To Repeat or Not to Repeat a Course[1]

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The difficult transition from high school to university means that many students need to repeat (retake) one or more of their university courses. This paper examines the performance of students who were repeating first-year core courses in an undergraduate business program. It used data from university records for 116 students who took a total of 232 repeated courses across 6 subjects. The results show that the student's original course grade and cumulative grade point average were positively associated with the new grade obtained in the repeated course. Conversely, the original course grade was negatively associated with the extent of improvement obtained by repeating.

***Keywords*:** GPA, grades, repeated course, student learning, undergraduate business

The transition from high school to university is not easy for students, and often includes a noticeable decline in their grades (Grove, Wasserman, & Grodner, 2006; Richter, 2006; Wintre et al, 2011). Many students, including about 25% of those in the cohort we analyze, receive unsatisfactory marks in one or more courses and consequently need to repeat them. Failed courses obviously need to be passed, but even courses that were passed the first time might be repeated to improve the student's mark and average, and thereby maintain their major or honors status. If deficient courses are not repeated, or are repeated unsuccessfully, they may force the students to change majors or withdraw from university. Thus the extent to which students are successful when repeating courses can directly influence their retention and degree completion rates. These success rates are not only of interest to students and professors, but also to public policy makers (see, e.g., Armario, 2012).

To help students and their advisors make informed decisions about repeating courses, this study examines a selection of academic and demographic factors to determine which ones relate to student performance in repeated courses. The analyzed data includes 116 undergraduate business students who repeated 232 first-year courses spread across 6 core subjects. Unlike some studies of student performance, the work herein used official university records, rather than relying on self-reported data from student surveys. This also allowed the study to cover several subjects at once, rather than just the one taught by the researchers. Most importantly, this empirical study seems to be the first to focus on student performance when repeating courses.

Many previous studies have examined factors related to undergraduate student performance in business courses. Past academic performance has been widely used in this body

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of literature as an indicator of the students' academic ability and future performance. For example, a student's grade point average (GPA) in previous university courses has been found to be a significant positive predictor in accounting (Edmonds & Edmonds, 2008), economics (Gratton-Lavoie & Stanley, 2009; Grove et al., 2006), finance (Biktimirov & Klassen, 2008), and statistics (Wang, Tu, & Shieh, 2007). A student's high school average is another positive predictor of university course performance (Arnold & Straten, 2012; Richter, 2006).

Student demographic variables, such as gender and age, form a second category of potential predictors, though here previous research is less consistent. For gender, studies of introductory accounting courses have variously reported that male students outperformed females (Doran, Bouillon, & Smith, 1991), females outperformed males (Gammie, Paver, Gammie, & Duncan, 2003), or that there was no significant relationship between gender and performance (Byrne & Flood, 2008; Carpenter, Friar, & Lipe, 1993; Fogarty & Goldwater, 2010;). Contradictory results have likewise been found in economics courses (Arnold & Straten, 2012; Ballard & Johnson, 2004; Swope & Schmitt, 2006; Tseng, 2010).

The relationship, if any, between students' age and their performance is similarly ambiguous. In economics, for example, Gratton-Lavoie and Stanley (2009) found that age was positively related to student performance, whereas Tseng (2010) found that it was not.

Taken together, a large body of literature examines different factors related to student performance. Despite the relatively high rate of repeats of first-year courses, student performance in repeat courses has not been examined yet. This study addresses this gap in the literature.

METHOD

Data Collection

The study took place at a medium-size Canadian university accredited by the Association to Advance Collegiate Schools of Business (AACSB). All of the data came from the university records of the 439 students who had entered the undergraduate business program in 2005. This year was chosen to ensure that substantially all of the students would have graduated or otherwise left the program by the time the study started. Altogether, about 25% of these students had repeated at least one core or elective course at some point during their program of studies.

We began by obtaining course marks and demographic data for the 281 cases where a student from this entering class had repeated a first-year course. From this initial sample, we then deleted 24 cases relating to arts and sciences courses, as these were electives and were thinly spread across 18 different subjects; 3 cases of business courses that had only 1 repeat each; 13 cases where the student had taken an equivalent second-year course to replace the original first-year course; and 9 cases where the student had repeated the same course more than once (only the first repeat was included).

Altogether this left a total of 232 course repeats by 116 different students. These covered 6 subjects: financial accounting (42 repeats), business data analysis (8), calculus (66), macroeconomics (35), microeconomics (42), and statistics (39). The students averaged 2 repeats

each, but the distribution was heavily skewed: 3 students repeated 5 different courses, 16 repeated 4, 18 repeated 3, 20 repeated 2, and the remaining 59 repeated only 1. In the sample, 135 (58%) of the repeats were "mandatory" in that the students originally had failed the courses, while the other 97 (42%) were "voluntary" in that the students originally had passed.

Table 1 presents some summary demographic information for the sample. The first column shows breakdowns based upon the 232 courses repeated, the second column is based upon the 116 unique students who did the repeating, and the third column shows comparative figures for the entire entering class of 439 students. The number of male students was twice as high as female students in the entering class (298 vs. 141), and the great majority of students were Canadian citizens. The high school admission average (78.3) for the 116 students who repeated courses was only slightly lower than that for the entering class overall (80.7).

TABLE 1
Student Demographics

	Repeated courses	Students with repeated courses	All students
Total	232	116	439
Male	179	86	298
Female	53	30	141
Canadian citizen	219	109	417
Foreign citizen	13	7	22
Admission average mean	78.0	78.3	80.7

Variables

We obtained the following data for each of the 232 repeats.

Grade1 was the grade that the student received when they took the course the first time (i.e., the original attempt). *Grade2* was the student's grade from taking the course the second time (i.e., the repeat), and was the primary response variable of interest in this study. The difference in grade due to repeating the course was *GradeDiff = Grade2 – Grade1*. All course grades in this study were out of 100.

TimeDiff was the time difference that had elapsed between *Grade1* and *Grade2*, measured in 4-month terms or trimesters (fall, winter, spring-summer). For example, if a student originally took a course in fall 2005 and then repeated it in fall 2006, then *TimeDiff* = 3; i.e., 1 year. Marcal and Roberts (2001) found that students who took finance immediately after their statistics course did better than those who took it sometime later. *Age* was the student's age in years at the time of repeating a course.

Admission average (*AdmitAvg*) was the student's high school average at the time of university admission. Grade point average (*GPA*) was the cumulative mean of all the student's university grades received prior to repeating the course. We also calculated the cumulative standard deviation (*StdDev*) of all the student's university grades received prior to repeating the

course. As far as we are aware, no previous study has considered this variable, which can be thought of as a measure of the consistency of a student's performance.

Several data elements were represented by binary indicator (dummy) variables for statistical analysis. *Gender* was set equal to 1 for male students, and 0 for female. *Foreign* equaled 1 for international students or Canadian permanent residents, and 0 for Canadian citizens. *Pass* equaled 1 if the original grade was a pass (*Grade1* $\geq$ 50), and 0 if it was a failure (*Grade1* $\leq$ 49). An indicator variable was also included for each of the 6 subjects; 1 indicated that the grades were from that subject, while 0 indicated that they were not. These were labeled as *ACTG* (financial accounting), *CALC* (calculus), *DATA* (business data analysis), *MACRO* (macroeconomics), *MICRO* (microeconomics), and *STAT* (statistics).

RESULTS

Descriptive Statistics

Table 2 displays summary statistics for student grades and other quantitative variables. The average grade in the original attempts was 43.9 (out of 100), while for the repeats the average was 59.6. Thus students who repeated courses obtained an average increase of 15.7 marks. However, individual results varied widely, as can be seen in the histogram of Figure 1. Interestingly, 9.1% of the repeat grades were actually lower than the originals. As Table 2 shows, most of the repeats were completed 3 terms (one year) after the course was originally completed; e.g., a student who failed a course in fall 2005 typically retook it in fall 2006. However, the range was fairly wide for this timing, and extended from 1 to 13 terms.

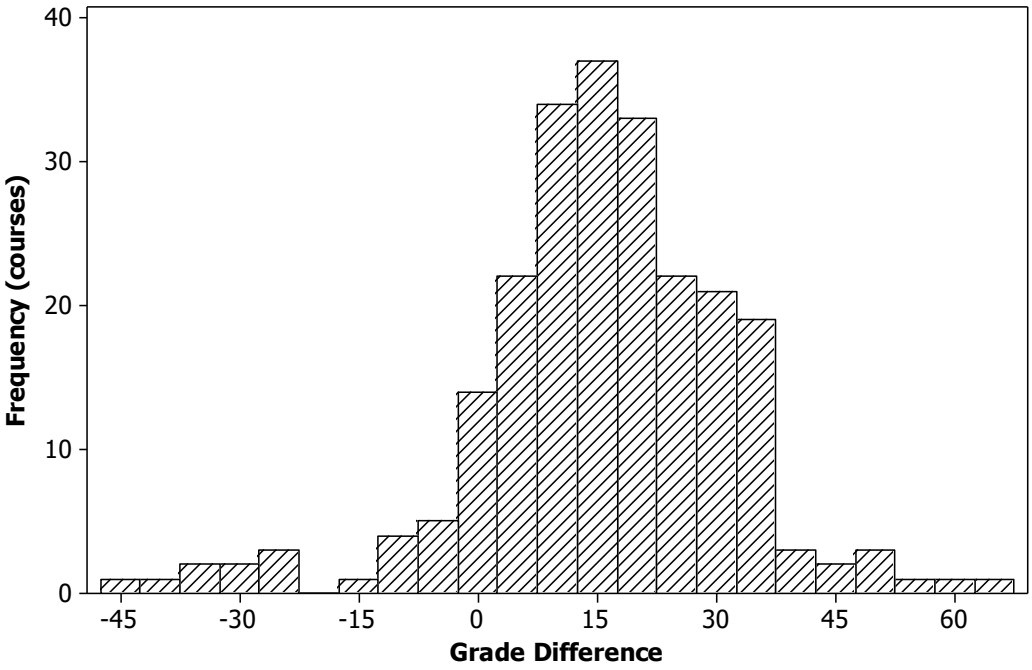

FIGURE 1. Distribution of the difference in grades between original and repeat courses.

TABLE 2
Descriptive Statistics

Variable	*M*	Median	Minimum	Maximum	*SD*
Grade2	59.6	62	0	95	19.1
Grade1	43.9	45	0	72	13.2
GradeDiff	15.7	16	-45	65	16.0
GPA	53.9	56.3	9.1	75.6	11.4
StdDev	13.0	12.2	3.0	32.1	4.3
AdmitAvg	78.0	77.2	73.0	91.3	4.0
TimeDiff	3.2	3	1	13	2.0
Age	19.7	19	18	24	1.0

Correlations

Table 3 shows the Pearson correlation coefficients for all of the quantitative variables. *Grade2* had statistically significant correlations with 4 variables. The strongest were positive correlations with *Grade1* and *GPA*. That is, students who had good marks the first time, or overall, tended to score higher marks in the repeat. The next strongest correlation was a negative one with *StdDev*. Students with more consistent (less variable) grades overall tended to achieve higher marks in the repeat than did students with widely varied grades.

TABLE 3
Correlations Between Quantitative Variables

Variable	1	2	3	4	5	6
1. Grade2						
2. Grade1	.563**					
3. GPA	.513**	.534**				
4. AdmitAvg	.087	-.026	-.044			
5. StdDev	-.254**	-.380**	-.430**	.102		
6. TimeDiff	.103	.168**	.069	-.105	.017	
7. Age	.137*	.173**	.176**	.022	.081	.462**

* $p \leq .05$, ** $p \leq .01$

Regressions

Table 4 presents the ordinary-least-squares regression results for the response variable *Grade2*. The parameter estimate for each variable is followed by its *p*-value. We used step-wise regression to discover which of the explanatory variables actually had significant relationships with *Grade2*, and then confirmed these by running more regressions manually. The first model shown in the table uses only the explanatory variable (*Grade1*) that had the highest correlation

with *Grade2*. The next models progressively add the other quantitative variables (*GPA* and *AdmitAvg*) that were found to provide statistically significant coefficients. The fourth model likewise adds all of the indicator variables that turned out to be significant (*CALC*, *DATA*, and *MICRO*). These indicate that repeat marks tended to be higher in microeconomics and lower in data analysis and calculus. Presumably this was due to course-specific features such as the assessment methods. Finally, for comparison purposes the last model added all of the remaining variables, none of which were significant. The *STAT* indicator variable is omitted from that final list and is used as a base category. Thus, the coefficients for the other five course-specific variables indicate the extent to which marks in those courses were higher or lower relative to the statistics course.

TABLE 4
Regressions of Repeated Course Grade on Explanatory Variables

Variable	I	*p*	II	*p*	III	*p*	IV	*p*	V	*p*
Constant	23.75	.00	6.978	.16	-34.76	.08	-38.17	.05	-26.84	.43
Grade1	0.817	.00	0.587	.00	0.588	.00	0.439	.00	0.358	.01
GPA			0.499	.00	0.507	.00	0.697	.00	0.724	.00
AdmitAvg					0.530	.03	0.536	.03	0.467	.07
CALC							-5.771	.02	-7.650	.02
DATA							-12.19	.02	-14.26	.02
MICRO							6.927	.01	3.842	.25
StdDev									0.147	.59
TimeDiff									0.120	.84
Age									-0.235	.87
Pass									3.214	.33
Gender									-0.747	.76
Foreign									1.655	.76
ACTG									-3.423	.30
MACRO									-4.130	.23
R^2 %	31.7		38.0		39.2		44.3		45.2	
Adj. R^2 %	31.4		37.4		38.4		42.8		41.7	
ΔR^2 *p*-value			.000		.036		.000		.943	

Grade1 by itself was a good estimator of *Grade2*, with $R^2 = 31.7\%$ in Regression I. The fit incrementally improved when we added *GPA*, and to a much lesser extent with the addition of admission average and the course-specific indicator variables, ending up at $R^2 = 44.3\%$ in Regression IV. *F*-tests of these incremental improvements in R^2 confirmed that each of these steps was statistically significant; see the *p*-values at the bottom of Table 4.

From a student viewpoint, the analysis above addressed the question "How *high* will my grade be if I repeat a course?" However, a student might also ask "How much will my grade *improve* if I repeat a course?" That is, they might think about their success in relative rather than absolute terms. To consider this viewpoint, the regression analysis was repeated using *GradeDiff* instead of *Grade2* as the response variable. The results are shown in Table 5.

In these regressions *Grade1* remained statistically significant, but with negative rather than positive coefficients. That is, students with higher marks in the original course tended to improve less when repeating. This seems reasonable, as students with higher marks had less room to improve; conversely, a student with a zero in the original course had nowhere to go but up. Not surprisingly, the R^2 values here were not as good. Using *GradeDiff* as the response meant subtracting a positively correlated variable (*Grade1*) from the original response variable (*Grade2*), and so removed most of its explanatory power. The coefficients and *p*-values for the other variables only changed slightly in these alternative models, and their overall relationship was materially the same.

TABLE 5
Regressions of Grade Difference on Explanatory Variables

Variable	I	*p*	II	*p*	III	*p*	IV	*p*	V	*p*
Constant	23.80	.00	7.077	.16	-34.30	.08	-37.71	.05	-28.69	.40
Grade1	-0.185	.02	-0.415	.00	-0.414	.00	-0.561	.00	-0.640	.00
GPA			0.497	.00	0.505	.00	0.693	.00	0.719	.00
AdmitAvg					0.525	.04	0.531	.03	0.464	.08
CALC							-5.650	.03	-7.651	.02
DATA							-12.07	.03	-14.33	.02
MICRO							7.027	.01	3.851	.26
StdDev									0.146	.59
TimeDiff									0.125	.84
Age									-0.127	.93
Pass									3.062	.35
Gender									-0.541	.83
Foreign									1.635	.77
ACTG									-3.397	.31
MACRO									-4.478	.20
R^2 %	2.3		11.1		12.8		20.0		21.3	
Adj. R^2 %	1.9		10.3		11.7		17.9		16.2	
ΔR^2 *p*-value			.000		.037		.000		.942	

As a robustness check, we also performed the regression analysis for *Grade2* with a pair of more refined data sets. For the first set, we considered only the 97 repeats where students had originally passed (*Pass* = 1). These repeats involved an interesting decision problem: since the students already had passing grades, they risked doing worse if they took the course a second time. (Like many other schools, this university counts the repeat grade in place of the original when evaluating the student's average and degree progress.) This alternative data set yielded somewhat similar results (not shown). *Grade1* and *GPA* both remained as the main predictors of repeat grade performance, *MICRO* was significant but made little contribution to R^2, and *AdmitAvg*, *CALC*, and *DATA* stopped being significant at all. The R^2 values were lower overall, and the best model with only statistically significant variables had R^2 = 30.2%.

The other refined data set was obtained by including each student only once. Although the main data set contained 232 repeated courses, these were taken by only 116 unique students.

Thus some students' demographic characteristics appeared several times in the analysis, while others' appeared only once. This was not necessarily a problem, and the inclusion of an indicator variable for each subject neutralized any bias that might otherwise have existed. But to be thorough, we also created and examined a data set (not shown) in which each student appeared only once. Using this set of 116 repeats, *Grade1*, *GPA*, and (to a lesser extent) *MICRO* were again significant, while the other variables were not. The R^2 values improved considerably, with the best model giving $R^2 = 61.9\%$. Taken together, both refined data sets produced results similar to the ones reported in Table 4.

DISCUSSION

Implications of the Research

This study found that the students with high original grades tended to achieve the best performance on the repeat in absolute terms, i.e., by obtaining high grades. However, the students with low original grades did the best in relative terms, i.e., by obtaining large grade increases. Performance in the repeat course also tended to be better, in both relative and absolute terms, when the students' university cumulative GPA were high. This is similar to what earlier studies have found in other contexts, as noted previously (e.g., Gratton-Lavoie & Stanley, 2009).

The student high school average was a statistically significant variable in only some of the regressions, and even there had little explanatory power. So while high school marks may have some predictive value for university performance generally (Richter, 2006), that value seems to fade by the time a student is repeating a course. The indicator variables for half of the course subjects in this study likewise had statistically significant relationships with repeat grades but with low explanatory power. This implies that student success on repeats could vary naturally from one subject to another, but not consistently enough for students to be concerned about.

It is worth mentioning some of the variables that did not have any significant influence on repeat grades. Firstly, there was no apparent difference in results between students who had originally failed the course (*Pass* = 0), and those who had passed (*Pass* = 1), aside from that already implied by the original course grade itself. This implies there was no distinct difference in student motivation, study habits, etc., between the voluntary and the mandatory repeaters. The amount of time that had passed between the original and repeat attempt at the course was also not significant. It seems there was no consistent advantage in hurrying to retake the course immediately, or in waiting for the passage of time to help digest the material. Finally, none of the demographic variables (gender, age, etc.) were significant. This is similar what most other studies of student performance have found (e.g., Fogarty & Goldwater, 2010).

These results remained essentially unchanged when the analysis included only the voluntary repeats, or only one repeat per unique student. This consistency provides some assurance that the results were not merely the artifact of a particular analysis approach.

Advice for Students and Advisors

For a student who is thinking of repeating a course, the results of this study imply that a repeat is likely to be more successful if the student's grade in the original course was not too low, if they did well in their other courses, and if their high school average was high. Consider, for example, a hypothetical student who received a 40 in the original course, had an overall average of 70 in their first-year university courses, and an 85 average in high school. With these numbers, regression model III would estimate an average mark of 69.3 in the repeat, so clearly it would be worthwhile for that student to repeat the course. Conversely, for a student who received only 20 in the original course, and had averages of 55 in their first-year courses and 75 in high school, the estimated repeat mark would be just 42.6. A repeat attempt in that case would be much less promising.

While the specific parameter values in our statistical analysis may only apply to business students at one university, we speculate that the general relationships would hold on other campuses as well. Students who otherwise have done well (i.e., have high GPAs) should be encouraged to repeat a lone low mark. Conversely, students with consistently weak marks need to realize that repeating is not guaranteed to be successful, and in fact may be a waste of their time. The latter group should be advised to improve their study skills before repeating, or perhaps even to change degree programs. By providing some guidance in these decision contexts, our results may contribute in a small way to larger efforts to improve student success rates, something that voters and governments are increasingly concerned about (see, e.g., Armario, 2012).

Limitations and Future Work

The data for this study had the advantage of being objective and reliable, as it came directly from the university's official records. However, these records naturally did not contain many of the attitudinal, behavioral, and situational factors that might also influence student performance. For example, why did a student do poorly the first time they took the course? Did they have weak study skills, low motivation, or major distractions in their personal life? When they repeated the course, did they put more time into their studies, attend workshops to improve their study skills, or simply repeat their previous behavior in the hope of getting a different result? These factors are all potentially of interest, but clearly would require a different research design, and so are beyond the scope of the work herein.

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