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**An analysis of the usefulness of Developmental Study courses in
higher education Principles of Economics courses**

Plummer, Jerry D., D.A.

Middle Tennessee State University, 1991

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AN ANALYSIS OF THE USEFULNESS OF DEVELOPMENTAL STUDY COURSES IN HIGHER
EDUCATION PRINCIPLES OF ECONOMICS COURSES

JERRY PLUMMER

A Dissertation presented to the
Graduate Faculty at Middle Tennessee State University
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Arts

December 1991

AN ANALYSIS OF THE USEFULNESS OF DEVELOPMENTAL STUDY COURSES
IN HIGHER EDUCATION PRINCIPLES OF ECONOMICS COURSES

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Abstract

AN ANALYSIS OF THE USEFULNESS OF DEVELOPMENTAL STUDY COURSES IN HIGHER EDUCATION PRINCIPLES OF ECONOMICS COURSES

by Jerry Plummer

This study will look at the usefulness of the Developmental Studies (DS) program at Middle Tennessee State University as it relates to success in Principles of Economics courses. The study looks at three particular areas:

1. Is there a significant difference in the Principles of Economics course grades (performance) for students who first complete the Developmental Studies program versus students concurrently taking both Principles of Economics and Developmental Studies courses?

2. Is there a significant difference in the grades of the Developmental Studies student versus the student with an ACT score of 17-18, or the student with an ACT score of less than 16 who is not in the Developmental Studies program?

3. Which, if any, Developmental Studies fields offer assistance in improving performance in the Principles of Economics grades, and to what extent?

The study utilizes a population of 775 students who took Principles of Economics at Middle Tennessee State University during the Spring, Summer and Fall Semesters of 1989. Of these students 542 were enrolled in the Developmental Studies program; the remaining 233 were not enrolled in the DS program, but had ACT scores between 17 and 18, or ACT scores below 17 and passed the entrance qualifications to bypass the DS program.

Binomial and multinomial logit regressions are used to test for a difference in performance measured first by a pass-fail approach, then on a grade by grade range basis.

Jerry Plummer

The study's results showed first that the Developmental Studies program brought the DS student up to the level of the two other groups, the group just above the ACT cutoff score of sixteen and the group that tested out of the DS program, but not above. Second, completion of at least one Developmental Studies math course should occur for DS students before taking Principles of Economics. Third, these DS students possibly should be guided toward enrollment in Principles of Economics classes that meet more than once per week.

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CHAPTER I

INTRODUCTION

Developmental Studies programs at universities in the United States have increased considerably in size since their inception in the latter 70's. The Developmental Studies program in Tennessee was mandated by the Tennessee Board of Regents for all 26 of the state's higher education institutions in 1985.¹ Trends since the latter 60's regarding enrollment procedures, coupled with social and legislative enactments, have opened the door to equal access and open enrollment. Additionally, the increase in the "non-traditional" student, often with needs for "refresher" courses, has led to the Tennessee Board of Regents mandate regarding the installation of the Developmental Studies (DS) programs.

The DS program is a separate department on most, if not all, campuses with a central purpose of bringing the "peripheral" student up to the level deemed necessary to successfully complete college level courses. The DS program at MTSU is the object of the study, and the structure of the DS program described is for MTSU, although most universities are very similar. Four general areas make up the DS program: (1) Mathematics, (2) English composition, (3) Reading skills and (4) Study skills. Up to three courses in each area may be required for the student, dependent upon the ACT score and the score on the AAPP placement test. That the DS program is adhered to by the University is clear; the data set contained several examples of students taking 12 separate DS courses before finally leaving the DS program. At MTSU, up to 50 percent of incoming freshmen have been enrolled in one or more of the course areas. In many cases, both DS classes and college classes

¹Minutes, State Board of Regents, (28 June 1985): 5

can be taken concurrently, depending on each department's decisions. For example, Principles of Economics classes can be taken concurrently with DS courses, but computer classes require completion of the DS program prior to enrollment. Whether a student has to attend the DS program is determined when the student applies for admission to the University. ACT test scores and age are the criteria used by the DS program (Figure 1.1). If the ACT score is under 17 (composite), the student is required to take the Academic Assessment and Placement Program test (AAPP), a "general" DS program test for overall aptitude. If this test is passed, the student bypasses the DS area. If the student scores less than 17 on any portion of the ACT (reading composition, writing and mathematics or study areas), he/she must take that particular portion of the Developmental Studies program, or can take that portion of the AAPP for waiver of the DS section. If the student is over 21 at the time of application for admission, the AAPP test must also be taken, regardless of ACT score. During the first one or two DS class meetings, the student is given a chance to "test out" of an assigned DS course, and to proceed instead to college level courses. A student cannot currently "go around" these guidelines due to the computerized enrollment procedures that are in effect. These procedures were placed into the registration process in 1989, due to the apparent ability of the Developmental Studies student to enroll in classes that were to be taken only after completion of the DS program.

It may be noted that the cut-off point for the ACT score has been changed recently. For students enrolling in classes after the Fall semester, 1989, an increased ACT score of 18 is required. This minimum requirement is for all Tennessee Board of Regents schools. All data and results of this study are based on the ACT minimum requirement of 16 that was in effect at the time of the student taking the Developmental Studies and/or Principles of Economics courses.

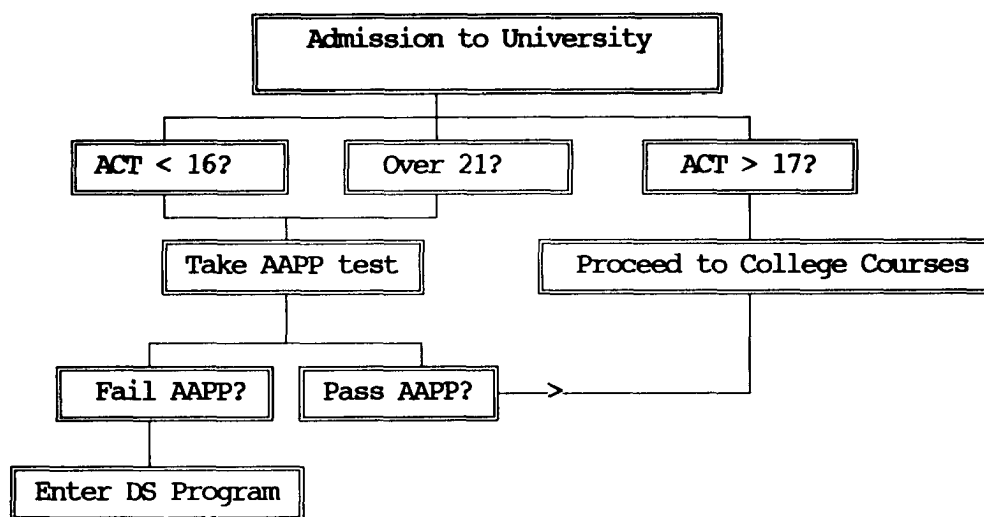


Figure 1.1. A flowchart of the path to DS (and around).

Legislators and educators appear divided on the usefulness of DS programs. Some advocate the elimination of DS programs, while others appear to favor continuation, but mainly at the high school level. Legislators such as Senator Richard Thompson of the Indiana State Senate and Representative Jim Scherer of the Colorado House of Representatives share the first view. Senator Thompson feels that return on the investment is too low, in that many DS students will probably not finish the four-year program and misuse valuable instructor time in non-college level courses. Representative Scherer's proposal to "spend time and money educating those with the ability to learn." seems to imply that not everyone is cut out to attend college, and that there may be a "watering-down" effect on the overall academic program caused by the influx of the DS student. Interestingly, Colorado is one of a handful of states that does not utilize the DS program approach. The second approach (defending the maintenance of the DS program) appears primarily to arise from social issues relevant to social enactments of the 1960's and consequent increase of the non-traditional student on most of today's college campuses. Many colleges, and in particular the community college system, employ the open-door policy. Volunteer State

Community College in Gallatin, Tennessee, for example, states in its Fall, 1991 catalog, "We maintain an open-door policy of admissions, which means we accept any student who desires to improve through education." The fact that any student, regardless of academic deficiency, can attend these colleges implies the need for the DS program to bring these students up to the level necessary to effectively complete the coursework. A second, somewhat hidden, implication is that either the student is brought up to college levels, or the college course declines to match the pool of students.

To investigate the factual usefulness of DS programs, numerous empirical studies have been conducted. They attempt to measure the contribution of DS programs on overall grade point averages and progress in mathematics and English. As of now, however, there exists little, if any, research relating DS programs to academic success in particular functional areas of study, such as economics. An exception is the pilot study by Smith for Middle Tennessee State University.² However, by its very nature as a pilot study in this field, Smith's study is still fairly general and does not conclusively pin down the contribution of the DS program to student success in Principles of Economics courses.

The main purpose of this study is to provide needed clarification and additional detail of the impact of the DS program at MTSU on student success in Principles of Economics courses. There are four main conceptual innovations in this study.

First, success in Principles of Economics classes is measured more broadly in this study. Rather than defining success solely in terms of passing or failing a Principles of Economics class, the study explores the implications of measuring success in terms of the actual grade levels achieved by students. This modification allows for the possibility that the DS program influences the level of student

²Kenneth W. Smith, "A Comparison of the Performance of Developmental Studies and Nondevelopmental Studies Students in Principles of Economics," D.A. diss. Middle Tennessee State University, 1990.

performance within the range of passing grades. For example, the DS program could turn out to have no influence on passing students but it could manage to push students from a C to a B, or from a B to an A.

Second, this study takes particular care in appropriately defining the counterfactual experiments that are used to assess the impact of the DS program. To answer the central question of how students would have done in the absence of the DS program, a number of alternative counterfactual experiments are conducted.

1. The performance of students taking Principles of Economics courses concurrently with the DS courses is compared with the success of DS students taking Principles of Economics courses after completion of all DS courses.

2. The success of DS students taking Principles of Economics is contrasted with that of students with an ACT score of 17-18 (not tested for the DS program) and of students with an ACT score of below 17 who "tested out" of the DS program.

Third, another innovation in this study is the inclusion of several new variables in the data set. Several of these are noted in the literature as in need of further study.³ This includes variables such as the semester Principles of Economics is taken; instructor experience at MTSU in teaching Principles of Economics courses; the time that the economics class is taken (i.e., morning, afternoon or night class), whether the class is a "block" single meeting per week or a class that meets two or more times per week and the size of the economics class. Of particular importance for the purpose of testing the usefulness of the DS program is the detailed information collected on whether DS courses are taken concurrently with Principles of Economics classes or not. This information, while time consuming to incorporate into the data set, brings much more clearly into view the

³W. Becker, R. Highsmith, P. Kennedy and W. Walstad, "An Agenda for Research on Economic Education in Colleges and Universities", AEA Papers and Proceedings, Vol. 81, no. 2, May 1991: 26-31.

actual impact of the DS program on success in Principles of Economics. As compared to earlier studies, the additional variables allow for better model building and testing.

Fourth, a detailed analysis is presented on which DS study areas are particularly useful in improving performance in Principles of Economics courses.

The study is organized as follows. Chapter II contains a review of the current literature relevant to the study. Chapter III will present the empirical analysis. This includes a description of the statistical model(s), the data relating to the model, and the empirical results of the study. Chapter IV will summarize the study, detail its findings and implications, and outline areas for future study. The appendix explains each of the courses and other nomenclature.

CHAPTER II

REVIEW OF LITERATURE

There have been numerous studies of the teaching of Principles of Economics in the past, covering a wide band of approaches and topics, but the coverage of topics is clearly not exhaustive. For example, very little has been done in the area of the DS program and its effects on performance in Principles of Economics. Smith's (1989) MTSU study showed a significant difference in performance between Developmental Studies and non-Developmental Studies students in Principles of Economics (the non-developmental student did much better), and that completion of DS study skills significantly aided students in Principles of Economics. Smith's study, however, did not limit the study to the "peripheral" student just above the ACT cutoff, or those who tested out of the DS program, but all non-DS students, regardless of ACT score. This strongly suggests the need for further work in this area. Numerous studies have looked at the determinants of success for economics classes without, however, paying attention to DS programs. Gery's (1972) study identified a marginal relationship between mathematical aptitude and grade levels in Principles of Economics.¹ Jackstadt and Gootaert (1980) reviewed personal characteristics and socioeconomic backgrounds of students and their performance in economics and found that variables affecting performance were grade level, GPA, intelligence measures, parental occupation, whether or not the student held a part-time job, and frequency of newspaper reading.² Other studies investigate the

¹F. W. Gery, "Does Mathematics Matter?" Research Papers in Economic Education, 1972, 143.

²S. Jackstadt and C. Gootaert, "Gender, Gender Stereotyping, and Socioeconomic Background as Determinants of Economic Knowledge and Learning," Journal of Economic Education 12, no. 80 (Winter 1980): 34-40.

differential in performance levels in economics classes by student characteristics. Heath's (1989) study, for example, states that there exists a wider-than expected difference in male versus female ability to successfully complete an economics course.³ From an instructor standpoint, some work has been done primarily from the approach of instructor effect on student expectations. Mehdizadeh (1990)⁴ and DeCanio (1986)⁵ have done studies, both stating that student expectations played a role in performance. Both of these studies concentrated on student evaluations.

In studies relating the effect of the DS program and student performance in college level courses, results are mixed as to effectiveness. Michello and Bader (1989) conducted a study at Middle Tennessee State University in an attempt to access the "success rate" of DS students in their first college algebra course. Their findings indicate no substantial difference in grades between Developmental Studies and non-Developmental Studies students, meaning that completion of the DS program brought this type of student up to the level of his/her non-DS peers.⁶ A 1985 study at Triton College shows a high degree of correlation between grades earned in Developmental Studies courses and later grades in upper level courses.⁷ These findings are supported by Mickler and Chapel (1989), whose study indicates that DS

³J. Heath, "An Econometric Model of Gender in Economic Education," American Economic Review Proceedings 79, no. 2 (1989): 226-30.

⁴Mehdizadeh, Mostafa, "Loglinear Models and Student Course Evaluations," Journal of Economic Education, Winter 1990: 7-21.

⁵S. DeCanio, "Student Evaluations of Teaching-A Multinomial Approach," Journal of Economic Education, Summer, 1986: 165-175.

⁶F. Michello and C. Bader, "An Evaluative Study of the Developmental and Math Program at Middle Tennessee State University," Daily News Journal, 14 January 1989, 5.

⁷S. Chand, "The Impact of Developmental Education at Triton College," Journal of Developmental Education 9, no. 2 (1985): 2-5.

course completion aid in further college-level courses.²⁸ These studies seem to indicate that the DS program does bring the "deficient" student up to the level of the non-DS group. On the other hand, Park and Kerr (1990) showed no significance for "complementary" courses, (courses considered to be of assistance to further college level classes) but suggest that higher ACT scores and high school grade point levels are significant.⁹ Other studies have shown that retention rates (the percentage of students remaining in school each semester) are significantly increased as a result of taking required remedial courses. Morante's study (1985) shows both retention and survival rates for students having completed the Developmental Studies program had more than doubled, both in state colleges and the community college system.¹⁰ Of course, the amount of time invested in a course and the natural aptitude of the student clearly play a role in success in all classes, whether DS or not. Rubin (1977) finds that verbal aptitude and hours of study specifically relate to students grade point averages, regardless of the course(s) taken.¹¹ Several of these mentioned studies also show that increased age of the student usually is a good sign toward successful completion of college level courses.

Again, studies regarding the DS program and its effect on specific disciplines are very limited. There is little done in the general area, and even less in the various disciplines. The only known work in the

⁸M. Mickler and A. Chapel, "Basic Skills in College: Academic Dilution or Solution?" Journal of Developmental Education 8, no. 1 (1989): 2-5.

⁹K. Park and P. Kerr, "Determinants of Academic Performance: A Multinomial Approach," Journal of Economic Education, Spring, 1990: 101-111.

¹⁰A. E. Morante, "The Effectiveness of Developmental Programs: A Two-Year Follow-Up Study," Journal of Developmental Education 9, no. 3 (1985): 14-45.

¹¹L. S. Rubin, "Socioeconomic and Academic Factors Influencing College Achievement of Economics and Business Majors," Journal of Economic Education 8, no. 2 (1977): 124-125.

field of economics and the DS program is the study by Smith (1989) mentioned earlier, which concludes that non-Developmental Studies students perform better in Principles of Economics than their Developmental Studies peers. The lack of more specific control groups in Smith's studies may lead to some ambiguity in his findings; that there exists a significant difference between the Developmental Studies and non-Developmental Studies student, yet that DS study skills are useful. There are no other articles relating the DS program to economics. Possibly this is due to the 1979 publication of a review of research on economic education at the college and university level which implies that extensive research had already been done and that further research would not likely yield other insights.¹² However, recent papers have noted the need for additional work in the area of DS courses and the impact on performance in Principles of Economics classes, pointing out particular segments of concern, including the role of basic skills (i.e., the DS course areas), course sequencing (concurrency), instructor effect on student success, the increasing number of graduate teaching students with English as a second language, and high school preparation.¹³ This study addresses several of these topics.

¹²J. Siegfried and R. Fels, "Research on Teaching College Economics: A Survey," Journal of Economic Literature, September 1979: 923-69.

¹³American Economic Review, Papers and Proceedings, May 1991: 20-37.

CHAPTER III
EMPIRICAL ANALYSIS
Data Section

The primary research variable used to measure performance in Principles of Economics is the final course grade. The "standard" measure of A=4, B=3, C=2, D=1 and F=0 will be utilized. For the purposes of this study, "success in economics" is defined in two alternative ways: (1) grades below a C are considered failure and (2) measures are based on each grade (i.e., A, B, C, D and F). For the first measure, binomial regressions are employed to obtain the test results, while the second group involves multinomial regressions, due to the possible outcomes being greater than the simpler one or zero possibilities. In conformance with existing studies, the first alternative (the pass or fail measurements) will be investigated initially, and the following tests will involve the "by grade" analysis.

The data used in this paper refer to students at Middle Tennessee State University who were taking Principles of Economics for the Spring, Summer and Fall semesters of 1989. The total sample size of all students taking Principles of Economics is 2125, with 775 of the total sample being either Developmental Studies students, students with ACT scores of 17-18 or students with ACT scores below 16 who tested out of the DS program. This 775 sample populace is the base data set for the models.

The data set has several fields, or variables, that will be used as independent variables. These variables are summarized in Table 3.1. Each of the variables will be used for each set of tests.

Table 3.1.--Variable characteristics and descriptions

Variable Characteristic	Description
Age	Numeric
Sex	Male/Female
Race	Caucasian/Non-Caucasian
ACT Score	Numeric
HSGPA	High School GPA
Instructor Experience	Numeric
Semester Taken	Fall, Spring, Summer
Time of Class	Morning, Afternoon, Night
Block	Once per week meeting versus multiple meetings
Class size	Size of economics class
DS Dummy	As required for test(s)

There are five variables used in this study that are totally new as compared to earlier studies on student success. Instructor experience at MTSU is one, as is the "block" concept--classes meeting once per week as compared to meeting two or more times. The third new variable is class time; morning, noon and night classes. The semester that Principles of Economics was taken is identified as either summer, fall and spring. The fifth variable is the size of the economics class.

Table 3.2.--General data characteristics

Characteristic	Sample Value
total students	775
total DS students	542
ACT scores 17-18	122
student ACT <17 not in DS	111
students taking concurrently	402
students not concurrent	140
range of ACT scores (entire group)	2-31
range of HSGPA (entire group)	1.46-4.00
total males	402
total females	373
total DS males	286
total DS females	256
minimum age overall	17
maximum age overall	58
average age overall	22.87
minimum DS age	18
maximum DS age	49
average DS age	21.29

Table 3.2. shows that 70 percent of the total students are in the Developmental Studies program, with the number of students testing out of the program about the same as the ACT 17-18 populace. The roughly three-to-one ratio of students taking DS courses concurrently with college level courses seems to reflect a feeling among academic deans that the effect of completion of the Developmental Studies program may not be crucial, or that the DS program is so new that little is known of its effects. The highest ACT score of 31, with the simultaneous placement in the DS program, is reflective of the over 21 year old student taking the AAPP test and not passing all the sections. The percentage mix of male to female in both overall and DS categories is about the same, implying little sex difference in the Developmental Studies programs' placement treatment. The average DS age being around 1.5 years less than the overall average could be reflective of lesser academic standards in the high schools. The maximum DS age of 49 is directly reflective of the "non-traditional" student referred to in the introduction. This older student, often returning to college to enhance his work skills, appears to frequently be included in the Developmental Studies program. This is probably due to the length of time since this student was exposed to the basic elements that are embodied in the DS program.

Since there are missing values for some variables, some of the regressions will contain fewer than the total number of data points. The overall population of 775, and the DS population of 542 will vary dependent on the data. Records for students that have missing values in selected fields are deleted. This deletion of records is necessary to compute the regressions. Each table reflects the total observations for the specific test.

Even allowing for the missing values, each regression has a substantial range of observations. These various subsets of the original dataset will differ for each test.

Table 3.3.--Performance in Economics 241/242 classes

% of DS students			% of Non-DS students with low ACT*		
grade	241	242	grade	241	242
A	3.9	1.9	A	3.1	1.9
B	14.8	17.9	B	18.6	9.6
C	43.9	34.5	C	36.4	40.4
D	15.5	17.9	D	17.1	29.8
F	21.9	27.8	F	24.8	18.3
	-----	-----		-----	-----
	100.0	100.0		100.0	100.0
n=	330	212	n=	129	104

ACT <17 and not DS; or ACT 17-18

Table 3.3. suggests that the DS student has a better chance of passing 241 (macroeconomics) than his low ACT/tested out peer (62.6 to 58.1) while in 242 (microeconomics) the difference is smaller (54.3 to 51.9). Possibly, macroeconomics has a more "real-world" feel to it, thus letting students be more comfortable with the text. Possibly, not taking some of the DS courses prior to Principles of Economics causes the DS student to fail more frequently--a topic of considerable work later in this study. A and B grades are hard to come by for both groups while the DS student will fail microeconomics much more frequently.

Statistical Analysis

The statistical tools utilized for the various tests will be the binomial (for the pass-fail models) and the multinomial (for 0-4 criteria models) logit regression models. Logit models, generally speaking, are a type of regression analysis that is gaining wide acceptance in econometric applications to individual data. Numerous studies (DeCanio, 1986 and Park and Kerr, 1988) have employed the logit model successfully in studies on economic education. Computer software is used to help compute the data, due to the relatively massive computations involved. It is quite possible that logit (non-linear)

models have become popular with the advent of the personal computer, making what was formerly labor intensive calculations relatively simple.

These models are grouped into two categories, binomial and multinomial, depending if the outcome is the choice between two or more than two outcomes. Both types of models are non-linear regression models. Most recent econometric work has been in the binomial field. The multinomial model is an extension of the binomial approach. Binomial models are applicable to the "pass-fail" group, while the multinomial models are used for the "0-4" grade tests.

For the two outcome ($y=0, y=1$) binomial logit, the probability of outcome $y=1$ is given by:

$$\text{Prob} [Y=1] = \frac{e^{\beta'x}}{1 + e^{\beta'x}}$$

Figure 3.1. Probability outcome for binomial logit.

Where e is the exponential function, β is a $(k \times 1)$ vector of coefficients and x a $(k \times 1)$ vector of regressor variables.¹

The multinomial logit model for outcomes $y=j$ ($j=0..n$) takes the form:

$$\text{Prob} (Y = j) = \frac{e^{\beta'_j x}}{1 + \sum_{k=0}^n e^{\beta'_k x}}, \quad \text{for } j = 1, 2, \dots, n$$

$$\text{Prob} (Y = 0) = \frac{1}{1 + \sum_{k=0}^n e^{\beta'_k x}}$$

Figure 3.2. Probability outcome for multinomial logit.

¹For more details, see Chapter 20 of Greene, William H., Econometric Analysis, New York, Macmillan, 1990.

The model implies m log-odds ratios of the form:

$$\ln \left[\frac{P_j}{P_0} \right] = \beta'_j x \quad \text{for } j = 1, 2, \dots, n$$

Figure 3.3. Log-odds ratios of the logit model.

There will be two major sets of regressions in this study. The first set of regressions looks at the overall usefulness of the DS program for success in Principles of Economics without differentiating among the various study areas of the DS program, that is math skills, reading skills, English skills and study skills. The dependent variable in this "pass-fail" approach is "success in economics" in all cases. In a first run, this is a simple zero/one variable (1 for C and above) and the matching regression technique is binomial logit. The regression will also be run with a different dependent variable: "success" defined with a variable that can take on values between 0 and 4 (0 for fail, 1 for D, etc.). The matching regression is the multinomial logit model described above. This regression specification could show that the DS program does not matter with regard to success or failure of students but that it matters in terms of the level of their performance, that is, it could push students from a C to a B.

The second set of regressions looks at the usefulness of the various subject areas of the DS program for success in Principles of Economics, that is reading skills, English skills, math skills, and study skills. As in the initial set of regressions described above, we will use two definitions of "success in econ": (1) above or below grade C; (2) grades F through A (variable with 0 through 4). The regression for this second set of regressions is of the form:

success in economics = f (stud. characteristics, teacher/course
math dummy, reading dummy, English dummy, skills dummy).

The dummy variables take on a 1 if all required courses in this subject area are completed before the economics classes are attended.

The regressions are based on the implicit assumption (1) that all students in the sample are deficient in all three areas, that is reading, math, English and study skills, or (2) that the testing procedures at the DS department to identify students with deficiencies are not very efficient. Neither assumption may be valid. Supposedly, students are tested by the DS department before they are assigned to particular Developmental Studies courses in one or several of the three study areas. Supposedly, there must also be a reason why students with ACT scores above 16 are not tested at all. Hence, the regressions may not fully capture the success of the DS program. Again, this is a question of the correct control group. A more specific test would have to be a bit more careful in specifying the control groups. For this, we will limit the sample to DS students that have to take specific areas of the DS program (for example, reading). The corresponding model takes the form:

success in economics = f (student characteristics, teacher/course
characteristics, DS program area dummy).

where the DS program area dummy takes on 1 if (i) all reading courses have been completed before economics is taken (first regression). This set of regressions will be run separately for each area of the DS only program (reading, English, math and study skills) only.

All models described include the following student characteristics:

age, sex, race, act, hsgpa

(+) (=) (=) (+) (+)

The signs below each of the characteristics denote the expected contribution to success in economics. Increasing age, along with higher ACT and high school grade point average is expected to be a positive contributor to success in Principles of Economics, with sex and race expected to be neutral as far as contributors to the models tested. For all models, characteristics for the model and the expected sign of the coefficients are:

Instructor, Block, Class time, Semester Taken, Class Size

(-) (?) (?) (?) (-)

Instructor, in this case, refers to the instructor's length of teaching at MTSU, with the higher number assigned to the lesser experience. This implies that a positive, significant sign would mean that the less experience, the better chance for success on the students part, while a negative, significant sign would imply that experience does matter. The expected sign of block, (once-per-week meeting versus multiple class meetings) is not known, nor is the class time and semester taken as far as its expected sign. The size of the class is assumed to be "the smaller, the better."

The sample populace is divided into four groups:

1. DS students having completed all DS courses prior to taking Principles of Economics
2. DS students taking DS courses concurrently with Principles of Economics
3. Students with ACT scores of 17-18 (non-DS), and

4. Students with ACT scores of 16 or below not in the DS program (tested out)

Three groups of models are employed:

1. All DS students tested for significance between concurrency and non-concurrency
2. The total populace tested for significance between the (a) DS student taking Principles of Economics concurrently with DS courses and (b) The DS student having completed the DS program, the student with an ACT score of 17-18 and the student with an ACT score below 16 who tested out of the program
3. Testing by DS area (DSM, DSE, DSR, DSS) of DS students; then DS students who are deficient in a specific DS area only

The reasoning for the three groups and their separate tests is one of the major differences in this work compared to previous work. There is a need for separate control groups to more clearly test the contribution of the DS program. The first group tests for the value of completing all DS work prior to taking Principles of Economics. The second group tests for any differences between (a) the DS student taking Principles of Economics concurrently with DS courses and the (b) the DS student who has completed all of his/her DS work, the student with an ACT score of 17-18 (just above the cutoff for DS) and the group that tested out of the DS program. The third group tests DS students in each area of the DS program (math, English, reading skills and study skills) whether they were deficient in that area or not, and then tests DS students that are deficient in each particular Developmental Studies area to see if these specific areas of the DS program are positive contributors to success in Principles of Economics.

The second grouping uses a dummy variable that controls the sample populace in the following way: Low ACT and tested-out students are grouped with DS students having completed all DS courses. In other words, these groups are treated the same, as one group. The idea

behind this is that the low ACT and tested-out students have no deficiencies compared to DS students. Hence, they are in the same category as DS students having completed their DS program. They are then tested against the Developmental Studies student taking Principles of Economics concurrently with DS courses.

The third group uses a similar dummy variable to control the sample populace in the following way: The DS student that has completed all his Developmental Studies courses is tested against his DS peer that has not completed all of his DS courses. This separation allows for clearer testing of the DS program effectiveness.

The dummy variable for the groups is defined as:

1 = the particular study area is required and completed prior to taking economics (DS students) or no prerequisite is required (non-DS student).

0 = the particular study area is required and not completed.

Tests Using the Pass-Fail Criteria

Three tables are presented in the pass-fail section. These tables (3.4.1., 3.4.2., and 3.4.3.) refer to the three models described earlier in the statistical section. Each tables show the results of the pass-fail criteria testing only. The first table presented (Table 3.4.1.) includes two models, or sets of regressions: the left hand column of numbers represent the results of the test of the Developmental Studies student taking Principles of Economics after completion of all the required DS courses versus the DS student taking Principles of Economics concurrently with Developmental Studies courses. The right hand column of numbers in Table 3.4.1. show the results of the test of the DS student taking DS courses concurrently with Principles of Economics versus the group of (a) the DS student having completed all his/her

required DS courses in the DS program, (b) the students with ACT scores of 17-18 and (c) the students that have tested out of the DS program.

Table 3.4.1.--Success in economics as dependent on completion of the DS program

Characteristic	Predicted odds ratios	
	All DS students	All students
Constant	-1.87 (-3.16)	-8.22 (-3.66)
Age	.01 (.97)	.17 (2.46)
Sex	-.01 (-1.08)	-.42 (-1.31)
Race	.01 (.54)	-.13 (-.31)
ACT	.83 (2.81)	.79 (2.78)
HSGPA	.00 (.80)	1.21 (4.07)
Instructor	-.51 (-2.14)	-.53 (-2.61)
Block	-2.76 (-3.39)	-3.43 (-4.94)
Class Time	.89 (3.87)	.88 (4.56)
Semester Taken	.02 (.33)	.24 (2.42)
Class Size	-.01 (-.55)	.01 (.44)
DS Dummy	-.67 (-.80)	.23 (.62)
Log-Likelihood	-251.59	-351.10
Observations	391	542

Notes: parentheses denote t-values. All DS students refer to the student having completed all DS courses versus the student not having completed all DS courses prior to taking Principles of Economics classes. All students column refers to the DS student taking his DS courses concurrently versus the DS student having completed the DS program, the students with ACT scores of 17-18 and the students that have tested out.

The first column of Table 3.4.1. uses a dummy variable set at one if the DS student has completed all DS courses prior to taking Principles of Economics, and a zero if these DS classes are not completed prior to taking economics. The low significance implies that the completion of the DS program prior to taking Principles of Economics has no effect to the student's success in economics, defined as a grade of higher than a D. This alone does not mean that the DS program has no merit, only that further testing is necessary. The DS dummy may tell that the nurturing effect of the DS program is still existent. In other words, the DS student with a economics problem related to math can go to the DS math teacher for instruction. The DS dummy result also says that concurrency is not an issue. The concurrent student can do as good or as bad as the other groups. The third approach is that this pass-fail test is simply too crude to identify any difference. The negative sign for instructor says that the teaching experience at MTSU affects in a positive way the student chance of success. The negative coefficient of the block class says that single class meetings weekly are not good, while the positive class time coefficient tells us that the later in the day the class meets, the better for the student. This may be that a once-per-week meeting gives this type of student time to forget, or lose interest, in the class. Early morning classes might catch the student at a time when he/she is not ready to learn. The right hand column of Table 3.4.1. uses a dummy variable set at one if the DS student has completed all of his/her DS courses prior to taking Principles of Economics. The variable is one also for the student with an ACT score of 17-18 and the student that tested out of the DS program. The idea behind this is that the low ACT and tested-out students have no deficiencies compared to DS students. Hence, they are in the same category as DS students having completed their DS program. All are counted as one. If the DS student has not completed the DS courses, he is coded as a zero. Again, the DS dummy shows no significance between

the two groups. This means (for this test) that taking Principles of Economics concurrently with DS courses plays no role in positively affecting the students chances of success in economics classes. Instructor experience for both tests indicate that the less experience teaching at MTSU, the poorer chance the student has of successfully passing Principles of Economics courses. Block and time of class behave the same in both tables, as described above.

Table 3.4.2.--DS Students only, by DS area

Characteristic	Predicted odds ratios			
	DSM	DSE	DSS	DSR
Constant	-3.04 (-3.60)	-.62 (-3.01)	-9.73 (-4.12)	-10.31 (-4.25)
Age	---	.16 (2.38)	.20 (2.79)	.19 (2.65)
Sex	---	---	---	---
ACT	.79 (2.56)	.66 (2.33)	.71 (2.45)	.68 (2.65)
HSGPA	.35 (1.47)	.55 (2.90)	.54 (2.82)	.51 (2.67)
Instructor	-.46 (-1.98)	---	-.45 (-2.21)	-.46 (-2.27)
Block	-2.89 (-3.51)	(-2.95) (-4.40)	-3.52 (-4.95)	-3.54 (-5.01)
Class Time	.93 (3.99)	.76 (4.13)	.89 (4.59)	.92 (4.69)
Semester Taken	---	---	.25 (2.46)	.24 (2.37)
Class Size	---	---	---	---
DS Dummy	.28 (1.05)	-.42 (-1.33)	-.57 (-1.05)	.51 (.63)
Log-Likelihood	-251.83	-323.21	-350.41	-350.21
Observations	392	401	447	450

Notes: parentheses denote t-values. DSM refers to the DS math program, DSE the DS English program, DSS the DS study program and DSR the DS reading program. For specific DS class descriptions, see the appendix.

Table 3.4.2. presents the results for DS students in the respective Developmental Studies section. The DS dummy variable takes on a one if all DS courses (in the respective area) have been completed prior to taking Principles of Economics, and carries a value of 0 if all Developmental Studies courses have not been completed at the time of taking economics. The results show that completion of DS courses prior to taking economics is not significant from the standpoint of positively affecting the student chances of success in economics. Higher ACT and high school grade point average are positive and significant, meaning the higher the score(s), the better the chance for student success in Principles of Economics classes. Instructor experience seems to contribute positively, meaning that the greater the degree of instructor experience teaching Principles of Economics at MTSU, the better the chances of the student passing economics. The single week meeting is not good for student chances of success, possibly implying that this type of student may tend to forget some of the lecture or material covered between class meetings. It again appears that the later in the day the class meets, the better the chance of success. For completion of study and reading skills, it appears that the later in the life of the DS program that these courses were completed, the greater the effect. Possibly new instructors came on board in these areas later in the life of the Developmental Studies program, or other changes were made. As stated earlier, the insignificant t-values regarding the DS dummy do not mean that the DS program does not contribute in a positive way, but that further tests are required, in the individual grade regressions and at the DS subject level.

Again, this table shows the individual Developmental Studies area (i.e., math, reading, English and study skills) for DS students only from a strictly pass-fail standpoint. It may be noted here that the Developmental Studies math area has the largest number of observations

as compared to the other DS areas, a statistic that will be repeated in further tests.

Table 3.4.3.-- DS Students, deficiency areas only

Characteristic	Predicted odds ratios			
	DSM	DSR	DSE	DSS
Constant	-3.34 (-3.52)	-3.96 (-1.97)	-.68 (-1.57)	-3.34 (-2.89)
Age	---	---	---	---
Sex	---	-.75 (-2.19)	---	---
Race	---	---	---	---
ACT	.80 (2.60)	.22 (2.63)	---	.26 (3.22)
HSGPA	.38 (1.65)	.86 (2.10)	---	---
Instructor	-.45 (-1.94)	-.34 (-1.00)	---	-.39 (-1.22)
Block	---	---	-1.78 (-1.82)	---
Class Time	.93 (3.99)	.31 (.97)	.59 (-1.82)	.38 (-1.22)
Semester Taken	---	---	---	---
Class Size	---	---	---	---
DS Dummy	.42 (1.01)	-.76 (-.56)	.42 (.92)	.94 (1.04)
Log-Likelihood	-251.88	-112.37	-144.22	-115.81
Observations	392	177	213	179

Notes: parentheses denote t-values. As in Table 3.4.2, each column refers to the respective DS program.

Table 3.4.3. shows the results of the regression for DS students only, with specific areas of deficiency. For this regression, only DS students deficient in a specific DS area (math, English, study skills or reading) are tested. The DS dummy takes on a 1 if the student has completed all DS work in the area of deficiency. As in the previous

test, the DS dummy contributes in a positive way in math skills, although it is not significant at the 5% level. This implies that the program, although slightly useful in this area, still does not contribute overall in a significant way. Higher ACT scores and higher high school grade point average help in most of the DS areas. Block classes here are not significant. Classes taking place later in the day seems to affect only the DS math student in a positive way. Overall, the insignificance of the DS program's contribution here does not necessarily imply that the program is not effective. Further testing is required.

The pass-fail tests can be briefly summarized as follows. The DS program does not appear to contribute in a significant way to the students chances of success in Principles of Economics. The math skills have positive coefficients, but are not significant at the 5% level of statistical significance. Some of the variables behave in a different fashion than expected. Class size does not appear to affect the students success chance. The higher ACT and high school grade point scores contribute positively to the student chances of success in Principles of Economics. Whether there is a difference in the time of the class (morning, afternoon, or evening) as related to the students success in economics is not known. While the results do not show any major contribution by the DS program at the pass-fail level, this does not necessarily mean that the program is not useful. Further testing at the 0-4, or individual grade level, is necessary to determine if there is a better way to measure the usefulness of the DS program.

Tests Using the 0-4 Analysis

In using the 0-4 criteria, four regressions are produced for each test. Each test moves one letter grade upwards to an A.

Significant variables from each test are then isolated and the second set of regressions is generated for each test with only these significant variables included. The rationale for four separate regressions is to properly identify coefficient and t-values for each grade differential. Previous studies (Park and Kerr) report grade differentials in a F to D, F to C, F to B and F to A sequence. This study looks instead at grade-by-grade levels to determine different measures of success from other studies, that is it utilizes F to D, D to C, etc. sequences.

The only other known study using a similar grade-by-grade model was done by DeCanio (1986) in the area of student evaluations.²

The results are arranged as follows:

Tables 3.5.1., 2 and 3 represent the "general" tests. Table 3.5.1. reports the results of the tests of DS students completing all DS courses prior to taking Principles of Economics with the DS students taking economics concurrently with DS courses. Table 3.5.2. compares the DS student taking his DS courses concurrently with economics versus the group of DS students having completed the DS program, the students with ACT scores of 17-18 and the students that have tested out. Table 3.5.3. looks at the results of the regression testing the DS student against the students with ACT scores of 17-18 and the students that tested out.

Tables in the 3.6 section are broken into the four DS areas, DSM (math), DSE (English), DSS (study skills) and DSR (reading skills). Each of these four areas are then divided into three tests, or tables comprising three regressions:

- (1) The total populace is tested for significance between the (a)

²DeCanio, "Student Evaluations of Teaching-A Multinomial Logit Approach," 170-173.

DS student taking his DS courses concurrently in the specific DS area and (b) the DS student having completed the DS program, students with ACT scores of 17-18 and the students that have tested out.

(2) All DS students in the specific DS area are tested for significance between concurrency and non-concurrency.

(3) Testing by specific DS area (DSM, DSE, DSR, DSS) of DS students deficient in that DS area only. The testing is for the DS student having completed the DS program versus the DS student taking his DS courses concurrently with Principles of Economics in the specific DS area.

Table 3.5.1.--DS Students only; concurrent versus non-concurrent

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-2.11 (-58)	-11.12 (-3.19)	-6.67 (-4.84)**	5.04 (.49)
ACT	-.08 (-1.61)	.10 (1.59)	.11 (2.49)*	-.21 (-1.44)
HSGPA	.95 (2.70)*	-.01 (-.10)	1.16 (2.98)*	.31 (.25)
Instructor	-.02 (-.06)	.10 (.61)	.01 (1.07)	.24 (1.73)
Block	1.40 (1.24)	.78 (2.32)*	-16.82 (-.01)	-.01 (.00)
Class Time	-.02 (-.05)	-.01 (-1.19)	.42 (1.23)	-1.50 (-1.28)
Class Size	.08 (1.17)	-2.84 (-2.86)*	.01 (.07)	-.01 (-.21)
DS Dummy	-.98 (-2.12)*	.87 (1.96)	-.49 (-1.13)	.33 (.26)
Log-Likelihood	-488.20	-474.74	-487.20	-487.20
Observations	391	391	391	391

Notes: parentheses denote t-value. Bold indicates second regression.

* Significant at .05. ** Significant at .01.

Table 3.5.1. show the results of the test to determine if there exists a statistical significance between the student that has completed

all DS courses prior to taking Principles of Economics and the Developmental Studies student taking both economics and DS classes at the same time. The DS dummy identifies (with a one) those students having completed their Developmental Studies program prior to taking Principles of Economics. Hence, DS students taking economics concurrently is the base group in this case against which DS students taking economics after completion of their Developmental Studies program are compared. This test contains regressions for each grade level (i.e., F to D grade range, D to C grade range, etc.). The DS dummy is significant at one level only: completing the Developmental Studies courses prior to taking Principles of Economics hurts the student in going from an F to a D. This could be because the Developmental Studies student is "nurtured" in the DS classes, and when taking regular college level courses the student may be a little bit lost. A good example of Developmental Studies nurturing is that if a test result is poor in the particular Developmental Studies course, the test can be retaken often up to three times, with no penalty. Although not statistically significant at the five percent level, it should be noted that completion of the DS courses aids the student in moving from a D to a C.

In other characteristics, the ACT scores and high school grade point averages acted as before, although not at all levels. Interestingly, block classes and class times are not (generally) significant in this set of regressions, possibly indicating that in moving the DS student from one grade level to the next these factors are not as important as in the simpler pass-fail criteria. Class size, generally thought to be a negative variable as the class size increases, only showed a negative contribution in the D to C level. It appears that "good" students are "good" students even in large classes. In other words, a "good" student knows what and when to study, and the relative size of the class does not present a major obstacle. Class size may be important for the marginal students or the struggling ones.

Table 3.5.2.--Total Population; all control groups versus DS student taking economics concurrently with DS courses

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-4.30 (-1.18)	-4.32 (-1.32)	-13.11 (-3.45)**	10.10 (1.05)
ACT	-.06 (-1.34)	.01 (1.53)	.11 (2.45)*	-.11 (-.89)
HSGPA	.83 (2.92)*	.13 (.46)	1.11 (3.40)**	.31 (.38)
Instructor	-.01 (-.43)	-.01 (-.97)	-.01 (-.63)	.14 (1.53)
Block	1.03 1.16	-3.06 (-3.74)**	-17.10 (-.01)	-.10 (.00)
Class Time	-.02 (-.01)	.74 (2.71)*	.52 (1.81)	-.99 (-1.21)
Semester Taken	.18 (1.16)	.01 (.53)	.27 (1.78)	.01 (.01)
Class Size	.02 (.35)	-.01 (-.04)	-.01 (-.04)	-.02 (-1.36)
DS Dummy	.97 (2.11)*	-.93 (-2.13)*	.43 (.99)	-.08 (-.08)
LOW ACT	1.16 (1.85)	-1.05 (-1.84)	.03 (.05)	-1.37 (-.96)
ACT 17-18	1.13 (2.21)*	-1.17 (-2.41)*	.22 (.44)	-.91 (-.72)
Log-Likelihood	-700.02	-674.14	-697.31	-697.31
Observations	549	549	549	549

Notes: Parentheses denote t-value. Bold indicates second regression.
 * Significant at .05. ** Significant at .01.

In Table 3.5.2., the DS dummy identifies only those students having already completed their DS program. DS students taking Principles of Economics concurrently is the base group in this test. This is the group against which the other three (Developmental Studies courses completed, LOWACT and ACT 17-18) are tested. All three groups fare about the same in the F to D range (a positive contribution). Further upward movement is not significant. This could indicate that

this set of control groups can perform at the D range, but have trouble moving upward to the passing range. The results of Table 3.5.2. also suggest that there is little, if any, difference between the three control groups. This means that completion of the Developmental Studies program brings the DS student close to the level of the low ACT and ACT 17-18 groups. The coefficient for the DS dummy in this test shows that the DS student comes close, but not equal to, the student with an ACT score of 17-18 and the student that tested out of the DS program. Smith's study noted a significant difference between the DS and non-DS student, and those results are not disputed here. In this study, only a selected subset of the non-DS student populace (students with an ACT score of 17-18 and the student that tested out of the DS program) is selected. This selective approach shows that the DS program brings the DS student up to these levels, but no further, as evidenced by the insignificance for all three groups in the C to better grade range. ACT and high school grade point average assist in the C to B range, but has no real contribution at the lower levels. The high school grade point average being higher appears to help the student from failing. Block and class time are significant at the D to C level only for this set of regressions. The block variable results mean the same as the earlier tests; the once-per-week meeting is not overly useful to this type of student. When the class meets more than once-per-week, the chances of success in economics appear to be improved. The single meeting per week may allow this type of student enough time to forget some of the coursework. The class time variable significance means that the later in the day that the class meets, the better the student chances of success in Principles of Economics. Instructor contribution is not significant at any level in this test. All other variables for this test were insignificant.

Table 3.5.3. will look at the pass-fail criteria from the last set of models denoted earlier in the data section.

Table 3.5.3.--Total populace; estimates for significance between DS student, ACT 17-18 and ACT below 16 (non-DS)

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-3.81 (-1.07)	-4.16 (-1.29)	-13.37 (-3.53)**	10.02 (1.05)
Age	.02 (.22)	.12 (1.20)	.17 (1.59)	-.21 (-.87)
ACT	-.06 (-1.39)	.01 (1.72)	.11 (2.40)*	-.12 (-.91)
HSGPA	.57 (1.90)	.01 (.09)	1.16 (3.59)**	.31 (.38)
Instructor	-.02 (-.55)	-.01 (-.93)	-.01 (-.66)	.14 (1.52)
Block	1.03 (1.19)	-3.12 (-3.83)**	-17.08 (-.01)	-.10 (.00)
Class Time	-.06 (-.19)	.79 (2.92)*	.49 (1.74)	-1.00 (-1.22)
Semester Taken	.23 (1.51)	.01 (.28)	.29 (1.93)	.01 (.01)
Class Size	.01 .08	.01 (.21)	-.01 (-.52)	-.02 (-1.37)
ACT 17-18	.41 (1.05)	-.56 (-1.40)	-.12 (-.36)	-.84 (-1.05)
LOW ACT	.41 (.84)	-.59 (-1.03)	-.33 (-.65)	-1.32 (-1.25)
Log-Likelihood	-700.96	-677.58	-700.96	-700.96
Observations	549	549	549	549

Notes: Parentheses denote t-values. Bold denotes second regression.
 * Significant at .05. ** Significant at .01.

Table 3.5.3. presents the results of the regressions of the total sample, all three groups, and compares the Developmental Studies student population with the student that tested out of the DS program and the student with an ACT score of 17-18. In this set of tests, there was no statistical significance on the part of the tested out student or student with an ACT score of 17-18. This implies that the Developmental Studies student is no different than his two peers. This means that

completion of, or taking Developmental Studies courses brings the DS student up to the level of his peers with an ACT score of 17-18 or the student that tested out, as far as potential success in Principles of Economics is concerned. This result is similar to the finding in Table 3.5.2.. These results also mean that all three groups have problems moving to a higher grade range. A further implication is that the concurrency issue is not really an issue. Here it appears that completion of DS courses do not significantly alter the Developmental Studies student chances of success in Principles of Economics. There are other, possibly non-DS variables, that do positively affect student performance. The higher ACT score hurts the student from the F to D level, while the high school grade point average (being higher) acted in the opposite direction. Both of these variables contributed positively in the C to B range. This might mean that the F to D range student does not feel that he/she should even be in the Developmental Studies program. Block classes and class times were significant only in the D to C range. Interpretation of these variables is difficult, although it may say that the D to C student has more desire, or some other unknown variable.

To summarize, it appears that the overall value of the DS program for success in Principles of Economics is limited to movement in the very lower ranges. The program seems to help the DS student from an F to a D. There is little, if any, difference between the DS student completing all the Developmental Studies courses as compared to the three other control groups (the student taking DS courses concurrently, the student with an ACT score of 17-18 and the student that tested out of the DS program). This means that completion, or taking, of DS courses appears to bring the Developmental Studies student up to the level of the tested out and ACT 17-18 student. In this regard, the DS program does show effectiveness. The inability of all the control groups to rise effectively above the D level shows not only that the

Developmental Studies program brings this student up to the other control groups level, but also accentuates Smith's results of a significant difference between DS and non-DS student. An interesting question now is what is the "cutoff" threshold of ACT scores where there is a significant difference between the DS and non-DS student? In other words, what ACT score, or is there such a thing, that can be used as a definitive separator for differentiating between anticipated student success in Principles of Economics? This is a good question for further study.

Next we will investigate success in Principles of Economics for each Developmental Studies grouping, (mathematics, English, reading and study skills) with three sets of tests for each area: (1) The total populace will be tested in a "completed versus not completed" way. The DS student having completed his/her DS courses is considered in the same group as the student that tested out and the student with an ACT score of 17-18 since the latter two groups have "completed" deficiencies. (2) The DS student population will be tested. The DS student having completed the specific Developmental Studies field (area of study) courses, or not having to take these specific courses, is tested against the DS student that is taking these DS courses concurrently with Principles of Economics. (3) The DS student population that is deficient in the specific DS area only is tested. The student that has completed these required Developmental Studies courses before taking Principles of Economics is tested against the DS student that is taking these required courses concurrently with economics.

These sets of test will show the results of the grade-by-grade regressions. Each of the regressions will test at one higher grade range, with the significant variables of the initial regression for each test retained and ran again. The second regression results are highlighted for each table, at each grade range. The highlighted second regressions are included in each table.

Table 3.6.M1.--Total population; all students (DS and non-DS),
completed all math courses versus non-completion

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-3.90 (-1.08)	-4.13 (1.24)	-13.44 (-3.56)**	8.88 (.94)
Age	-.01 (-.02)	.14 (1.39)	.17 (1.58)	-.19 (-.75)
ACT	-.43 (-.98)	.05 (1.37)	.12 (2.58)*	-.01 (-.63)
HSGPA	.41 (1.34)	.14 (.50)	1.09 (3.37)**	.13 (.16)
Instructor	-.17 (-.51)	-.02 (-.99)	-.01 (-.59)	.14 (1.59)
Block	.98 (1.12)	-3.10 (-3.78)**	-17.13 (-.01)	-.28 (.00)
Class Time	-.20 (-.06)	.76 (2.80)*	.49 (1.73)	-1.02 (-1.27)
Semester Taken	.18 (1.14)	.01 (.09)	.28 (1.83)	.01 (.06)
Class Size	.01 (.29)	.01 (.08)	-.01 (-.45)	-.02 (-1.35)
DS Dummy	1.48 (3.10)**	-1.12 (-2.37)*	.33 (.74)	-.28 (-.24)
Log-Likelihood	-696.97	-687.90	-696.97	-696.97
Observations	549	549	549	549

Notes: Parentheses denote t-values. Bold denotes second regression.

All DS students having completed their DS math courses, along with the student that has tested out and the student with an ACT score of 17-18 are tested against the DS student taking his DS math courses concurrently with economics. The DS student that has not completed math carries a value of zero for the dummy variable, while all others are assigned a one. For these tests, completion of math does assist the student (all groups) in the F to D range, but hurts in the D to C range. In other words, completion of math keeps the student from failing Principles of Economics. This means that completion of the DS math

courses (or non-deficiency) aids all student in the F to D range. Concurrent taking of DS math courses is not a good idea if one tries to avoid F's. This means that completion of DS math courses brings the DS student up to the level of the other two groups. Another interpretation may be that there are two groups of DS students; a group that has no idea what's going on in the math area, and a group that has some idea. The group that has some idea has the chance to make a D rather than failing, and the group that has taken no math either fails or falls into the negative significance around the D to C range. Higher ACT scores and high school grade point averages play a significant role only in the C to B range. Block classes and class times contribute from the D to C area only. Class size and instructor are not significant at any level.

Table 3.6.M2.-DS students only; DSM section

Characteristic	F to D	Predicted odds ratios		
		D to C	C to B	B to A
Constant	-1.34 (-.49)	-.50 (-.15)	-11.87 (-3.45)**	5.47 (.54)
ACT	-.05 (-1.08)	.01 (1.67)	.12 (2.52)*	-.21 (-1.43)
HSGPA	.40 (1.31)	-.01 (-.03)	1.17 (3.01)*	.28 (.23)
Instructor	-.06 (-.18)	-.01 (-1.23)	.01 (1.10)	.24 (1.73)
Block	1.20 (1.42)	-2.86 (-2.93)*	-16.79 (-.01)	-.01 (.00)
Class Time	-.05 (-.18)	.77 (2.29)*	.39 (1.16)	-1.51 (-1.28)
DS Dummy	1.53 (3.21)**	-.97 (-1.98)*	.47 (1.04)	-.19 (-.15)
Log-Likelihood	-702.29	-484.53	-485.02	-485.02
Observations	391	391	391	391

Notes: Parentheses denote t-value. Bold indicates second regression.
 * Significant at .05. ** Significant at .01.

Table 3.6.M2. compares the DS student taking his/her DS math courses concurrently with Principles of Economics and the DS student that has completed all math or was not deficient in the math area. The DS dummy carries a value of 1 if all DS math courses are completed, or if the DS student was not deficient in math. The DS student taking economics concurrently with DS math courses carries a zero for the dummy variable. The results for the DS dummy show that completion of math courses (whether through DS or not) prior to taking economics significantly aids in the chance of going from an F to a D. Completion of DS math courses (or not being deficient) clearly helps the student chances of success.

Table 3.6.M3.--DS students only; DSM Section, deficient in math only

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-2.34 (-.67)	-.71 (-.22)	-11.76 (-3.40)**	5.52 (.54)
Age	.04 (.28)	.01 (.09)	.24 (1.77)	.01 (.12)
Sex	-.06 (-1.71)	-.01 (-.07)	-.01 (-.14)	.69 (.66)
ACT	-.08 (-1.64)	.09 (1.93)*	.11 (2.37)*	-.20 (-1.37)
HSGPA	.69 (1.84)	-.16 (-.48)	1.23 (3.20)**	.25 (.19)
Instructor	-.01 (-.01)	-.01 (-1.40)	.01 (1.13)	.23 (1.69)
Block	1.67 1.84	-3.00 (-3.08)*	-16.74 (-.01)	.01 (.00)
Class Time	-.11 (-.29)	.84 (2.50)*	.36 (1.08)	-1.50 (-1.27)
DS Dummy	.65 (.99)	-.04 (-.06)	-.09 (-.14)	.12 (.09)
Log-Likelihood	-490.28	-490.39	-490.28	-490.28
Observations	391	391	391	391

Notes: Parentheses denote t-value. Bold denotes second regression.
 * Significant at .05. ** Significant at .01.

Table 3.6.M3. is the last of the DS math tests. The sample for this group of regressions consists of Developmental Studies students deficient in math only. The DS dummy is coded with a one for the DS students who completed their DS math courses before taking Principles of Economics. The DS student who is taking Developmental Studies math courses concurrently with economics is coded with a zero. Table 3.6M.3. is quite critical because it shows like no other table the impact of concurrency: there is no statistical difference between the Developmental Studies student completing his/her DS math courses prior to taking Principles of Economics. The prior tables have shown that math knowledge is significant to avoid making F's. In this test, completion of the DS math courses are not significant at any grade level, although there is a positive coefficient at the F to D area. This implies that the Developmental Studies program in math for the DS math deficient student aids slightly in keeping the student from failing. It could be that the Developmental Studies student who is deficient purely in math has a much poorer chance of success in economics. For this type of student, the higher ACT scores are more critical than a higher high school grade point average, particularly in the D to C and C to B range. Again, classes that are taken later in the day appear to help the student chances of success in Principles of Economics. Classes that meet more than once per week seem to help these students in the same way, as with earlier results. As with the general test, it appears that the DS math program aids the student in moving from an F to a D. By keeping the student from failing, the Developmental Studies program shows some value. Table 3.6M.3. also shows that math knowledge, generally speaking, is important for economics.

Now the DS reading area will be tested, under the same criteria as the mathematics area; three separate sets of regressions will be run for this subject area.

Table 3.6.R1.--Total population; DSR section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-18.34 (-.01)	13.24 (.01)	-25.71 (-.01)	7.46 (.00)
ACT	-.06 (-1.39)	.06 (1.54)	.11 (2.38)*	-.01 (-.67)
HSGPA	.57 (1.94)	.01 (.03)	1.05 (3.33)**	.15 (.19)
Instructor	-.07 (-.22)	-.01 (-.81)	-.01 (-.20)	.14 (1.60)
Block	1.27 (1.51)	-3.00 (-3.80)**	-16.67 (-.01)	-.43 (.00)
Class Time	-.06 (-.21)	.74 (2.77)*	.44 (1.56)	-.94 (-1.24)
Class Size	.01 (.44)	.01 (.31)	-.01 (-.42)	(-.20) (-1.26)
DS Dummy	17.81 (.01)	-16.88 (-.01)	17.24 (.01)	1.32 (.01)
Log-Likelihood	-708.39	-698.02	-708.39	-708.39
Observations	549	549	549	549

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.R1. shows the results of the first set of tests in the DS reading area. The control groups are as follows: All DS students having completed their DS reading courses, along with the student that has tested out and the student with an ACT score of 17-18 student are tested against the DS student that is taking Principles of Economics concurrently with his DS reading courses. The DS student that is taking reading classes concurrently with economics is coded zero for the dummy variable, while the comparative group is assigned a one. For these tests, the completion of DS reading courses is not significant in any case. As in the general tests and the DS math area, higher ACT and high school grade point average assist in upper levels (here C to B). Again,

classes that meet later in the day and classes that meet more than once per week help the student, generally.

Several of these same variables will begin to appear on additional tests with similar findings.

Table 3.6.R2.--DS student only; DSR section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-18.50 (-.01)	15.81 (.01)	-28.71 (-.01)	3.35 (.01)
Age	.01 (.38)	.01 (.09)	.23 (1.73)	.01 (.12)
Sex	-.57 (-1.61)	-.01 (-.09)	-.01 (-.13)	.68 (.65)
ACT	-.94 (-1.87)	.09 (2.00)*	.11 (2.37)*	-.20 (-1.40)
HSGPA	.68 (1.83)	-.14 (-.41)	1.21 (3.17)**	.27 (.22)
Instructor	-.01 (-.13)	-.01 (-1.28)	.01 (1.06)	.23 (1.72)
Block	1.47 (1.32)	-2.92 (-2.99)*	-16.76 (-.01)	-.01 (.00)
Class Time	-.01 (-.23)	.80 (2.39)*	.39 (1.15)	-1.49 (-1.27)
DS Dummy	16.72 (.01)	-16.65 (-.01)	17.01 (.01)	2.23 (.01)
Log-Likelihood	-490.38	-490.43	-490.38	-490.38
Observations	391	391	391	391

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.R2. compares the DS student that has not completed his DS reading courses prior to taking Principles of Economics with the DS student that has completed the reading section or was not deficient in the reading area. The DS dummy has a value of one if all DS reading courses are completed, or if the DS student was not deficient in

reading. The DS student taking reading courses concurrently with economics has a zero for the dummy variable. Completion of reading was not significant at any level. Higher ACT and higher high school grade point averages assist in the D to C and C to B range. It seems that the higher high school grade point average helps the student from failing. Classes that meet later in the day help the student chances of success in economics.

Table 3.6.R3.--DS students only; DSR section, deficient in reading

Characteristic	F to D	Predicted odds ratios		
		D to C	C to B	B to A
Constant	-26.72 (-.01)	23.50 (.01)	-34.21 (-.01)	34.51 (.06)
Age	.33 (1.41)	-.32 (-1.44)	.36 (1.25)	.15 (.01)
Sex	-.73 (-1.34)	-.15 (-.29)	-.52 (-.85)	-1.90 (-.03)
ACT	-.24 (-2.11)*	.36 (3.10)**	-.01 (-.02)	-2.83 (-.23)
HSGPA	.84 (1.36)	-.14 (-.24)	2.56 (2.99)**	2.01 (.02)
Instructor	-.05 (-.08)	-.01 (-1.36)	.01 (.33)	.01 (.00)
Block	-.06 (-.04)	-22.64 (-.01)	2.74 (.00)	-12.63 (-.03)
Class Time	-.03 (-.06)	.78 (1.49)	-.46 (-.73)	.21 (.00)
Class Size	.01 (1.88)*	-.02 (-2.05)*	-.01 (-.01)	-.01 (-.03)
DS Dummy	19.48 (.01)	-19.37 (-.01)	19.28 (.01)	11.02 (.03)
Log-Likelihood	-193.77	-193.77	-193.77	-193.78
Observations	177	177	177	177

Notes: Parentheses denote t-value. Bold denotes second regression.
 * Significant at .05. ** Significant at .01.

Table 3.6.R3. shows the results of the test for the DS student who is deficient in reading skills. The DS dummy is coded with a one for the DS students that have completed their reading courses prior to taking economics. The DS student taking reading courses concurrently with Principles of Economics is coded with a zero. Completion of reading skills prior to taking Principles of Economics shows no significance at any level. This implies that reading courses in DS do not contribute significantly to student chances of success in economics. Higher ACT scores and higher high school grade point average variables act as before, assisting in success in the upper levels. The higher ACT score seems to hurt the student in trying to move from an F to a D. This may be because the student with the slightly higher ACT score could feel that he/she does not belong in the DS program, and may not try as hard. The time of day that the class meets and the single meeting per week against meeting more than once-per-week variables are not significant for this class of student. The size of the class is significant at the lower levels in this test.

As a summary of the DS reading set of tests, it appears that completion of the reading section of the DS program is of little, or no, significance to the chances of success in Principles of Economics. None of the tests showed significance at any level. As compared to the DS math section, this set of tests show that reading skills do not seem to positively affect the DS student, the student that tested out or the student with an ACT score of 17-18 student in success in economics. This means that completion of reading skills prior to taking Principles of Economics does not appear to be necessary. It could also mean that economics textbooks are quite easy to read and do not require high levels of reading abilities. Classes that meet later in the day seem to be better for the student in aiding success in economics. Classes that meet more than once per week appear to be better for these students.

Higher ACT scores seem to negatively impact the "peripheral" grade student, sometimes hurting in going from an F to a D.

Table 3.6.E1.--Total population; DSE section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-4.84 (-1.33)	-3.36 (-1.00)	-13.03 (-3.47)**	23.50 (.01)
Age	.01 (.17)	.13 (1.34)	.18 (1.68)	-.17 (-.69)
ACT	-.05 (-1.20)	.01 (1.53)	.12 (2.58)*	-.01 (-.59)
HSGPA	.55 (1.86)	.01 (.22)	1.14 (3.57)**	.14 (.17)
Instructor	-.02 (-.59)	-.01 (-.93)	.01 (.69)	.14 (1.56)
Block	.99 (1.15)	-3.09 (-3.79)**	-18.11 (-.01)	-.32 (.00)
Class Time	-.02 (-.06)	.75 (2.79)*	.42 (1.22)	-1.02 (-1.26)
Class Size	.01 (.13)	.01 (.17)	-.01 (-.18)	-.02 (-1.40)
Semester Taken	.22 (1.45)	.12 (.23)	.22 (1.24)	.01 (.04)
DS Dummy	1.18 (1.05)	-1.30 (-1.20)	-.60 (-.80)	-15.20 (.01)
Log-Likelihood	-701.52	-692.01	-701.52	-701.52
Observations	549	549	549	549

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.E1. show the results of the first set of tests in the DS English area. All DS students having completed their DS English courses (or were nor required to take these courses), along with the student that tested out and the student with an ACT score of 17-18 are tested against the DS student taking DS English classes concurrently with Principles of Economics. This concurrent DS student is coded with a

zero for the dummy variable, while all others are assigned a one. For these tests, completion of DS English courses (or non-deficiency) is not significant. As in most earlier tests, the higher the ACT and high school grade point average, the greater the chance of success in economics (here in the D to C and C to B range). Higher ACT scores hurt the student in moving from F to D, as before. Classes that meet later in the day and multiple class meetings per week are not significant.

Table 3.6.E2.--DS student only; DSE section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-5.14 (-1.14)	-2.00 (-.48)	-15.18 (-3.38)**	29.28 (.01)
Age	.06 (.47)	.01 (.34)	.28 (2.08)	-.01 (-.13)
Sex	-.57 (-1.64)	-.01 (-.02)	.18 (1.68)	.69 (.65)
ACT	-.08 (-1.67)	.09 (2.01)*	.11 (2.52)**	-.18 (-1.31)
HSGPA	.66 (1.74)	-.11 (-.32)	1.30 (3.35)**	-.13 (-.09)
Instructor	-.01 (-.35)	-.01 (-1.48)	-.01 (-.65)	.23 (1.80)
Block	1.02 (.70)	-3.13 (-3.08)*	-18.09 (-.01)	-.81 (.00)
Class Time	-.04 (-.12)	.83 (2.45)*	.48 (1.68)	-1.75 (-1.30)
Semester Taken	.17 (.91)	.14 (.79)	.22 (1.24)	-.47 (-.86)
DS Dummy	1.03 (.91)	-1.14 (-1.04)	-.61 (-.81)	-14.49 (-.01)
Log-Likelihood	-485.01	-483.51	-485.01	-485.01
Observations	391	391	391	391

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.E2. show the results of the tests for the Developmental Studies student population that compares the Developmental Studies student taking his DS English courses concurrently with Principles of Economics and the DS student who completed all the required DS English courses or was not deficient in English. The Developmental Studies student who was not deficient in any area of English is grouped with the DS student having completed all Developmental Studies English courses. This is the same logic employed in all earlier grade-by-grade tests. The DS dummy carries a value of one if all DS English courses are completed, or if the DS student was not deficient in English. The DS student taking Principles of Economics concurrently with the DS English courses carries a zero for the dummy variable. For these tests, completion of Developmental Studies English courses prior to taking economics was not significant at any level. There is a positive coefficient in the F to D range. The implication in this case is that completion of DS English courses helps, but not enough to be statistically significant. It appears logical that mastery of English should help the student in higher education courses (generally speaking), but in these set of tests, the usefulness is limited. Higher ACT and high school grade point averages assist in the D to C and C to B range. It seems that the higher ACT score average on the part of the student hurts the student from failing to a D, as in earlier tests. This could be due to the fact that the student does not feel that he/she belongs in the Developmental Studies program, as noted earlier in other tests. Classes that meet later in the day and classes that meet more than once per week help the student, here, in moving from a D to a C. In this case, instructor experience does not play a role in helping the student from failing to making a D for these set of tests. All other variables are shown to be insignificant for each level (i.e., grade separators) of testing.

Table 3.6.E3.--DS student only; DSE section, deficient in English

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	.23 (.05)	1.63 (.27)	-13.55 (-1.99)*	43.42 (.02)
Age	.01 (.47)	-.01 (-.51)	.46 (1.94)*	-.11 (-.18)
ACT	-.07 (-.80)	.12 (1.56)	.12 (1.37)	-.31 (-1.07)
HSGPA	-.11 (-.20)	.27 (.57)	1.43 (2.47)*	.39 (.18)
Instructor	1.77 (2.12)*	-.01 (-.57)	.03 (.69)	.35 (1.14)
Block	1.26 (1.09)	-2.72 (-1.94)*	-16.96 (-.01)	2.06 (.00)
Class Time	-.01 (-.11)	.98 (2.12)*	-.12 (-.23)	-2.87 (-.95)
DS Dummy	-.25 (-.19)	-.98 (-.87)	-.88 (-1.09)	-16.92 (-.01)
Log-Likelihood	-251.33	-256.15	-265.15	-256.15
Observations	213	213	213	213

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.E3. is the last of the Developmental Studies English area tests, and includes only DS students that are deficient in English skills. The DS dummy is coded with one for Developmental Studies students having completed all their required DS English courses prior to taking Principles of Economics, while the DS student taking economics concurrently with the Developmental Studies reading courses is coded with a zero. In these tests, completion of DS English skills prior to taking Principles of Economics shows no significance at any level. This implies that English courses in Developmental Studies do not contribute greatly to the student chances of success in economics. The results also imply that any type of English skills are not a strong requirement for Principles of Economics. This might be because economics testing is

primarily multiple choice, true/false type questions with little writing or essay type responses used by most instructors. The higher the ACT and high school grade point average, as in several of the earlier tests, assist in success (here in the medium/upper levels). The time of day that the class is taken, and the single versus multiple class meetings are not significant for this type of student. The size of the class is significant at the lower ranges, as with the results of Table 3.6.E2.. For this test, instructor experience at MTSU appears to help the student avoid an F.

As a summary for the DS English set of tests, the DS dummy is not significant anywhere. This means that completion of DS English courses, or not having a deficiency in the English area, does not play a major role in increasing the student chances of success in Principles of Economics. Most economics tests do not require written, essay type responses and this may contribute to the insignificance of these tests. Later in the day classes, or classes that meet more than once per week do not affect significantly the student chances of success, in contrast to several other sets of tests shown earlier. These results are different from the math and study skills areas, and the explanation for this is unknown. Again, higher ACT scores seem to negatively impact the "border" grade student, as in earlier tests. As noted, the student that does not feel that he/she should be in the Developmental Studies program may not tend to be as cognizant of the particular deficiency, and tend to not do as well. The older student that did not fare well on the AAPP test, and is placed in the Developmental Studies program, may be of a similar nature. Also possible is that the older student has been away from the coursework so long that he/she may feel that they know the material, but really do not. This would help to explain the higher ACT scores associated with placement in the DS program, and the subsequent results seen in the tests.

Table 3.6.S1.--Total population; DSS section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-4.84 (-1.33)	-4.06 (-1.20)	-29.83 (-.01)	7.50 (.01)
Age	.01 (.17)	.12 (1.23)	.17 (1.62)	-.19 (-.76)
ACT	-.06 (-1.21)	.06 (1.51)	.11 (2.49)**	-.01 (-.61)
HSGPA	.55 (1.86)	.01 (.09)	1.11 (3.46)**	.13 (.16)
Instructor	-.02 (-.59)	-.01 (-.96)	-.01 (-.64)	.14 (1.60)
Block	.99 (1.15)	-3.11 (-3.81)**	-18.12 (-.01)	-.31 (.00)
Class Time	-.02 (-.07)	.77 (2.85)*	.49 (1.73)	-1.01 (-1.26)
Semester Taken	.22 (1.45)	.01 (.22)	.29 (1.89)	.10 (.28)
Class size	.01 (.13)	.01 (.21)	-.01 (-.43)	-.02 (-1.35)
DS Dummy	1.17 (1.05)	-.15 (-.13)	16.54 (.01)	1.28 (.00)
Log-Likelihood	-701.52	-693.03	-702.41	-702.41
Observations	549	549	549	549

Notes: Parentheses denote t-value. Bold denotes second regression.
 * Significant at .05. ** Significant at .01.

For this set of tests, all DS students having completed their DS study skills courses or were not deficient, along with students that tested out and the student with an ACT score of 17-18 are compared to the DS student taking Principles of Economics concurrently with study skills courses. In Table 3.6.S1. the DS student taking economics concurrently has a value of zero for the dummy variable. All others (completed study skills) are assigned a one. The results indicate that completion of DS study skills courses (or non-deficiency) as related to success in Principles of Economics is not significant in any case. The

F to D range is positive, but not significant. It may be that having some study skills is an asset. As in the general tests and the DS math and reading areas, the higher ACT and high school grade point averages assist in upper levels generally, but not in the B to A area. Here, however higher ACT scores are not significant (do not hurt the student) in moving from failing to a D, as before. Classes that meet later in the day and classes that meet more than once per week are significant in assisting the student from a D to a C.

Table 3.6.S2.--DS student only; DSS section

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-6.65 (-1.28)	-2.45 (-.58)	-30.80 (-.01)	29.79 (.00)
Age	.40 (.22)	.01 (.20)	.27 (1.97)	-.82 (-1.76)
ACT	-.04 (-.84)	.09 (2.04)*	.11 (2.43)*	-.26 (-1.76)
HSGPA	.65 (1.85)	-.16 (-.45)	1.25 (3.24)**	-.42 (-.38)
Instructor	-.02 (-.61)	-.01 (-1.52)	.01 (.69)	.21 (2.00)
Block	-.27 (-.23)	-3.18 (-3.13)*	-17.11 (-.01)	.60 (.00)
Semester Taken	.37 (2.14)	.13 (.73)	.22 (1.21)	-.41 (-.85)
Class Time	-.04 (-.10)	.86 (2.53)*	.44 (1.28)	-2.04 (-1.95)
DS Dummy	.35 (.29)	-.13 (-.11)	15.52 (.01)	2.95 (.01)
Log-Likelihood	-558.74	-484.13	-485.65	-558.74
Observations	391	391	391	391

Notes: Parentheses denote t-value. Bold denotes second regression.

* Significant at .05. ** Significant at .01.

Table 3.6.S2. contains the results of the test of the DS student population in Developmental Studies study skills. The student taking DS study skills classes concurrently with Principles of Economics is matched against the Developmental Studies student that completed the study skills section or was not deficient in the study skills area prior to taking economics. The DS dummy carries a value of one if all Developmental Studies study skills courses are completed, or if the DS student was not deficient in study skills. The Developmental Studies student taking Principles of Economics concurrently with study skills (or still needing to take DS study skills courses) carries a zero for the DS dummy variable. In this set of tests, the completion of DS study skills prior to taking economics variable was not significant at any level. The results say that the Development Studies study skills knowledge does not contribute in a significant way to success in Principles of Economics. The higher ACT score and higher high school grade point average assist in the D to C and C to B range. As earlier, it seems that the higher ACT score average hurts the student from failing to a D. This type of student might not believe that he/she should be in the DS program, and may not try as hard. This explanation seems to hold true for the majority of the tests presented so far. Classes that meet later in the day appear to assist the student chances of success in economics. Classes that meet more than once per week aid the student in moving from a D to a C, but not at any other range of grades. Instructor experience in teaching Principles of Economics at MTSU plays a positive role in assisting the student from a B to an A, although the sample size is probably quite small. Other grade ranges do not show significance for the relative amount of instructor experience in teaching economics, as far as helping in student chances of success.

Table 3.6.S3. reviews the results of the DS student deficient only in study skills.

Table 3.6.S3.--DS student only; DSS section, DS student deficient in Study Skills

Characteristic	Predicted odds ratios			
	F to D	D to C	C to B	B to A
Constant	-14.27 (-1.92)	7.62 (1.12)	-31.72 (-.01)	94.44 (.84)
ACT	.33 (1.42)	.35 (3.12)*	.01 (.08)	-1.32 (-1.05)
HSGPA	.91 (1.56)	-.36 (-.65)	2.51 (3.09)*	-10.69 (-1.09)
Block	-1.02 (-.59)	-24.32 (.00)	2.57 (.00)	-6.20 (-.07)
Class Size	.01 (1.25)	-.01 (-1.55)	-.01 (-.03)	-.18 (-.89)
DS Dummy	.71 (.52)	.19 (.14)	20.39 (.01)	7.60 (.17)
Log-Likelihood	-195.31	-193.68	-193.68	-194.37
Observations	179	179	179	179

Notes: Parentheses denote t-value. Bold denotes second regression.
 * Significant at .05. ** Significant at .01.

Table 3.6.S3. presents the results of the tests for the DS student population that is deficient in study skills. The DS dummy is coded with one for DS students having completed their DS study skills courses prior to taking Principles of Economics, and the DS student taking DS study skills concurrently with Principles of Economics is coded with a zero. In these tests, completion of study skills prior to taking Principles of Economics is not significant for any of the levels. This means that study skills courses in DS do not contribute greatly to the students chances of success in economics. The higher ACT and high school grade point average variables behave as before, assisting in success in the D to C area only. The time that the class meets (later in the day, as before) and the multiple class meetings per week are significant in the D to C range. For this type of student, the

instructor experience teaching at MTSU aids the student from failing to making a D.

As a summary for the tests involving DS study skills, the DS dummy is not significant. This means that completion of DS study skills courses, or not having a deficiency in the study skills area, does not play a major role in increasing the students chances of success in Principles of Economics. Classes that meet later in the day and more than once per week do affect success chances significantly. This result is as in the math and reading skills areas. Again, higher ACT scores seem to negatively impact the "border" grade student, hurting in going from an F to a D, but not as strongly as in the other DS areas. Possibly, the higher ACT student may not feel that he/she should be in the DS program, and the negativity, or false hope, contribute to this type of student chances of success in economics.

In summation, the DS section tests show that only the completion of math courses (or prior math skills for the student with an ACT score of 17-18 and students that have tested out) before taking economics positively affect the student chances of success in Principles of Economics. This improvement brings the DS student only up to the level of the other two control groups and not above, as seen by total group inability to rise above the D category generally. For the DS student with no math background, it appears that chances of success are very limited. For the DS student deficient only in math, chances of success appear slim, whether Principles of Economics is taken concurrently or not. As far as the other DS areas (English, reading and study skills) are concerned, completion of the various DS courses prior to taking economics did not significantly contribute to chances of success. This means that concurrency is not an issue for these type of courses. It is possible that economics textbooks have eased in readability over recent years, and that since little testing is done with essay type questions that the English portion is not as needed as expected.

Regarding the student characteristics, the higher ACT score seemed to contribute positively to the student chance of success in economics. There is some indication that the higher ACT score can hurt students in the lowest (F to D) range. The higher high school grade point average shows to help the total student population (not just DS) in chances of success in Principles of Economics. These two variables generally do not aid the student in upper range movement, but mostly in the F to D and D to C levels. Other factors are not of major significance.

As for class characteristics, it appears that classes that meet once per week are not (generally) good for the student chances of success. Classes that take place early in the day (i.e., morning) classes are the same way. This may be related to the youth of much of the sample population, who may not be fully prepared for the rigors of full-time study, especially early in the morning. As expected, relative instructor experience seems to positively improve the student chances of success in general. Class size does not appear to be significant, with some change at the bottom and high end in a few cases. This may be interpreted to mean that a "good" student is a "good" student, regardless of the class size.

CHAPTER IV

SUMMARY AND CONCLUSIONS

One of the points of major concern of this study is the effect of completion of DS courses prior to taking Principles of Economics, with the associated relationship to the general usefulness of the DS program. The control groups (i.e., DS concurrent, DS non-concurrent, LOWACT and ACT 17-18) are clear separators for analysis of this question and make interpretation of the results easier.

The initial set of tests looked at the "pass-fail" criteria. Although several other coefficients held significant t-values, the low t-values for the DS dummy in each case forced further testing using a different type of measure of success. This was the objective of tests that investigated economics classes from a grade-to-grade aspect. In the separated grade testing, the test models were more conclusive. The initial general test (3.5.1.) comparing the DS student taking Principles of Economics concurrently with DS courses with the student having completed all DS courses prior to economics show that completion of the program contributes in a negative way to success in Principles of Economics in aiding the student from failing to a D, with insignificant results for the remaining grade levels. This suggests that completion is (generally) not crucial, and possibly a disadvantage to the "peripheral" student. It may be that the DS student is more personally counseled in the DS classes, and when faced with regular college level courses he becomes lost. However, when comparing the DS students that have completed the DS program with those that tested out of the DS program and those that have an ACT score of 17-18 score the program appears to aid the DS student from an F grade to D grade. The results suggest that the DS program brings this "peripheral" student up to the

level of the student with an ACT score of 17-18 level or the student that tested out of the DS program. However, all groups have trouble moving higher. This indicates that for any of the control groups, the DS program is unable to move students from an F to the C range. Moving even higher is just not going to happen much, if at all. This implies that the DS program is most effective in bringing the student up to the level of students who have tested out of the DS program and the student with an ACT score of 17-18, but not above. These results are slightly different from Smith's study. In this study, we see that the DS program brings the DS student up to the level of the non-DS student, but only at the extreme low end of the range.

The tests also looked at the influence on student success of student and class characteristics. ACT and high school grade point averages are significant contributors to success among student characteristics. Generally, these two characteristics acted as anticipated. Higher scores lead to a better chance of success. This is particularly true in aiding the student from going from a C to a B. In these general tests, higher high school grade point averages aided the student from an F to a D in some tests, while the higher ACT score often could be seen as hurting the student from failing to making a D. It might be supposed that this student felt that he did not belong in DS anyway, and possibly tried not as hard as others. None of the other variables assisted the student in success in completion of Principles of Economics. In contrast to Heath's study, which indicated wider than expected differences in male/female course grades, this study showed no significance between the sexes.

The class characteristics showed two significant variables: block and class time. Block, or once-per-week meetings versus multiple per week classes, indicated that there is a greater chance of success in Principles of Economics if the classes meet more than once per week. Classes that take place later in the day improve the student chances of

success. In the specific tests by DS subject area, only mathematics appears to assist the DS student. This success is mostly in the area of helping the student from making an F to the D level. Surprisingly, completion of DS math seems to hurt the student in moving from the D to C level. However, it is true that completion of math skills (or previous non-deficiency) helps not only the Developmental Studies student, but his peers that tested out of the DS program and those that had an ACT score of 17-18 peers. This assistance aided all groups from failing to making a D, but not above. This again says that completion of the DS math section brings the DS student up to the level of his non-DS peers, but no greater. Completion of the other Developmental Studies areas (reading, English and study skills) is insignificant at each level of testing. This means that taking DS courses concurrently with Principles of Economics (except for math) does not matter.

In comparing these results to earlier studies, both similarities and differences emerge. As with Smith's study, ACT and HSGPA are significant (at the above noted levels), but age is not. Park and Kerr's study noted these two variables as significant. Park and Kerr also note that age, sex and race are non-significant variables for assistance in complementary courses. Smith's study showed DSS (study skills) as significant, where this study shows that only DSM (mathematics) emerges as significant in success in Principles of Economics, and only at lower levels. The fact that the Developmental Studies math area emerged as (marginally) useful to student chances of success is in accordance with Gery's work, noted earlier. Again, Park and Kerr showed that prior preparation, or concurrent enrollment, in complimentary courses showed no significance, as does this study. The major difference here is in the Developmental Studies math area. Smith's study shows that there exists a significant difference between DS and non-DS students. This study examines a subset of the non-DS group (the students who tested out and the ACT 17-18 level) at the

lowest levels and finds that the DS program brings the Developmental Studies student up to these group levels for success in economics, but not beyond.

Based on the reported findings, the following conclusions can be drawn:

1. DS students should (probably) not take Principles of Economics before completion of their DS math courses.
2. DS students should be guided toward later in the day, multiple meeting classes, particularly if they are younger.
3. Additional study could be undertaken to determine how much above these control group levels the DS program could positively affect.
4. Further research could be conducted employing differing variables possibly involving student attitudes and expectations.
5. The study may be replicated in other higher education environments to determine if this study is specific to the MTSU setting only.
6. Analysis may be conducted in other fields to determine the applicability of the DS program to overall success in the collegiate environment.

APPENDIX

APPENDIX

Activities are defined here, and are taken from the Middle Tennessee State University undergraduate catalog.¹

Economics 241: Basic principles to aid the understanding of modern economic society; basic economic concepts; national income and its fluctuations; fiscal and monetary policies; international trade and finance.

Economics 242: Basic principles to aid the understanding of modern economic society; basic economic concepts; the pricing of productive factors; contemporary problems and policies; consumer and firm behaviour; market structure and alternative systems.

ACT: The American College Test, prepared by the American College Testing Services. This is a preliminary testing battery to generally determine applicability of the student for College level courses.

RSE 070: Basic Writing. Intensive practice in paragraph and sentence construction and an intensive review of the basics of spelling, grammar and punctuation.

RSM 070: Basic Mathematics. Intensive study of all arithmetic operations with decimals and fractions, percent and equivalency, units of measure, word problems, geometry, graphs, elementary probability and statistics.

RSR 070: Basic Reading. Intensive practice in reading comprehension to improve basic reading skills through classroom instruction and self-paced activities.

RSS 070: Basic Study Skills. Intensive study and practice in spelling, vocabulary improvement, note-taking, test-taking, library usage and study techniques.

¹MTSU Undergraduate Catalog, 1989-91: 63-120.

DSE 080: Developmental Writing. Intensive practice in writing brief essays which places emphasis on strategies for pre-writing, writing and rewriting.

DSM 080: Elementary Algebra. Intensive study of numbers and sets, algebraic expressions, solutions of linear equations and rational expressions.

DSR 080: Developmental Reading. Intensive practice in methods of understanding and retaining textbook material, in developing an efficient rate of reading, and in learning techniques for improving vocabulary and comprehension.

DSS 080: Developmental Study Skills. Intensive study and practice of effective note and test-taking, study techniques, the use of library resources and critical thinking.

DSM 080: Intermediate Algebra. Intensive study of algebraic functions, first-degree equations, inequalities, exponents, roots and radicals, second-degree equations, inequalities, functions, relations and graphs.

AAPP: Academic Assessment Placement Program; an assessment examination for students who have a composite score of fifteen or lower on the ACT (eighteen on the enhanced ACT), fifteen or below on the English or Math portions of the ACT, or who are twenty-one years of age or older at the time of their admission.

Successful completion of Principles of Economics: Indicates receiving a grade of C or better in these courses; or F to D, D to C, C to B or B to A.

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