DOES DISTANCE LEARNING WORK? A LARGE SAMPLE, CONTROL GROUP STUDY OF STUDENT SUCCESS IN DISTANCE LEARNING

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In 2001, the total budgets of all institutions of higher education in the United States exceeded $255 billion (Chronicle, 2004). In the public sector, state colleges and universities accounted for 11.8 percent of all state government general fund expenditures (Education Commission of the States, 2003). By nearly any measure then, higher education expenditures are significant in the United States and throughout the world.

A small, but growing portion of these expenditures now relate to "distance learning," whereby student and instructor do not make face-to-face contact in a bricks and mortar classroom. Instead, students and faculty members, who may be located continents apart, communicate via television, the Internet, or telephone. Course materials and lectures may be distributed in the same fashion, or by other means such as CDs and DVDs.

The relevant public policy question is this---Does distance learning "work" in the sense that students experience as least as much success when they utilize distance learning modes as compared to when they pursue conventional bricks and mortar education? The answer to this question is a critical in determining whether burgeoning distance learning programs are cost-effective investments, either for students, or for governments.

Of course, it is difficult to measure the "learning" in distance learning, not the least because distance learning courses now span nearly every academic discipline. Hence, most large sample evaluative studies utilize students' grades as an imperfect proxy for learning. That approach is followed in the study reported here, as well.

A recent review of research in distance education reported that 1,419 articles and abstracts appeared in major distance education journals and as dissertations during the 1990-1999 period (Berge and Mrozowski, 2001). More than one hundred of these studies focused upon various measures of student success (such as grades, subsequent academic success, and persistence) in distance learning courses. Several asked the specific question addressed in this paper: Why do some students do better than others, at least as measured by the grade

they receive in their distance learning course? A profusion of contradictory answers has emanated from these studies (Berge and Mrozowski, 2001; Machtmes and Asher, 2000). It is not yet clear how important to individual student success are factors such as the student's characteristics (age, ethnic background, gender, academic background, etc.). However, other than knowing that experienced faculty are more effective than less experienced faculty (Machtmes and Asher, 2000), we know even less about how important the characteristics of distance learning faculty are to student success, particularly where televised, interactive distance learning is concerned.

Perhaps the only truly strong conclusion emerging from previous empirical studies of distance learning is the oft cited "no significant difference" finding (Saba, 2000). Indeed, an entire web site, http://teleeducation.nb.ca/nosignificantdifference, exists that reports 355 such "no significant difference" studies. Yet, without quarreling with such studies, they do not tell us why some students achieve better grades than others when they utilize distance learning.

Several studies have suggested that student learning styles and receptivity to distance learning influence student success (see Taplin and Jegede, 2001, for a short survey). Unfortunately, as Maushak et. al. (2001) point out, these intuitively sensible findings are not yet highly useful, because they are not based upon large sample, control group evidence that relates recognizable student learning styles to student performance. Studies that rely upon "conversation and discourse analysis" (Chen and Willits, 1999, provide a representative example) and interviews with students are helpful, yet are sufficiently anecdotal that they are unlikely to lead us to scientifically based conclusions about what works and what does not.

This paper moves us several steps forward in terms of our knowledge by means of a very large distance education sample (76,866 individual student observations) and an invaluable control group of students who took the identical course at the same time from the same instructor, but did so "in person" in a conventional "bricks and mortar" location. The results indicate that gender, age, ethnic background, distance learning experience, experience with the institution providing the instruction, and measures of academic aptitude and previous academic success are statistically significant determinants of student success. Similarly, faculty characteristics such as gender, age, ethnic background, and educational background are statistically significant predictors of student success, though not necessarily in the manner one might hypothesize.

BACKGROUND AND THE SAMPLE

The data sample consists of 76,866 student performances in distance learning courses at Old Dominion University, Norfolk, VA, USA, 1994-2002. Old Dominion, a public doctoral institution enrolling approximately 20,000 students,

has been heavily involved in distance learning for almost two decades. The predominant Old Dominion distance education model (and the only one involved in this data sample) involves the transmission of televised courses to more than 60 locations in Virginia, the remainder of the United States, several foreign countries, and U.S. Navy ships at sea. Approximately 30 complete degree programs are offered, with about 20 at the baccalaureate level and 10 at the master's level. All of the undergraduate programs are "degree completion" such that students already have accumulated two years of college credit before they begin their program. Thus, no beginning college students are part of the sample. The system is known as TELETECHNET and currently generates about 30,000 student registrations annually.

The televised courses typically are "one- way video, two-way audio" in nature. Students can see the instructor and talk back and forth to her, but most faculty cannot see their students, though their students can see them. (This is an important point to which we will return below.) While Old Dominion does offer some fully streamed video distance learning courses to students who may be located where a high quality Internet connection exists, none of these students are included in this sample.

Old Dominion University distance learning students travel to one of the University's distance learning centers in order to access a course. These centers typically are located at a community (two-year) college, military base, or corporate site, and the institution boasts that no citizen in Virginia is more than 50 miles distant from one of its distance learning sites. At these locations, students enter a well-outfitted classroom where they access the course at a predetermined time and utilize supporting technology such as television screens, microphones, and microcomputers. Each site has a "site director" who advises and assists students, helps them iron out predictable registration and financial aid problems, and ensures that the system works as advertised. The site directors also help students access library materials and the University offers students extensive digital library access and 72-hour turn around time for all non-electronic library materials that do not require interlibrary loans. Site directors also proctor examinations and make videotapes available to students who miss a class, or who wish to review course materials. Muilenburg and Berge's (2001) factor-analytic study of barriers to distance education found such student support services to be a "critical facet" of quality distance learning programs.

Nearly all of the distance learning classes being received by students at the 60+ locations are simultaneously being offered in a bricks and mortar classroom on the University's home campus in Norfolk, Virginia. A distance learning faculty member, then, simultaneously teaches both a conventional classroom of students in Norfolk as well as distance learning students. In the statistical work reported in the next section, the conventional bricks and mortar students are the control group. They take the identical course from the same instructor at the same time. Their course requirements, examinations, and the grading standards

applied to them are identical. These control group students address the criticism of Machtmes and Asher (2000) that most studies of the effectiveness of distance learning that have attempted to provide control groups have suffered from methodological problems such as noncomparable instructional content, or because students take the same course from differing faculty members. Only one previous study (Bisciglia and Monk-Turner, 2002), focusing upon student attitudes and involving 238 students (both distance learning and bricks and mortar), has utilized such a control group.

In addition, the University's distance learning courses are received at four regional campuses in Virginia (Loudoun County, Virginia Beach, Hampton, and Portsmouth). These sites are especially well appointed with technology, library, and staff support.

Approximately 71 percent (54,786) of the students were undergraduates. The empirical analysis presented below separates undergraduate and graduate students. The large sample size is fortuitous because not all data observations are complete. Alas, some individual piece of data often may be missing in a student's file. For example, one student's high school grade point average or ethnic background may be unknown, while another student's past distance learning experience for some reason may not have been recorded. Thus, depending upon the regression specification utilized in the statistical analysis, observations may drop out of the sample because of missing values for certain variables in an observation. Despite this, the sample sizes utilized here still are considerably larger than those reported in previous studies.

SAMPLE CHARACTERISTICS

Who were the distance learning students in the sample? Table One reports that the majority (71.3 percent) were undergraduates and almost exactly two-thirds were women, up from 63 percent in 1998 (Koch, 1998). Women students dominate distance learning in the U.S. even more so than conventional bricks and mortar education, where 56 percent of undergraduate students were female in 1999-2000 (NCES, 2002).

Approximately three-quarters of this sample of distance learning students were white. "Approximately" is the appropriate adverb in that about ten percent of students declined to indicate any ethnic status, or perhaps checked multiethnic status. Such students are not included in the empirical analysis.

The mean age of these distance learning students was 33.4, with the typical woman student being slightly older, 33.9. Thus, these distance learning students are older than the typical college student in the U.S. NCES (2002) reported that the mean age of a U.S. undergraduate was 26 in 2000; this was about five years older than the typical "bricks and mortar" Old Dominion student,

but about seven years younger than the typical Old Dominion distance learning student.

Almost two-thirds of these students received the course via television at a community college site, while 18 percent received the course via television at one of the University's regional campuses, and 2.6 percent utilized television on the home campus. Thus, there are three distinct television populations in terms of student location in addition to the bricks and mortar students taking the course on the home campus in front of the professor. The control group for this study consists of the 10,959 students (14.3 percent) who took the course in the same classroom as the faculty member who simultaneously was teaching the three previous groups of television students.

An issue in previous distance learning research has been the impact of higher education experience upon performance. Two types of experience are reported in Table One. The first, the mean number of TELETECHNET courses taken previously, addresses specific distance learning experience, though it is possible some of these students may have taken distance learning courses from other institutions. Note that students at the community colleges sites and the regional campuses have more distance learning experience than those who accessed the course on the main campus.

The second type of experience is institution specific and records the number of Old Dominion credit hours students accumulated prior to this course. Plausibly, knowing the ropes at the institution offering the course is valuable, for example, in having information about faculty, registration procedures, financial aid, veteran's affairs, and so forth. Not surprisingly, main campus students (who do relatively little distance learning) had substantially more Old Dominion experience (more than 60 semester hours) than off campus students, who only recently may have be admitted to the University.

What is the history of academic success of the students in the sample? For students coming to the University more or less directly from high school, their mean high school grade point average was 2.94 (on a scale ranging from 0 to 4). This contrasts to the entire undergraduate student body of the University, whose mean high school grade point average was 3.2. The great majority of TELETECHNET students, however, transferred into the University and took their distance learning courses at a community college site, frequently the one from which they just had graduated. Upon transferring, their mean grade point average was 3.03. This was very close to the all-University average for transfer students.

TABLE ONE

CHARACTERISTICS OF 76,866 DISTANCE LEARNING STUDENTS

Enrollment	
Undergraduate	54,786 (71.3%)
Graduate	22,080 (28.7%)
Total	76,866 (100.0%)
Gender	
Male	25,564 (33.4%)
Female	51,202 (66.6%)
Ethnic Background	
White	56,989 (74.1%)
African-American	10,061 (13.1%)
Asian-American	2,157 (2.8%)
Other or Unknown	7,659 (10.0%)
Mean Ages	
Entire Sample	33.4
Men	32.2
Women	33.9
Undergraduate	32.6
Graduate	35.3
Main Campus, Bricks and Mortar	27.8
Main Campus TV	27.9
Community College Sites	34.2
Regional Campuses	32.5
Site Where Student Took Course	
Main Campus, Bricks and Mortar	10,959 (14.3%)
Main Campus TV	2,031 (2.6%)
Community Colleges	49,823 (64.8%)
Regional Campuses	14,053 (18.3%)
Mean Number of Credit Hours Taken Previously at ODU	
Undergraduate	
Main Campus, Bricks and Mortar	67.4
Main Campus TV	64.7
Community College Sites	25.1

Regional Campus Sites	48.2
Graduate	
Main Campus, Bricks and Mortar	22.5
Main Campus TV	23.6
Community College Site	15.9
Regional Campus Site	20.3
Mean Number of TELETECHNET Courses Taken Previously	
Undergraduate	
Main Campus, Bricks and Mortar	.42
Main Campus TV	.72
Community College Sites	2.12
Regional Campuses	1.46
Graduate	
Main Campus, Bricks and Mortar	.64
Main Campus TV	.79
Community College Sites	1.71
Regional Campuses	1.51
Mean Grades Earned in the Past	
High School GPA	2.94
Transfer GPA (for students at community college sites)	3.03

What were the characteristics of the distance learning faculty? Table Two illustrates that they averaged 46.7 years of age, most typically occupied the assistant or associate professor ranks,[1] and almost 60 percent were tenured.[2] Of the 261 faculty in the study, 64 percent were men and 78.4 percent had earned the terminal degree in their field (less than the University average of almost 90 percent). As a group, they were predominantly white.

TABLE TWO

MEAN CHARACTERISTICS OF 261 DISTANCE LEARNING FACULTY

Age	46.7

[1] Four professorial ranks were available: Instructor, Assistant Professor, Associate Professor, and Professor.

[2] In the U.S., a tenured faculty member may not be dismissed unless highly unusual circumstances exist---severe financial exigency, gross moral turpitude, or dramatic performance failures---and then only after substantial due process has been granted and many hearings have been held.

Academic Rank (Full Prof. = 4)	2.6
Years at Old Dominion University	8.4
Tenure	59.5%
Terminal Degree	78.4%
Male	64.0%
Female	36.0%
White	86.7%
African-American	6.5%
Asian	7.8%

Old Dominion University grades its students on a conventional F through A grading scale, where F = 0 and A = 4. However, faculty also may assign "plus" and "minus" grades and hence the number of available grading intervals is 12. As Table Three indicates, the mean undergraduate grade assigned to the upper division students in the courses surveyed in this sample was 2.99, while it was 3.56 at the graduate level. At the undergraduate level, off-campus students (those at the community colleges and the regional campuses) earned higher grades than those on campus. This finding, if supported in a multivariate analysis, would constitute an interesting variant of the "no significant difference" hypothesis. In the case at hand, there is a significant difference, *but it is in favor of distance learners*, though it disappears at the graduate level. Of course, much depends here upon the qualifications and characteristics of the distance learners and shortly we will address that matter. Further, selection bias could be present here. For example, it's possible that TELETECHNET students simply were more motivated and more disciplined.

One of the most eye-catching relationships with respect to both undergraduate and graduate grades is the differences in grades earned by various ethnic groups. In general, white students earned higher grades than Asian and Asian-American students, who in turn earned higher grades than African-American students. Similar relationships hold true nationally (NCES, 2002). These differences will be investigated in detail below.

TABLE THREE

MEAN GRADES EARNED BY DISTANCE LEARNING STUDENTS

(A = 4.00)

Undergraduate	2.99
Main Campus, Bricks and Mortar	2.79
Main Campus TV	2.81
Community College Sites	3.05

Regional Campuses	2.86
Male	2.79
Female	3.10
White	3.09
African-American	2.61
Asian	2.66
Graduate	3.56
Bricks and Mortar	3.56
Main Campus TV	3.59
Community College Sites	3.55
Regional Campuses	3.54
Male	3.46
Female	3.62
White	3.65
African-American	3.21
Asian	3.47

EMPIRICAL ANALYSIS

Table Four contains several regressions that attempt to predict student distance learning grades on the basis of the characteristics we explored in Tables One and Two. The basic equation specification was the following:

Grade = f(Location, Student Characteristics, Faculty Characteristics)

That is, student grades are assumed to depend upon the location where students received the course, student personal characteristics such as age, ethnic background, and higher education experience, and the characteristics of the faculty teaching them. Equation 4.2 differs from Equation 4.1 only in that it introduces as an explanatory variable the high school grade point average of students, if that is available. Frequently, the HSGPA variable was not available, since a significant majority of these students transferred to Old Dominion University from another institution and brought with them junior or senior status (third or fourth year in a four-year degree program). This reduced the sample size to 2,345. Equation 4.3, in turn, differs from Equation 4.1 only in that it includes the transfer grade point average of the students as a predictor variable. This reduced the sample size to 7,390.

Let's focus initially on Equation 4.1, where we have 20,428 observations. Note first that inclusion of 16 independent variables in the equation eliminated almost two thirds of the 61,676 undergraduate observations because of missing data on one or more of these variables. For example, as noted above, ten percent of all students did not indicate their ethnic background and hence they were eliminated

from the statistical analysis. This introduced the possibility of some unknown selection bias. However, more than 20,000 observations remained, a very healthy number by past standards. Second, observe that despite the fact that 13 of the independent variables were statistically significant (two-tailed tests), Equation 4.1 explained only 15.5 percent of the variance in student grades (R^2 = .155). In fact, the highest R^2 reported in the three regressions found in Table Four is .216. This is not unusual in large, diverse cross-sectional samples, which take a snapshot of individuals at a single moment in time and consequently often finds them in a disequilibrium, less than ideal situation. Even so, such a result warns us that despite the statistical significance of the individual variables, there are many other relevant influences on student academic achievement that have not been included in the equation. By way of illustration, one would expect a student's work schedule and family responsibilities to influence his/her academic achievement. Further, Equation 4.1 does not account for *differences* in student abilities, academic background, motivation, or preferred learning styles.

Nonetheless, with these caveats in mind, let's examine the regressions in Table Four. Many of the variables were specified as multiple category "dummy variables." For example, the three location variables (CC, REGIONAL, and MAINCAMPUSTV) represented the influence of location upon student achievement in relation to the excluded category, which was the "control group" students who are taking the course facing the faculty member in a conventional bricks and mortar classroom on the main campus. Thus, the -.065 coefficient on the REGIONAL variable in Equation 4.1 means that students who took the course via television at a regional campus site earned a grade which is .065 lower than students who took the course in the conventional bricks and mortar classroom. This is an "other things held constant" estimate. For a particular student, given average values for all other variables (such as the average age for undergraduate students, 32.6), he/she will earn a slightly lower grade if he/she takes the distance learning course at one of the University's regional campuses.

The results from Equations 4.1 through 4.3 can be summarized as follows:

- The location and manner of delivery of a course (on-campus versus distance learning) may make a difference to students. Equation 4.1 tells us that students who take a course at a *community college site* earn a grade that is .045 lower than students in a bricks and mortar classroom on the home campus. When either the student's high school grade point average or his/her transfer grade point average is considered (Regressions 4.2 and 4.3), there is no statistically significant difference. Students who take a distance learning course at a *regional campus site* (a branch campus) earn a grade that is .065 lower than students on the home campus; this difference accelerates to .186 when the high school grade point average of the students is taken into account. However, the difference is not statistically significant when students' transfer grade point average is entered into the equation. Students who receive the course on *main campus television* (the signal usually

coming from a branch campus) do not have any statistically significant advantage or disadvantage. These results, while not uniform, provide only a bit of evidence against the "no significant difference" hypothesis.

TABLE FOUR

REGRESSIONS OF STUDENT GRADES ON EXPLANATORY VARIABLES

Independent Variables	Estimated Coefficients (absolute value of t-statistics in parentheses) Regression 4.1	Regression 4.2	Regression 4.3
CC	-.045	-.066	.018
	(2.13)**	(.76)	(.60)
REGIONAL	-.065	-.186	.052
	(3.03)***	(2.83)***	(1.49)
MAINCAMPUSTV	-.026	.087	.132
	(.44)	(.95)	(1.08)
UNDERGRAD	-.498	-.706	-.510
	(30.87)***	(10.40)***	(21.60)***
MALE	-.169	-.215	-.167
	(10.16)***	(4.02)***	(4.56)***
AGE	.014	.036	.013
	(17.65)***	(6.00)***	(9.99)***
ODUCRHOURS	.003	.003	.007
	(8.26)***	(5.23)***	(10.61)***
TTNCOURSES	.019	-.005	.010
	(2.67)***	(.16)	(.98)
AFRICANAMER	-.460	-.430	-.270
	(20.27)***	(7.33)***	(7.40)***
ASIANAMER	-.046	-.107	-.083
	(1.26)	(1.34)	(3.35)***
HSGPA		.376	
		(8.36)***	
TRANSFERGPA			.351
			(16.61)***
DEPTGPA	.411	.492	.443
	(20.06)***	(7.45)***	(14.12)***
FACAGE	.002	.007	.003
	(2.58)**	(2.78)***	(2.26)**
FACTENURE	-.103	-.115	-.158
	(6.72)***	(2.16)**	(6.68)***

FACMALE	-.091	-.093	-.043
	(5.92)***	(1.72)*	(1.83)*
FACAFRAMER	.079	-.367	.095
	(2.61)**	(2.78)***	(2.11)**
FACASIAN	-.033	-.424	-.182
	(.87)	(4.47)***	(2.18)**
R^2 =	.155	.173	.216
F =	233**	28.6***	119***
Constant =	1.89	.581	.646
Sample Size =	20,428	2,345	7,390

*** = statistically significant at the .01 level
** = statistically significant at the .05 level
* = statistically significant at the .10 level
(all two-tailed tests)

where:

CC	Course taken at a community college site
REGIONAL	Course taken at a regional branch campus site
MAINCAMPUSTV	Course delivered from another site to the main campus via television
UNDERGRAD	Dummy variable. 1 = undergraduate
MALE	Dummy variable. 1 = male
AGE	Student's age
ODUCRHOURS	Previous ODU credit hours completed by student
TTNCOURSES	Previous TELETECHNET courses completed by student
AFRICANAMER	Dummy variable. 1 = African-American student
ASIANAMER	Dummy variable. 1 = Asian or Asian-American student
HSGPA	Student's high school grade point average
TRANSFERGPA	Student's grade point average at institution from which he/she transferred, if student did transfer
DEPTGPA	Mean undergraduate grade assigned by the department offering the student this course
FACAGE	Faculty member's age
FACTENURE	Dummy variable. 1 = faculty member is tenured
FACMALE	Dummy variable. 1 = faculty member is male
FACAFRAMER	Dummy variable. 1 = faculty member is African- American
FACASIAN	Dummy variable. 1 = faculty member is Asian or Asian-American

- Not surprisingly, undergraduate students earned lower grades than graduate students. Depending upon the regression specification, the difference ranges from .498 to .706. Interestingly, it appears that a student's high school grade point average had a rather large influence on his/her graduate grades. Perhaps the HSGPA variable functions as a
rough equivalent of the Graduate Record Examination here (the "GRE" is an American standardized test that examines a student's ability to pursue a graduate degree program) .
- The performance of men distance learning students was noticeably inferior to that of women. Holding other things constant, men earned a grade that was .169 lower than women in Regression 4.1, .215 lower in Regression 4.2, and .167 lower in Regression 4.3. The 1999-2000 National Center for Education Statistics study of American undergraduates found a similar grade pattern in the U.S. (NCES, 2002). Some of this might be due to differences in disciplines and course selection, though all three equations include a control variable that represents the mean grade assigned in the department offering the course. We should not ignore the reality that at Old Dominion University, a disproportionate number of women were distance learning students (two-thirds of all TELETECHNET students, as one can see in Table One). Is there something about distance learning in general, or the nature of the lives of men and women, that makes it less attractive to men and more attractive to women? Nationally, 55.8 percent of U.S. undergraduate distance learning students were women in 1999-2000 (NCES, 2002). Is there something about the specific interactive television model of distance learning that makes it especially attractive to women? Or, are the men who undertake distance learning less talented, less motivated, less disciplined? See Oxford, et. al. (1993) for an example of a small sample study that found motivation was the single most important predictor of student success and that women students were more motivated than men students. Or, is it possible that men have more difficult work and family responsibilities than women? We cannot say, but note that these are provocative subjects that have been discussed before. See Whittington (1995) and Koch (1998) for summaries of often conflicting evidence and Taplin and Jegede (2001) for a recent empirical study of 712 distance education students at the Open University of Hong Kong that focused on gender differences in student learning styles and backgrounds.
- The older the student, the better grade he/she was likely to earn. This is not a new finding (see Dille and Mezack, 1991, for an example). Specifically, a student who is ten years older than the average will earn a grade that is .14 higher (Regression 4.1). In the two other regression specifications, this advantage ranges from .13

to .36. Maturity appears to confer advantages to distance learning students who sometimes must be self motivated (Bisciglia and Monk-Turner, 2002) and cannot always count upon peer support. This is consistent with the findings of the NCES (2002) study of American undergraduates (both bricks and mortar and distance learning) in 1999-2000, which found that 42.6 percent of undergraduates aged 18 or younger earned mostly C's and D's, or lower, while only 23.1 percent of undergraduates aged 30-39 did the same.

- Higher education experience counts. The number of credit hours a student had taken at Old Dominion University was statistically significant in all three regression specifications, though the advantage conferred by previous Old Dominion experience is rather small. According to Regression 4.1, for example, a student who had accumulated 60 credit hours at Old Dominion would earn a grade that was .018 higher. Pragmatically, it may be true that when students know faculty members and departmental expectations, and when they are aware of sometimes mundane tasks such as how to pay bills and obtain advising, that this knowledge confers a small advantage over students who do not have this savvy. On the other hand, specific experience with Old Dominion's TELETECHNET distance learning system is statistically significant only in Regression 4.1 and this advantage disappears when either the student's high school grade point average or transfer grade point average are taken into account. See Whittington (1995) for a brief survey of the impact of experience on student performance.
- African-American students earned noticeably lower grades than Asian and Asian-American students, who in turn earned lower grades than white students (who are the excluded category). We will return to this point in a moment. These differentials could be due to lower academic qualifications, intentional or unintentional discrimination, differing group personal characteristics such as work schedules and family responsibilities, and/or a lack of comfort on the part of individual minority students with this distance learning setting.
- Quantitatively, the single most important determinant of a student's grade was the identity of the department in which the student is taking the course. The DEPTGPA variable was large and statistically significant and accounts for .411 to .492 of a student's grade in the three regression specifications. This reflects the reality that, for example, economists and engineers grade their students differently than sociologists and musicians.
- The coefficient on the faculty age variable (FACAGE) was positive and statistically significant in all three regression specifications, indicating older faculty assign higher grades. But, the effect was

small, ranging from .02 to .07 for each additional ten years increase in a faculty member's age.

- Holding other things constant, tenured faculty members assigned lower grades to distance learning students than non-tenured faculty. Plausibly, tenured faculty are less sensitive to student evaluations than untenured faculty and our prediction is they will assign a grade that is .103 to .158 lower.
- Male faculty assigned lower grades, *ceteris paribus.* Their grades ranged from .043 to .091 lower than those assigned by female faculty. Note that the discipline of male faculty is at least partially controlled by the DEPTGPA variable.
- The FACAFRAMER variable was statistically significant in all three regression specifications, but the sign of the coefficient was undependable. Regardless, this provokes interesting questions. Do African-American faculty assign higher or lower grades than other faculty, holding all other things constant? Do African-American faculty grade African-American students differently than other students? Alas, we cannot tell here, but these questions are worthy of additional research. The small number of African-American faculty in the sample (6.5 percent) militates against reaching any strong conclusions.
- In two of the three regression specifications, the coefficient on the FACASIAN variable was statistically significant, implying that students earned lower grades from Asian and Asian-American faculty. But, the size of the coefficients is quite variable, suggesting caution in interpretation.

Let's now return to the matter of the achievement of minority students. As Equation 4.1 indicates, holding other things constant, African-American students were assigned a grade .460 lower than white students, while Asian and Asian-American students were assigned a grade .046 lower than white students (though this estimate is not statistically significant). We offer four rough and ready hypotheses for consideration with respect to why this might be true:

- Minority students are less well prepared academically.
- Minority students are subjected to intentional and unintentional discrimination.
- Minority students have non-classroom characteristics (work schedules, family responsibilities, and the like) that impose demands upon them that white students do not experience.
- Minority students are not as comfortable as majority, white students in distance learning situations because they are not included as often in study groups, chat room conversations, and bull sessions where learning may occur.

Let's consider each of these hypotheses in turn. Are minority students less well prepared than majority, white students? This is a hypothesis advanced by many

(Shoichet, 2002) after the 1999-2000 NCES study (NCES, 2002) reported that 48.9 percent of African-American undergraduate students earned "C's and D's, or lower," while only 32.2 percent of Asians and Asian-Americans, and 30.3 percent of whites earned similar grades. Academic qualifications are difficult to assess and the problems associated with standardized test scores have been debated fiercely. Further, it is difficult to separate native intellectual ability from motivation and drive. Most problematic, however, is the lack of availability of personal academic preparation and performance data on most of the distance learning students in this sample. However, for a reasonable group of students (2,345), their high school grade point average is available, along with all other necessary data points. One reason so few observations are available is that nearly all TELETECHNET undergraduate students enter the program having already earned an associate degree. Further, their average age is 32.6. Hence, the University does not focus excessive attention on retrieving the high school performance of mature distance learning students. Other personal characteristics are far better predictors of success.

In Equation 4.2, for those students for whom it is available, the high school grade point average (HSGPA) of distance learning students was inserted into the equation. Otherwise, Equation 4.2 is a duplicate of Equation 4.1. One can see that the coefficient of the HSGPA variable was highly significant and quantitatively important. Holding other things constant, we predict that a student who has earned a 3.0 (B) average in high school rather than a 2.0 (C) average will earn a distance learning grade that is .376 higher. High school grades, then, do not translate precisely to distance learning, but they do tell us quite a bit. To the extent that high school grades reflect the ability and motivation of the typical distance learning student who is in his/her 30s, then they are a useful predictor variable. Note that when HSGPA was included, the coefficient of the African-American variable became less negative and changed, but only a bit, from -.460 to – .430. However, the comparable coefficient for Asian-Americans changed from -.046 to -.107, but again was not statistically significant.

Individuals from various ethnic groups may enter TELETECHNET with differing academic preparations and perhaps even differing levels of motivation. However, the HSGPA variable is at best an imperfect measure of such things, especially because of the almost 15-year gap between the typical student's high school graduation date and his/her distance learning activities. Hence, while there is a bit of empirical support for our first hypothesis, this evidence does not permit a strong confirmation.

There is another, perhaps more relevant test of this hypothesis that is available. Since nearly all TELETECHNET students transfer into the institution with at least two years of college credit, it is possible to determine a transfer grade point average (TRANSFERGPA) for many of them upon their entry into Old Dominion. A total of 7,390 such observations were available. Equation 4.3 reports a regression for these students (all of whom took their courses at a community

college site) that included the TRANSFERGPA variable. It is apparent that TRANSFERGPA was a highly significant argument in the equation. It produced a significant increase in R^2 and a very high t-statistic. Holding other things constant, a student who brings a B-average (3.0) TRANSFERGPA rather than a C-average (2.0) to the institution will earn a predicted grade that is fully .351 higher. While the TRANSFERGPA also is an imperfect measure of academic preparation and motivation, this result suggests that previous academic performance is important in distance learning. This is hardly surprising, though at least one previous study (de Freitas and Lynch, 1986) found that previous academic performance had no effect on the subsequent academic performance of non-traditional students.

When the transfer grades are considered, the coefficient on the African-American variable changed from -.460 to -.270, though the Asian-American coefficient moved a bit in the opposite direction, from -.046 to -.083. All other variables maintained their expected relationships.

Given the imperfect measurement of academic preparation (and perhaps motivation) by the HSGPA and TRANSFERGPA variables, we can conclude only that the evidence suggests that differing levels of academic preparation and motivation among the three ethnic groups appear to be important. More precise measures would enable a more definitive test of this hypothesis.

This brings us to the possibility of discrimination, intentional or unintentional. To discriminate against minority students, distance learning faculty must know who they are. Therein lies the rub. In Old Dominion's distance learning system, in nearly all cases, faculty members cannot see their students. Hence, unless tipped off in other ways, faculty do not know the ethnic background of the students they are teaching. It is of course possible for faculty to discern the ethnic background of their students in other ways, for example, from their speech or even from their writing. However, the mean size of a TELETCHNET course is about 100 students and just as in a bricks and mortar situation, many students do not ever choose to speak in class. Arguably, this might be especially true for minority students who sit in a classroom dominated by majority students. This means that their faculty members frequently will be clueless with respect to their ethnic identity.

It is possible that distance learning students tip off their ethnic identity in other ways, for example, through their names or via their writing styles and the examples they use in their writing. If this is so (and latent racism demonstrably exists in many spheres), then the discrimination hypothesis requires that distance learning faculty (who are almost 87 percent white) take this information and act upon it, either consciously or unconsciously. Yet, distance learning administrators report an almost complete lack of complaints from distance learning students on this topic and point out that minority enrollment, particularly among African-American students, has been strong and growing at Old

Dominion, both on campus and in distance learning. Indeed, minority enrollment has more than doubled during the past decade while the University's enrollment increased about 25 percent. Of course, this evidence does not by itself defeat any version of the discrimination hypothesis, but it is important background information.

What can we say about the hypothesis that the various ethnic groups may have differing non-academic characteristics, for example, differing work schedules, family responsibilities, and the like? Not much. We could address this class of hypotheses with this data set. It seems reasonable that the non-academic personal lives of students will influence their academic performance (see Whittington, 1995, for a survey of the evidence). The 1999-2000 NCES study (NCES, 2000) of American undergraduates found that minority undergraduate students (especially African-American) were more likely to be characterized by one of nine "risk factors" that NCES believes contribute to lower academic performance and drop outs. NCES cites risk factors such as a student having dependents of children, being a single parent, working full time, and so forth. The typical white student had an average of 2.0 such risk factors, while the typical African- American student exhibited an average of 2.7 such risk factors (NCES, 2002). Parenthetically, however, it is worth noting that the NCES study also found that women undergraduate students had more risk factors than men (2.2 versus 2.1, on average), but nonetheless excel men students in terms of grade point average.

Finally, what about the "comfort" hypothesis? Is it possible that minority students are less comfortable in a distance learning setting because they may be one of the few minority students at a distance learning site, or perhaps even the only minority student at the site? One can speculate that minority students may not be included as often in study groups, chat room discussions, or ordinary out of class bull sessions where learning may occur. Nonetheless, it is impossible to know the extent to which this could be true. Ironically, distance learning often is "sold" as a mode of learning that makes gender, race, and national origin irrelevant. The results reported here, which could be idiosyncratic to Old Dominion University, nevertheless suggest at least the possibility that this view is faulty.

At least one in six distance learning students at Old Dominion is a member of a minority group. The actual proportion could be larger because ten percent of students chose not to record their ethnic identity. In this regard, it is possible minority students may have a greater tendency to decline ethnic or racial identification. Regardless, while faculty cannot see their distance learning students, students at particular sites can see each other, and it is possible that they act negatively based upon what they see. If so, then the result could be a chilled classroom atmosphere for minority students.

That said, other available evidence makes this proposition problematic. The student satisfaction surveys collected by the institution both during and at the completion of every distance learning class do not reveal the existence of such feelings or problems. Additionally, the highly favorable minority student enrollment trends cited above suggest the opposite. Minority students apparently have been voting with their feet in favor of this distance learning model. While this information does not definitively destroy this hypothesis, it does render suspect its validity.

Where does this leave us? We find ourselves in the position of being unable to pinpoint the precise causes of the gender and ethnic grade differentials reported in Table Four. At the very least, they are interesting and we need to know more why these differentials exist and, to the extent the differentials are remediable, devise palliatives. Perhaps these differentials would be erased if we had available sufficiently detailed personal information on individual students, including measures of academic preparations, native intellectual ability, motivation, detailed indicators of work and family responsibilities, and financial data. This is a fertile area for future research.

FINAL COMMENTS

This study does not represent the final word on the determinants of student success in distance learning. It focuses on actual student grade achievement and not upon student ratings and preferences. Similarly, this study neither examines the personality characteristics of distance education students (for example, see Biner, et. al., 1995), nor does it examine the determinants of student persistence. What this study does contribute, however, is considerable new information about the academic success of distance learning students. It also deals with many, but not all, of the deficiencies Machtmes and Asher (2000) found in previous empirical studies. Among the most important of these deficiencies addressed by this study are: (1) the absence of a genuine control group of students who took the identical course from the same faculty member; and, (2) small experimental samples.

This study benefits from a larger and more precisely matched control group than nearly all other studies, very large sample sizes compared to previous studies, and the use of hard to obtain data on student academic qualifications and faculty characteristics. What we need now, however, is the completion of many additional large sample studies of this type at many different institutions. Only then will we be able to infer whether the results reported here are idiosyncratic to Old Dominion University, or whether they can be easily generalized to the remainder of televised distance learning, or the many other varieties of distance learning. In the meantime, we would do well to heed the cautions of Friedman (1991), Christ (1993), and Tomek (1993), who warn against reaching strong policy conclusions based upon the statistical significant of coefficients in a single regression equation. We should, they point out, pay more attention to results

that are repeatedly confirmed in appropriately rigorous testing circumstances than we do to results, however strong, that emanate from a single study.

Distance learning now is a large, highly diverse enterprise in the United States and involves hundreds of thousands of students (NCES, 2002, estimated that 1.32 million U.S. undergraduates were distance learning students in 1999-2000). With some exceptions, we know the identity and several relevant characteristics of these students. Hence, one of our foremost empirical needs now is straightforward---we must learn much more about why students succeed and fail when they undertake distance learning.

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