new scheme was again studied using statistical analysis of data obtained from both the old and new schemes. Some assessment schemes use a grading category index (GCI) instead of actual mark for each assessment criterion. GCIs usually have a smaller number of options to choose from when awarding results. For

example, the GCI may gave eight levels with the highest being awarded to exceptional students and the lowest being awarded to students of inadequate performance. This reduced level of categories has been shown to result in less variability between assessors compare to systems which use marking ranges between 0 and 100 [4]. Staff also find it easier to use GCI to grade each criterion. A number of studies have been performed to examine the relation between FYP assessment methods and student performance levels [5, 6]. Validity and reliability are reported as two main concepts which must be addressed when devising assessment schedules. Validity is related by Teo and Hu to ensuring assessment of the correct aspects of the work and reliability to the consistency of the marking. These two concepts have to be borne in mind as well as the distribution of the grading. In this paper, the student assessment method and performance over the last six years in engineering are presented.

METHOD OF ASSESSING FYPs

A systematic approach is suggested using statistical analysis in order to examine the final year student project performance in mechanical engineering. Project marks of the final year student project in mechanical engineering obtained from the past six years (2002-2008) were recorded and analysed. The recorded data and assessment criteria are presented in Table 1.

Table 1: Breakdown of (a) progress and presentation 1st semester marking, (b) final project report assessment, and (c) 2nd semester presentation, performance and overall mark.

Progress	Interim Presentation 10%								
Mark	Supervisor				2nd reader				
Sem. 1	QP	C	Q/A	Tot	QP	C	Q/A	Tot	Aver
15%	40%	30%	30%	100%	40%	30%	30%	100%	100%

(a)

Final Report 50%								
Supervisor				2nd reader				
C	QR	BG	Tot	C	QR	BG	Tot	Aver
50%	30%	20%	100%	50%	30%	20%	100%	100%

(b)

Final (Lab) Presentation 20%										TOTAL
Supervisor				2nd reader					Perform.	15%P1+10%IP
QP	C	Q/A	Tot	QP	C	Q/A	Tot	Aver	Sem. 2	50%FR+20%LP
40%	30%	30%	100%	40%	30%	30%	100%	100%	5%	5%P2

(c)

Since performance, presentations and the final report contribute directly to the overall mark of the FYP, all of them were considered for FYP assessment. As shown in Table 1, the performances for the two semesters were considered. The presentation skills distributed between the two semesters were considered and every semester mark distributed among three parts: 1- the quality of the presentation, 2- the content of the presentation and 3- the ability of the student to answer questions directed to him at the end of the presentation. The

final report distributed among three parts: 1- the content, 2- the quality of the report and 3- the background. So the performance of the first semester, the interim presentation, the final report, the final presentation and the performance of the second semester contribute 15%, 10%, 50%, 20% and 5% respectively to the overall total. The supervisors supervised and guided the project student for the whole year. Also, another staff member who is familiar with the topic of the project was appointed as a second project assessor for presentation skills and final report in order to ensure that impartiality and consistency is preserved in marking.

RESULTS

A confidence interval gives an estimated range of values which is likely to include an unknown population parameter, the estimated range being calculated from a given set of sample data [7]. A 75% confidence interval based on the normal distribution was used to evaluate the margin of error, i.e. the rage of marks that has a 75% probability of containing the marks that students have achieved. The total number of FYP students decreased for the last six years shown in Table 2. In Figure 1, a similar trend for a reduction over this period can be observed from the overall FYP marks. A FYP marks comparison between the first and second semester in terms of presentation is shown in Figure 2. This trend of marks was noted separately in the marks over the six years for the quality of presentation, the content, and in their ability to respond to questions and answers. The second semester presentation marks and were always better than the first semester results. Figure 3 shows FYP report marks for the last six years. In these figures a downward trend in terms of marks is noticed. These figures also show an upward trend with time in terms of margins of error, which indicates that the marks are becoming more widely scattered in recent years.

Table 2: Number of students in the years analysed.

Year	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Number of students	73	69	66	66	55	47

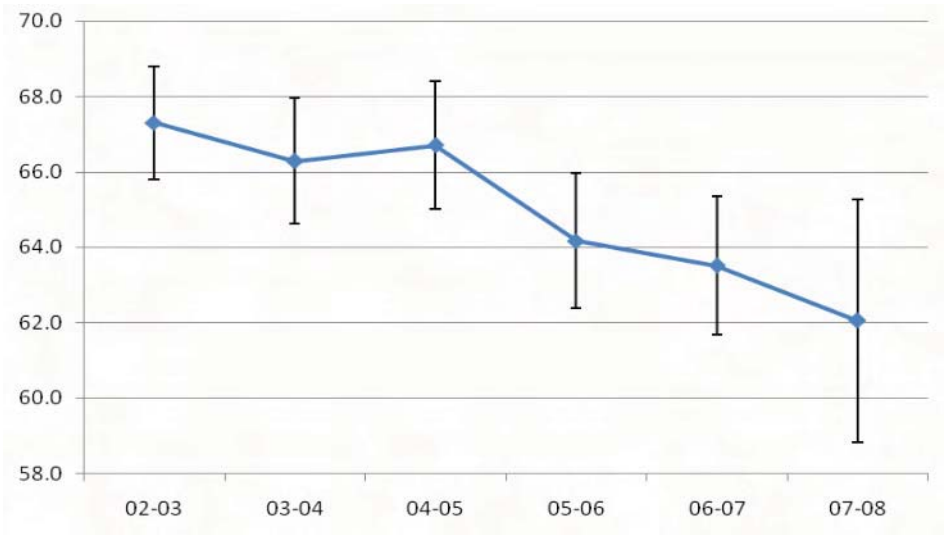

Figure 1: Average FYP marks for last six years. Confidence intervals shown were calculated using Z values for a 75% level of confidence.

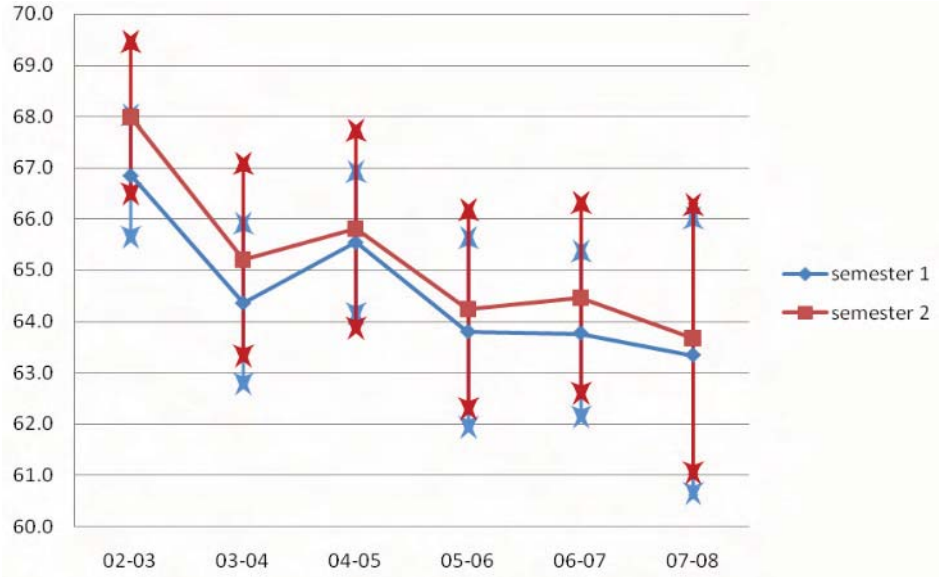

Figure 2: Average FYP first and second semester presentation marks for last six years. Confidence intervals shown were calculated using Z values for a 75% level of confidence.

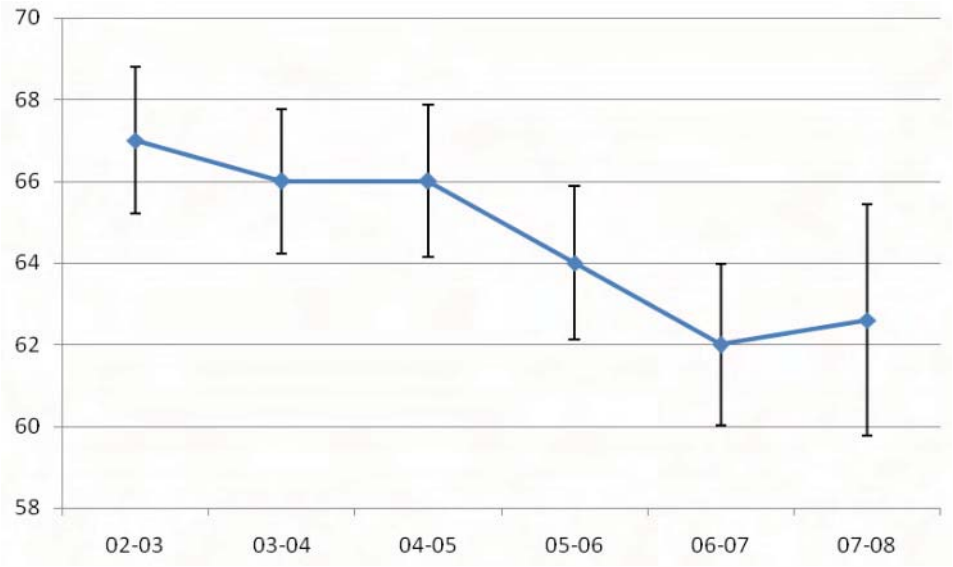

Figure 3: Average FYP report marks for the last six years. Confidence intervals shown were calculated using Z values for a 75% level of confidence.

DISCUSSION AND CONCLUSIONS

Upon successful completion of the project, students should be able to adhere to imposed deadlines, keep organised record activities, carry out applied research in a critical manner, communicate in a written report, give oral presentations, and have an appreciation for safety aspects [8]. The FYP in the curriculum of the academic programmes at the degree level is a major element in which the student uses their previously learned engineering skill as well as developing new skills and abilities. It is also a major element of their final degree assessment. Since the FYP mark eventually affect the career prospect of the student, standardization of the project assessment should be implemented. In this paper, the final year student project performance in mechanical engineering for the last six years was analysed using a systematic statistical approach. The outcome of this study helps to identify teachers marking and student performance trends. A downward trend in FYP marks over the last six years may be attributable to hard marking scheme. However, the authors believe that this is unlikely as the same marking methods and lectures have been in place during this period. The downward trend in the FYP results mirrors the downward trend that has been seen in the mathematical results at second level over the last ten years [9]. If it is the mathematical element that is causing a reduced level of performance, a change in the lecturing and support for the students' mathematical elements needs to be provided to compensate for this deficiency.

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