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The Effects of Promotion Exams in Preparatory Year Program on Students Performance in First Calculus Course at University

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Abstract. In principle all students admitted into King Fahd University (KFUPM), and many similar Middle Eastern Universities, are required to undergo a mandatory one-year preparatory program. The main purpose for this program is to foster a smooth transition from Arabic language secondary schools to an English medium university. However, at KFUPM, students can take *promotion exams* in order to qualify for exemption from some courses or even the whole program. But, little is known about the effects of promotion in preparatory programs such as this. This study aims at providing some insights in this direction. In particular, we investigate the effect of the program and, in particular, the promotion exams to the student performance in first Calculus course at KFUPM. It was found that promotion exams have mainly the same effects for the larger group of students and more substantial effects for the few promoted students.

1. Introduction

Students admitted into King Fahd University of Petroleum & Mineral (KFUPM), and many other Middle Eastern Universities are required to undergo a one-year preparatory program. This program mainly consists of an intensive English language program and a review of some basic high school mathematics namely algebra and trigonometry. The main purpose of this program is to create a smooth transition from Arabic language schools to an English medium university

The preparatory program at KFUPM is flexible in the sense that students may be exempted from the entire or a part of the program by taking promotion exams in either English, mathematics or both. The promotion exams are conducted at the start of each semester. In the case of English, students with acceptable good points in TOEFL are also exempted from taking English courses.

Well known universities have used local and standardized (such as College-Level Examination Program (CLEP)) promotion exams to grant students credit in lieu of taking certain lower-level pre-requisite university courses. Mathematics has been cited as an area in which majority of university credit hours are granted to students by passing promotion exams (See [4]). One main purpose of promotion exams is to free up students from some pre-requisite course loads so that they can concentrate on higher level university courses.

At the grade school level, the research has been on the effects and other issues of the examination. The practice of credit by promotion exams at the university level appears to have attracted the attention of many researchers (See [1], [2], [3], and [5]). Most of these studies were done to see the applicability of the program in different universities. However, not much is known about the effects of promotion at the college level, especially in preparatory programs

that serve as an English language bridge to Arabic speaking student cohort. This study is aimed at providing some insights in this direction. In particular, the study investigates the effect of the program in general, and promotion exams in particular, to the student performance in first Calculus course at KFUPM.

2. Method

The participant in this study comprises of male students with an average age of 19 years. Almost all of these students have Arabic as their first language as well as the language of instruction during their high schooling. Most of them have little English background at the time of admission.

2.1 Data

The data for this study was collected longitudinally from the Fall 2002 to the Fall 2004. All students who went through orientation program at KFUPM and those who obtained exemption partially or fully by taking promotion tests and progressed through Calculus I comprised the data for this study.

2.2 Procedure

To investigate the relationship between orientation program variables with students' performance in Calculus I at KFUPM, an ordinal logistic regression procedure was utilized in this study. The dependent variable for the analyses is the students' ordinal equivalent of their letter grades in Calculus I. The independent variables on the other hand, are the students' numerical grades in ENGL 001, ENGL 002, MATH 001, and MATH 002 and promotion exams for these subjects. Other independent variables include academic Term in which the students took Calculus I and how many times a student repeats Calculus I course. For repeating students, only their last Calculus I grade was used in the analyses.

3. Results and Discussion

The numbers of students who took Calculus I in all the seven terms and those promoted in English and Mathematics preparatory year courses, respectively, are presented in Table 1.

Table 1. Number of students promoted from each Term.

Year	Term	English Promoted	Math Promoted	Total
Fall 2002	21	63	9	643
Spring 2003	22	23	2	242
Summer 2003	23	26	5	148
Fall 2003	31	52	3	554
Spring 2004	32	24	3	282
Summer 2004	33	16	1	136
Fall 2004	41	93	2	673
	Total	**297**	**25**	2678

From the table, it is clear that more students were promoted for English courses than for preparatory year mathematics, with percentages 11.09% and 0.93% respectively. These are relatively small percentages of the students especially for mathematics. Student grades in

Calculus I ranged from WF (Withdraw-Fail) to A+ with most students getting C (467) or C+ (428) grade and the least getting WF (5), DN (Denial for failing to attend lectures, 22), F (94), and A+ (135) grade out of the 2678 total number of students.

Ordinal logistic regression was used to predict the probabilities of obtaining the particular grades in calculus I. Among the main effects investigated is that of promotion in English and mathematics on calculus I grades.

Apart from small number of students (only top students) getting promoted in mathematics, another difficulty faced in this study is that the grade of NP (No grade- Pass) has an undetermined numerical value. At KFUPM, the working assumption has been that a student who is promoted from a course has a proficiency level of a C grade in the course they were promoted from. However, no empirical evidence has been provided to support this assumption.

The result of studying the likely numerical value for the promotion grade of NP for each preparatory year subject is given below. All slope GFI index reported in Table 2 have 1 degree of freedom and show that the effect of each preparatory year course is significant (α=0.05) regardless of how NP is treated. The percent concordance index shows that Mathematics subject have higher agreement with the data than do English subjects alone, irrespective of how NP is treated. The highlighted negative likelihood index suggests the best fitting data for MATH 001 to be when NP is treated as A+. The same holds true for MATH 002. For ENGL 001, NP should be treated as C+ while for ENGL 002, it should be treated as B.

Table 2. The likely numerical values of NP for different preparatory year subjects.

NP	MATH 001			MATH 002			ENGL 001			ENGL 002		
treated As	% conc	Log-Likeli	Slope GFI	% conc	Log-likeli	Slope GFI	% conc	Log-likeli	Slope GFI	% conc	Log-likeli	Slope GFI
NP = D+	62.0%	-5142.04	679.02	61.0%	-5133.80	695.50	45.0%	-5447.33	64.00	44.4%	-5416.54	125.58
NP = C	62.0%	-5138.20	686.69	61.0%	-5125.66	711.78	42.3%	-5441.94	74.77	42.6%	-5406.80	145.05
NP = C+	62.1%	-5134.89	693.30	61.3%	-5117.67	727.75	43.8%	-5439.09	80.47	44.5%	-5400.15	158.35
NP = B	62.2%	-5132.22	698.65	61.5%	-5110.02	743.05	42.9%	-5440.39	77.87	44.4%	-5398.26	162.14
NP = B+	62.3%	-5130.26	702.58	61.7%	-5102.98	757.13	44.8%	-5445.27	68.11	45.3%	-5401.17	156.31
NP = A	62.3%	-5129.56	703.97	61.8%	-5099.80	763.49	44.3%	-5448.38	61.89	45.2%	-5404.01	150.64
NP = A+	62.3%	-5129.06	704.96	61.9%	-5096.90	769.29	44.7%	-5451.57	55.50	45.2%	-5407.44	143.77

Note: (1) %conc = %concordance or % of data correctly predicted by model. (2) Log-likeli = Log-likelihood for the fit of the model to the data. (3) Slope GFI = Goodness of Fit index for the slope of the subject course effects.

Table 3 shows the effects of the remainder of the variables in the study. From the last three columns, although Semester and Repeat are significant terms, some of the promotion terms are not. Specifically, these are the promotion variables for the two English language courses.

Table 3. Effect of other variables in the study

	Pearson			%	Log	Slope Significance		
Variables	GFI	df	p-value	concordance	likelihood	GFI	df	p-value
Semester	111.98	42	0.0000	44.20%	-5443.67	75.75	6	0.0000
Repeat	24.24	21	0.2820	11.40%	-5448.91	65.27	3	0.0000
Promotion for								
MATH 001	14.53	7	0.0430	0.70%	-5476.91	9.28	1	0.0020
MATH 002	1.39	7	0.9860	1.00%	-5458.71	45.68	1	0.0000
ENGL 001	54.68	7	0.0000	7.40%	-5479.28	0.10	1	0.7550
ENGL 002	29.70	7	0.0000	5.60%	-5477.92	2.81	1	0.0940

Table 4 provides the selection of the Best model. The full model containing all variables in the study is compared against simpler models with lesser terms as described in the table. From the Table, the best model includes all variables except promotion for ENGL 002 and promotion for MATH 001. This shows the importance of the preparatory year courses, the semester term, how many repeats, and some of the promotion statuses for the preparatory year courses. Further details of the best model are given in Table 5.

Table 4. Selection of the Best Model

	Pearson			%	Log	Slope Significance		
Model	GFI	Df	p-value	concordance	likelihood	GFI	df	p-value
All variables	12802.17	13903	1.0000	74.50%	-4839.68	1279.29	17	0.0000
Without promo E2	12705.74	13752	1.0000	74.50%	-4839.96	1278.74	16	0.0000
Without promo E2 and promo M1	12654.33	13737	1.0000	74.50%	-4840.96	1276.73	15	0.0000

Table 5. Details of the Best Model

						0.95 CI			Changes in		
Predictor	Parameter Estimate	SE Coef	Z	P-value	Odds Ratio	Lower	Upper	% Conc	log likeli	df	p-value
Constant[a]											
F or DN	4.63830	0.3192	14.53	0.0000							
D	6.07300	0.3152	19.27	0.0000							
D+	6.90550	0.3180	21.72	0.0000							
C	7.95810	0.3251	24.48	0.0000							
C+	8.87650	0.3336	26.61	0.0000							
B	9.83530	0.3438	28.60	0.0000							
B+	10.75930	0.3539	30.40	0.0000							
A	12.16490	0.3704	32.84	0.0000							
Term[b]								0.90%	47.470	6	0.0000
22	-0.74440	0.1408	-5.29	0.0000	0.48	0.36	0.63				
23	-1.29370	0.1672	-7.74	0.0000	0.27	0.20	0.38				
31	-0.54650	0.1051	-5.20	0.0000	0.58	0.47	0.71				
32	-0.80830	0.1333	-6.06	0.0000	0.45	0.34	0.58				
33	-0.67430	0.1690	-3.99	0.0000	0.51	0.37	0.71				
41	-0.71230	0.1031	-6.91	0.0000	0.49	0.40	0.60				
Repeat[c]								0.40%	11.671	3	0.0086
2	0.35480	0.1340	2.65	0.0080	1.43	1.10	1.85				
3	1.64620	0.3555	4.63	0.0000	5.19	2.58	10.41				
4	0.16490	0.8870	0.19	0.8530	1.18	0.21	6.71				
PromoM2[d]								0.10%	6.936	1	0.0084
1	-2.13810	0.5997	-3.57	0.0000	0.12	0.04	0.38				
PromoE1[e]								0.40%	15.093	1	0.0001
1	0.74220	0.1318	5.63	0.0000	2.10	1.62	2.72				
HiM1	-0.88369	0.0490	-18.04	0.0000	0.41	0.38	0.45	3.30%	166.226	1	0.0000
HiM2	-1.04639	0.0551	-18.98	0.0000	0.35	0.32	0.39	3.60%	183.837	1	0.0000
CpE1	0.18106	0.0733	2.47	0.0130	1.20	1.04	1.38	0.10%	2.968	1	0.0849
BE2	-0.39970	0.0737	-5.42	0.0000	0.67	0.58	0.77	0.30%	14.378	1	0.0001

Note: (a) A+ grade for calculus is the reference grade (b) Odds are expressed with Semester 021 as reference (c) No repeats (repeat = 1) is the reference for Repeat (d) The not promoted is the reference group for MATH 002 promotion (e) The not promoted (PromoE1=0) is the reference group for ENGL 001 promotion (f) HiM1 (MATH 001 with NP treated as A+), HiM2 (MATH 002 with NP treated as A+), CpE1 ((ENGL 001 with NP treated as C+), and BE2 (ENGL 002 with NP treated as B).

The effect of promotion can be seen in the contribution of the term "PromoE1" and "PromoM2". From the analyses, it appears that the promotion effect on Calculus I grade is larger for ENGL 001 in comparison to that of MATH 002. The effects of promotion for MATH 002 on Calculus I grade is only adding 0.10% to the accuracy of the model as represented by the change in the percent concordance column. This essentially says that for the larger group of students, the promotion effects are very minimal. However, when considering the fact that the percentage of students who were able to attain credit on courses by these examinations were the few top students in mathematics (less than 1%), this says that the effect is substantial for these students.

4. Conclusion

In this study, we have looked into the effects of the promotion exams on student performance in the first calculus course at KFUPM. It was found that promotion exams have mainly the same effects for the larger group of students and more substantial effects for the few promoted students. The most important effect appear to be the mathematics courses themselves followed by Semester and the English courses with student promotion grade equivalent of A+ in the mathematics courses, C+ in English 1 and B in English 2.

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