THE EFFECTIVENESS OF USING ECONOMICS TO AID READING SKILLS DEVELOPMENT: SOME EMPIRICAL EVIDENCE

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ABSTRACT

Student enrollment in colleges and universities has increased markedly during the last three decades. Between Fall 1970 and Fall 2000, enrollment in all degree-granting institutions rose from 8.5 million to about 15.1 million students. Simultaneously, there has been a proliferation of developmental skills programs in higher education institutions largely in response to an increasing proportion of under-prepared college students. This paper compares the impact of alternative remedial reading courses on students' academic performance in college. The findings indicate that while a reading development course generated relatively better outcomes for under-prepared students than a paired economics-reading development course, there was no statistical difference in long-term academic success between the top performers (A and B students) in both courses.

INTRODUCTION

The expansion in college enrollment at an average annual rate of 1.98 percent between 1970 and 2000 coincided with a growing number of college entrants who were under-prepared to do college-level academic work.[1] Meanwhile between 1987 and 2000 the proportion of degree-granting institutions offering remedial services to students increased from 72.7 percent to 76.4 percent. Invariably, these developmental education programs in higher education seek to "eliminate deficiencies that diminish students' potential to succeed in college level courses" (Tomlinson, 1989).[2] Conflicting results about the impact of developmental education courses on the academic success of students, however, have raised questions about the role of remedial coursework in postsecondary education ((Bohr (1994/95); Manno 1995; Taraban (1997); Schrag 1999). Reading development programs, in particular, were thrust into the forefront of this discussion with the findings of a recent study, which examined a cohort of high school graduates students over a twelve-year period (NCES, 2000). This study found that the assignment to remedial reading in college is associated with additional remediation and that "students who take any remedial reading courses are less likely to earn a 2- or 4-year degree than those who take other combinations of remedial courses."[3]

The purpose of this paper is to examine the relative effectiveness of different approaches to building

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[1] Average student proficiency in reading of 17-year olds, for instance, was relatively unchanged between 1971 and 1999 with respective scores of 285.2 and 287.8. These are test scores from the National Assessment of Educational Progress (NAEP). The NAEP scores have been evaluated at certain performance levels. A score of 300 implies an ability to find, understand, summarize, and explain relatively complicated literary and informational material.

[2] In the short run, such success amounts to completing required and elective discipline courses with a passing or higher grade. In the long run, it amounts to students successfully completing their degree programs. Traditionally, and in this paper as well, the term "developmental course" is used to refer to any course offered by a college or university which is designed to help initially under-prepared students remedy any basic academic skill deficiency which they may have upon entering college. The term "discipline course" is used to refer to all other college and university courses.)

[3] Among the students who took any remedial reading, 42 percent were in three or more other remedial courses, and 67 percent took remedial mathematics. In contrast, among the students who took any remedial mathematics courses, 16 percent were in three or more remedial courses, and 24 percent took remedial reading. Students who took only one remedial course (other than remedial mathematics or reading) completed degrees at the same rate as students who took no remedial courses (55 and 56 percent, respectively). Students whose only remedial requirement was mathematics and who took a maximum of two remedial courses completed associate's or bachelor's degrees at a higher rate (45 percent) than students with any reading problems (34 percent). A higher percentage of community college students than 4-year college students are assigned to remedial courses. Sixty-three percent of students who attended only a 2-year college and 64 percent of those who attended both a 2-year college and a 4-year college took at least one remedial course, compared with 40 percent of those who attended only a 4-year college.

reading skills on the long-term academic success of under-prepared college students. Recent findings from the related literature suggest that alternatives to remedial reading courses have had some success in fostering reading development (Bohr 1994/95). Specifically, previous studies identify freshman classes in music, engineering, and english literature as having statistically significant impacts on reading development. This paper considers the role of economics as an aid to reading development by comparing the impact on students' academic success of a combined economics-reading development course with two traditional reading development courses at a four-year, regional, open admissions state university. The empirical results indicate that overall, students in one of the developmental reading courses outperformed students in the combined economics-reading development course as well as those in another developmental reading course. Further, the findings indicate that student performance above a threshold level in the remedial reading course and the "combined" economics/reading course resulted in no difference in long-term academic success.

The remainder of our paper is structured as follows. The second section discusses theoretical relationships between reading skills and academic success and considers alternative approaches to reading skill development. The third section describes the database used in the paper. The fourth section presents analysis of variance results and the final section provides a summary of our research findings and suggestions for future research.

Reading Comprehension Skills and Academic Success

Under-prepared students face two reading-related hurdles compared to students who enter with an ability to read at the college level. First, they have to close a reading achievement gap in a relatively short time period. Second, after closing that gap, they must continue to increase their reading comprehension skills at a rate equal to that of initially prepared students.

Reading skills courses can contribute to under-prepared students' long-run success in college by helping them accomplish the first task, but reading skills learned in such courses must be reinforced through use in core discipline courses taken concurrently with, and soon after, a reading course if under-prepared students are to keep up with prepared students. In addition to the curriculum of reading skills courses, two factors are likely to be important determinants of under-prepared students' long-run success in college. They are the students' themselves and the nature of the core discipline courses required of all students.

Two recent studies have compared under-prepared students who succeeded in college to those who did not (Nelson 1998 and Yaworski, Weber, and Ibrahim 2000). Their findings provide clear and consistent evidence that successful students: 1) attend class, 2) are prepared for class (by completing course assignments), 3) perceive instructors as experts, 4) adhere to an organized study routine, 5) develop a repertoire of study skills strategies, and 6) take responsibility for their own learning. Both studies therefore, find that student input to the learning process is critical to long-run success in college.

A second factor which is likely to be important to under-prepared students' effort to keep up with the growing reading abilities of initially prepared students is the type of core discipline courses required of all students. Research on the type of freshman courses which generate good readers suggest that some courses are more positively associated with reading gains than others. They include English composition and literature courses, foreign language courses, and music courses (Bohr 1994/95). The degree of students' achievement in such courses, as measured by grade earned, may be an especially important determinant of under-prepared students' long-run success in college for two reasons. Achievement in such courses not only serves as a useful proxy of the growth in their reading comprehension skills but can also represent their current dedication and commitment to academic learning.

Alternative Approaches to Reading Skills Development

There are at least three possible reasons for the potential ineffectiveness of developmental education courses in general and developmental reading courses in particular. First, credit hours for such courses rarely, if ever, count toward the completion of a college degree; thus, many under-prepared students may not enroll in such courses because doing so increases the opportunity cost of their degree program (i.e., course-related tuition and time costs in the short run and graduation delay in the long run).[4] Second, because developmental course credits don't "count," students who do enroll in them may fail to work as diligently as they should (or, need to), leading to fewer skill gains than that needed to ensure subsequent academic success.[5] Third, recent evidence

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[4] Some under-prepared students may even deny that they have any academic skill deficiencies and, thus, may avoid enrolling in any developmental education courses as a way of preventing a loss of self-esteem (Manno, 1995).

[5] Two studies have found that student input to the learning process is critically important to under-prepared students' long-run

on the determinants of student success at the college level suggests that such success depends more on the content and emphasis of a student's entire curriculum background than on the successful completion of one or a few particular courses (Lopus and Maxwell 1994; Lopus 1997; Walstad and Soper 1988; and, Baumol and Highsmith 1988). A single developmental course aimed at improving a critically important academic skill like reading comprehension, therefore, may simply be insufficient to remedy most students' skill deficiencies.

In view of the questionable effectiveness of developmental reading courses, higher education institutions have utilized several approaches to build students' reading skills. These approaches range from utilizing discipline-specific freshman courses to a single-subject focus in existing developmental reading courses. This paper considers another alternative, which involves collaboration between developmental reading courses and freshman courses offered for different college majors. The premise is that there are complementarities in this "pairing" approach that would lead to greater academic success for under-prepared students.

The pairing that is investigated in this paper is an experimental course which combined the curriculum of a developmental reading course and an introductory, freshman-level college discipline course in economics. By the end of the Fall 2000 semester, as many as 10 (and, as few as 8) semesters had passed since students enrolled in (and successfully completed) that experimental course. The course was offered for three semesters: Fall 1995, Spring 1996, and Fall 1996.[6] This experimental course, ECON 174X had two immediate purposes and one ultimate purpose. The immediate purposes were (1) to encourage more students (especially those students who enter college under-prepared to read at this level) to take a course designed specifically to increase their reading comprehension skills,[7] and (2) to

provide an immediate discipline curriculum context for practicing and reinforcing the reading skills taught. The ultimate purpose of the course was to improve the college academic success of under-prepared students.

DATA ISSUES

Our study's database consists of all first-time students who enrolled in one or more courses at the University of Southern Indiana (USI) during any or all of the three semesters that ECON 174X was offered and who successfully completed any of the following three remedial reading courses: EDUC 151; ECON 174X, GENS 099. After eliminating observations because of missing data or data with some measurement error, we were left with a sample of 826 students.[8]

First-semester students are required to take the University's reading placement test [Degrees of Reading Power (DRP)] upon entering the University. Possible scores on the DRP range from 0 to 100. A score of 72 or more suggests that the student reads at the college level. If a student received a score of 67-71, it was recommended that s(he) take a course offered by the School of Education and Human Services, entitled "Reading Power" (EDUC 151), to improve her/his reading comprehension skills.[9] If a student received a

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academic success in college. See Nelson (1998) and Yaworski, Weber, and Ibrahim (2000).

[6] During the 1994-95 academic year, an economics professor and a reading development instructor team-taught two separate, but paired, courses; namely, Fundamentals of Economics, ECON 175, and Strategies for College Reading, GENS 099. Based on their experience with that paired course arrangement, they designed an experimental, combined curriculum course, ECON 174X, Fundamentals of Economics with a Reading Component.

[7] The ECON 175 course is a 3 credit hour class that is graded on a letter-grade basis. GENS 099 is a traditional (pass-fail) developmental course whose 3 credit hours do not count towards graduation. ECON 174X provided students with 4 credit hours, all of which would count toward a college degree program. Also, students could count the course's 4 credit hours toward meeting one component of the University's Core Curriculum requirements (namely, Individual Development and Social Behavior).

[8] At USI, a student's class standing is determined by the number of college credit hours completed with a grade of D or better. Freshmen have completed 16 or fewer credit hours. Not all students who enter the University as freshmen, however, are required to take the DRP. There are four ways entering freshmen can be exempt from the DRP. They are: 1) by entering the University with a grade of C or better in a college-level class from another college or university; 2) by taking a summer class at USI prior to registering for classes during a regular semester (Fall or Spring); 3) by receiving credit for a USI class while enrolled in high school; and, 4) by returning to the University after an absence of one or more semesters. We restrict our analysis, therefore, to a sub-set of freshman students who entered USI during any of the three semesters ECON 174X was offered. We call our sub-set "first-time" students because they have neither transferred in any credit hours from another college or university nor have they previously completed any courses at USI. Since all "first-time" students are required to take the DRP, we have a measure of their reading abilities upon entering the University and we can track these students' complete academic progress at USI.

[9] The past tense is used here because the University no longer uses the DRP to determine a student's reading placement. Instead, it now uses a different test named 'Accuplacer'. Also, starting with the Fall 1999 semester, the course acronym was changed from EDUC to GENS because the course is now offered by the University's Academic Skills Center rather than the School of Education and Human Services. At USI, students may count the credit hours of any course numbered in the 100's or higher,

DRP score of 66 or less, it was recommended that s(he) take a specific general studies course (GENS 099). Its 3 credit hours cannot be counted toward graduation. Since ECON 174X was designed as a substitute for GENS 099, any student who was recommended for GENS 099 could enroll in ECON 174X instead.[10] The sections of ECON 174X tended to fill up faster than the sections of GENS 099 because the 4 credit hours that a student received for completing ECON 174X with a grade of D or better could be counted toward graduation.

Long-run academic success can be viewed as consisting of two components: the breadth (or number) of skills learned and the depth at which those skills are mastered. We measure the breadth of skills by the number of credit hours the student has completed successfully and the depth of skill mastery by the letter grade (expressed in quality points) earned in each class.[11] To take both of these effects into account simultaneously, we multiply credit hours earned by quality points to obtain each student's grade points. [12] We use this last variable as our measure of long run academic success.[13]

Data was also collected on a number of background variables such as students' high school

grade-point-average (HSGPA), and their percentage correct composite SAT or ACT scores (PCTSCORE).[14] In the event that a course is graded on a pass/fail basis (such as GENS 099), a dummy variable was created that took a value of one if the student passed the course and zero otherwise. A brief description of these courses may be found in Table 1, which gives the name and definition for each of the variables used in this study.

For hypothesis testing purposes, our sample of students was broken into the following groups:[15]

(1) those students whose DRP score was 71 or less and who took and passed GENS 099 (514 students);

(2) those students whose DRP score was 71 or less and who took and passed ECON 174X (117 students);

(3) those students whose DRP score was 71 or less and who took and passed EDUC 151 (283 students) and,.

(4) those students who took and passed more than one of the above courses. There were 88 students in this category, consisting of three students who took and passed GENS 099 and ECON 174X; twelve students who took and passed ECON174X and EDUC 151, and seventy-three students who took and passed GENS 099 and EDUC 151.

EMPIRICAL MODEL AND FINDINGS

Our study's hypothesis, expressed in null hypothesis form is:

There is no significant difference in academic performance between (a) students who are under-prepared to read at the college level and who pass a combined curriculum reading skills course (i.e., ECON 174X, or Group 2, students) and (b) students who are under-prepared to read at the college level and who pass a reading skills course based on traditional developmental reading curriculum

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regardless of its acronym, toward the total required to graduate in any of the University's undergraduate degree programs.

[10] It is important to note that, while GENS 099 and ECON 174X were designed to be substitutes in terms of the reading skills taught, the ECON 174X class also taught economics-related skills as well. Consequently, while students were encouraged to take either GENS 099 or ECON 174X, two students in our sample successfully completed both classes.

[11] The University of Southern Indiana does not use minus sign grades. As a result, a letter grade of 'A' equals 4 quality points, a 'B+' gives 3.5 quality points, a 'B' equals 3 points, and so on.

[12] By using this variable to measure long run academic success, we implicitly make a number of assumptions. First, holding all else constant, we give equal weights to the two component variables in determining academic success. Second, if two classes have the same number of credit hours, then we must also assume (ceteris paribus) that each class provides students with an equal (albeit different) breadth, or number, of skills. An analogous assumption applies for quality points. Lastly, when a student transfers a course in from another university, the credit hours are included in the student's total earned credit hours but the grade received is not recorded. To obtain grade points for these courses, the credit hours are multiplied by the student's overall USI grade-point-average (GPA). Our assumptions and estimation of grade points earned on transfer hours introduce the possibility of measurement error in our dependent variable; however, that should not affect the consistency of our regression estimates (Greene 1999).

[13] Because of how we chose to measure long-run academic success, we eliminated from our database all first-time students who left the University after earning an Associate's degree in order to preserve the homogeneity of our data set (namely, bachelor's degree seeking students).

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[14] In the case of SAT scores, the PCTSCORE variable was composite SAT score divided by 1600 and for the ACT it was ACT score divided by 36. When a student took both SAT and ACT, the higher PCTSCORE was used.

[15] Overall there were 914 students including the 88 students who took and passed more than one of the three courses.

only (i.e., GENS 099 or EDUC 151, or Groups 1 and 3).

Descriptive Statistics

Table 2 presents some of the descriptive statistics for the variables for all students and for the sub-groups based on the type of remedial reading course passed. A comparison of mean values for measures of academic success such as cumulative grade points (GRDPTS), cumulative credit hours (HRS), and overall grade point average (GPA) indicates some differences between groups with students passing EDUC151 exhibiting larger values than those successfully completing GENS099 and ECON174X. Examination of the coefficients of variation for the three measures of long-term academic success indicate much less variability in GPA (0.31) compared with GRDPTS (0.89) and HRS (0.74) for the sample of students. Much less variability is exhibited within the group judging from the coefficients of variation for indicators such as high school grade point average (HSGPA) and performance on the SAT and ACT measures as percent score (PCTSCORE). A comparison of mean and median values indicate that while the distributions of cumulative grade points and cumulative hours are skewed to the right, the distribution of overall GPA was skewed to the left. Based on the data presented in Table 2, we see that one group appears to stand out from the other two, namely, group 3. Compared to the other two groups this group entered college with a stronger academic achievement record on average and achieved the greatest long-run success in college as measured by the three indicators of long-term academic success.

Empirical Model Specification

The null hypothesis claims that the curriculum of a reading skills course will not significantly affect the long run academic performance of under-prepared students who take and pass such a course (ECON 174X, EDUC 151, or GENS 099). To test this hypothesis, we restrict ourselves to that subset of students who took and passed at least one of the three different reading skills courses (n = 826). We create several dummy variables. DV174 is given a value of one if a student passed ECON174X and a value of zero otherwise. DV151 is given a value of one if a student passed EDUC 151 and a value of zero otherwise. DV99 is equivalent to a dummy variable since the course, GENS 099, is graded on a pass/fail basis. Interaction variables among the courses are given a value of one if a student satisfies the interaction condition (e.g..INTERACT174151, is given a value of one if a student passed ECON174X and

EDUC151) and a value of zero otherwise. The inclusion of variables pertaining to type of course taken and passed yields the following model for each measure of academic success:

$$ACSUCCESS = \phi_1 DV174 + \phi_2 DV151 + \phi_3 DV99$$
$$+ \sum_{i=1}^{3} \phi_i INTERACT_i + \nu \qquad (1)$$

where ν is an error term (with the standard classical assumptions). This framework is extended to include dummy variables indicating the level of performance in each of the three courses.[16] Since this framework allows us to test the hypothesis that there is no difference in the sample means of the respective measures of academic success it is equivalent to the analysis of variance procedure.

EMPIRICAL RESULTS

Analysis of variance results based on dummy variable regressions are indicated in Table 3. The F-test indicates that the null hypothesis of no difference among the courses in terms of impacts on long-term academic success is rejected for all three measures of long-term academic success. The results of further investigation to identify the source(s) of the differences among the courses are shown in Table 4.[17]

Considering the effect of type of course taken on measures of students' long-term academic success, the F statistics reported in Table 3 reject the hypothesis of no difference in effects based on type of reading course taken. Moreover, higher mean values for each measure of success were associated with those students who took EDUC 151 compared to those who took ECON174 or GENS099. Comparisons of effects between courses reported in Table 4 indicate no statistical difference between ECON174 and GENS099, but a difference between EDUC151 and GENS099 for all three measures of long-term academic success. A comparison of ECON174 and EDUC151 shows a statistical difference in effects for grade point average and total grade points but not for cumulative hours.

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[16] This results in thirteen interaction coefficients, which are shown in Table 3.
[17] The results in Table 4 are based on t-tests of coefficient differences in the regressions. These were conducted to identify the source(s) of differences in the academic success of students based on the type of reading course taken and students' performance in these courses.

Next, we consider the effect of the same level of performance across courses on the measures of long-term academic success. The reported F statistics for regressions based on dummy variables indicating the level of performance in the different courses reject the null hypothesis of no difference in the effect of course performance. Higher mean values for each measure of long-term academic success are also observed for students receiving A's and B's in ECON174 compared to those receiving A's or B's in EDUC151. However, t-tests of these coefficient differences indicate no statistical difference between in effects between the A students in ECON174 and EDUC 151 and the B students in ECON174 and EDUC151. While there is a statistical difference in effect between A students in ECON174 and B students in EDUC151 for the GPA measure of success, there was no statistical difference in the case of the cumulative grade points and hours variables. A similar pattern with regard to these success variables is observed between B students in ECON174 and A students in EDUC151. Tests of coefficient differences for the A students who took ECON174 and the C and D students from EDUC 151 indicate a statistically significant difference for all three measure s of success. Similarly, there was a statistical difference between the measures of success for B students who took ECON 174 and students with D's in EDUC151. Table 4 also shows that there is a statistical difference in effect between A and B students in ECON174 and GENS099 and one between A students in EDUC151 and students who passed GENS099.

Tests of differences in effect between students taking one reading course and those taking more than one course provide some support for the recent finding that students who take more remediation courses tend to be less successful than those taking fewer such courses (NCES, 2000). For example, with regard to GPA, students who took EDUC 151 achieved greater long-term success compared to students who took EDUC 151 with any of the other two courses as well as those students who took ECON 174 and GENS 099. However, no difference is found between EDUC 151 and other course combinations for the cumulative grade points and hours measures of success. It was also found that students who took the ECON 174 course achieved greater long-term success compared to those students who took both EDUC 151 and GENS 099.

A final issue considered is the effect on long-term academic success of differences in performance in the specific courses. Table 4 indicates that there is consistent statistical difference in effect across measures of long-term academic success between A and C, and A and D students in ECON174, but that there is no statistical difference in effect for two of the measures between the A and B students who passed ECON174. In the case of EDUC151 there is a consistent difference in effect between A students and students receiving the other letter grades in that course.

Based on the preceding discussion we find that the differences in mean values for the three measure of long-term academic success, which indicated relatively greater effectiveness for students taking EDUC151, is generally supported.

SUMMARY AND CONCLUSIONS

The main purpose of this paper was to test the relative long-run effectiveness of an experimental, combined curriculum economics/reading course compared to that of two other reading skills courses which use a more traditional developmental reading curriculum only. The empirical results indicate that students who performed at a high level in the 'paired course' (ECON174) attained comparable levels of long-term academic success relative to students who achieved an A or B level in one of the reading development courses (EDUC 151). Moreover, the A and B students in ECON 174 achieved greater long-term success than the C or D students who took the EDUC 151 course. In addition, under-prepared students' completion of another developmental course (GENS 099) did not contribute significantly to their long-run success in college according to our study's findings

A major message from the empirical findings of this paper is that while there is a consistent positive relationship between a strong educational background and long-run success in college, there appears to be scope for success in reading development using alternative approaches. In both a developmental reading course (EDUC 151) and a "combined" discipline and reading development course (ECON 174) there was evidence of greater long-term academic success for students who achieved an A or B compared to those with lower letter grades. Not surprisingly, we also find that performance among students within a course does make a difference with regard to measures of long-term academic success.

TABLE 1: VARIABLE DEFINITIONS

Variable	Definition
GRDPTS	Total grade points
PCTSCORE	SAT/ACT composite score
HSGPA	High school grade point average
DRPE	Reading placement score upon entering the university
EDUC151	Proxy variable for reading skills course, EDUC 151, entitled "Reading Power"
ECON174X	Proxy variable for combined curriculum course, ECON 174X, entitled "Fundamentals of Economics with a Reading Component"
DVG99	Dummy variable that gives a value of 1 if a student passed a developmental reading course (GENS 099: Strategies for College Reading) and gives a value of zero otherwise.
DUMREM	Dummy variable giving a value of 1 if a student (who does not read at the college level) passed a reading skills course and a value of zero otherwise.
DV174	Dummy variable giving a value of 1 if a student (who does not read at the college level) passed ECON 174X (a specific reading skills course) and a value of zero otherwise.
DV151	Dummy variable giving a value of 1 if a student (who does not read at the college level) passed EDUC 151 (a specific reading skills course) and a value of zero otherwise.

TABLE 2: DESCRIPTIVE STATISTICS

Variable	All Groups	Group One (GENS 099)	Group 2 (ECON 174X)	Group 3 (EDUC 151)
GRDPTS				
Mean	158.47	146.99	153.57	189.71
Median	96.50			
Standard Deviation	141.27			
HRS				
Mean	62.21	58.70	60.76	69.77
Median	44.00			
Standard Deviation	46.29			
GPA				
Mean	2.23	2.16	2.23	2.44
Median	2.29			
Standard Deviation	0.71			
HSGPA				
Mean	2.38	2.36	2.37	2.55
Median	2.35			
Standard Deviation	0.59			
PCTSCORE				
Mean	53.64	52.53	53.7	56.7
Median	52.50			
Standard Deviation	11.33			
Number of Observations	826	514	117	283
Note: 88 students took more than one course.				

TABLE 3: REGESSION RESULTS - TESTING HYPOTHESES INVOLVING TYPE OF COURSE TAKEN AND LEVEL OF PERFORMANCE IN COURSES

Dependent Variables: GPA (Overall grade point average); HRS (cumulative hours); GRDPTS (Cumulative Grade Points)

Standard Errors in Parentheses

Variable	GPA	HRS	GRDPTS	GPA	HRS	GRDPTS
DV174	2.23 (0.069)	60.76 (4.56)	153.57 (13.89)			
DV151	2.44 (0.049)	69.76 (3.27)	189.71 (9.96)			
DV99	2.15 (0.033)	58.69 (2.20)	146.99 (6.70)			
INTERACT174151	2.32 (0.202)	89.75 (13.30)	221.12 (40.49)			
INTERACT17499	1.98 (0.404)	70.66 (26.61)	158.92 (80.99)			
INTERACT15199	2.14 (0.082)	59.87 (5.39)	139.09 (16.41)			
DV174A				2.98 (0.208)	89.60 (14.38)	266.05 (43.34)
DV174B				2.48 (0.124)	76.75 (8.59)	204.13 (25.90)
DV174C				2.09 (0.089)	52.93 (6.13)	124.68 (18.48)
DV174D				1.53 (0.220)	26.89 (15.16)	47.89 (45.68)
DV151A				2.91 (0.081)	84.89 (5.60)	253.77 (16.87)
DV51B				2.37 (0.068)	68.25 (4.72)	176.85 (14.21)
DV151C				1.99 (0.127)	55.30 (8.75)	134.74 (26.37)
DV151D				1.37 (0.19)	34.17 (13.13)	60.67 (39.56)
DV99				2.16 (0.03)	58.70 (2.17)	146.99 (6.55)
EC174C99				2.13 (0.47)	96.50 (32.15)	222.31 (96.91)
EC174D99				1.69 (0.66)	19.00 (45.47)	32.15 (137.05)
ED151A99				2.19 (0.23)	58.13 (16.08)	132.89 (48.45)
ED151B99				2.26 (0.10)	65.28 (7.19)	158.37 (21.67)
ED151C99				2.06 (0.16)	48.61 (10.72)	106.01 (32.30)
ED151D99				1.67 (0.25)	60.00 (17.19)	121.10 (51.80)
ED51A74B				2.50 (0.47)	108.00 (32.15)	261.97 (96.91)
ED51A74C				2.77 (0.47)	86.00 (32.15)	244.02 (96.91)
ED51B74B				2.66 (0.66)	130.00 (45.47)	345.93 (137.05)
ED51B74C				2.35 (0.66)	121.00 (45.47)	283.87 (137.05)
ED51C74C				2.19 (0.33)	83.00 (22.74)	199.76 (68.52)
ED51D74B				2.28 (0.66)	79.00 (45.47)	180.12 (137.05)
ED51D74C				1.21 (0.66)	27.00 (45.47)	32.59 (137.05)
F Statistic (p- value in parentheses)	4.79 (0.0008)	2.51 (0.02)	3.33 (0.003)	6.88 (0.00)	2.43 (0.0003)	3.5 (0.00)

TABLE 4: T-tests for Statistical Difference Between Selected Coefficients in Table 3 Regressions

GPA

174Vs151	-2.42		
174Vs99		0.99	
151Vs99			4.71

HRS

174Vs151	-1.60		
174Vs99		0.41	
151Vs99			2.80

GRDPTS

174Vs151	-2.11		
174Vs99		0.43	
151Vs99			3.56

GPA

	174A Vs	174B Vs	174C Vs	174D Vs	151A Vs	151B Vs	151C Vs	151D Vs
EC174XA								
EC174XB	2.07							
EC174XC	3.93	2.54						
WC174XD	4.77	3.73	2.34					
ED151A	0.31	-2.91	-6.82	-5.87				
ED151B	2.76	0.72	-2.54	-3.65	5.05			
ED151C	4.05	2.74	0.64	-1.79	6.11	2.67		
ED151D	5.69	4.85	3.41	0.56	7.43	4.95	2.70	
G99	3.90	2.48	-0.73	-2.80	8.64	2.88	-1.29	-4.07

HRS

	174A Vs	174B Vs	174C Vs	174D Vs	151A Vs	151B Vs	151C Vs	151D Vs
EC174XA								
EC174XB	0.77							
EC174XC	2.35	2.26						
EC174XD	3.00	2.86	1.59					
ED151A	0.34	-0.73	-3.78	-3.55				
ED151B	1.41	0.87	-1.98	-2.61	2.19			
ED151C	2.04	1.75	-0.22	-1.62	2.79	1.30		
ED151D	2.85	2.71	1.29	-0.36	3.51	2.44	1.34	
G99	2.12	2.04	-0.89	-2.08	4.26	1.84	-0.38	-1.84

Table 4 continued

GRADEPTS

	174A Vs	174B Vs	174C Vs	174D Vs	151A Vs	151B Vs	151C Vs	151D Vs
EC174XA								
EC174XB	1.23							
EC174XC	3.00	2.50						
EC174XD	3.46	2.97	1.56					
ED151A	0.26	-1.61	-5.16	-4.23				
ED151B	1.96	0.92	-2.24	-2.70	3.49			
ED151C	2.59	1.88	-0.31	-1.65	3.80	1.41		
ED151D	3.50	3.03	1.47	-0.21	4.49	2.76	1.56	
G99	2.72	2.14	-1.14	-2.15	5.90	1.91	-0.45-2.15	

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