THE BENEFITS OF ACCELERATION:
GRADUATION ADVANTAGES

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ABSTRACT

The purpose of this study was to assess the impact of acceleration (dual enrollment) on college graduation. Over 9,200 student records from 1996 to 2006 at North Iowa Area Community College were analyzed in a logistics regression model. Holding all other independent variables constant the odds that an accelerated student graduates compared to a non-accelerated student is 1.61 times (about 61% greater than) the odds of a non-accelerated student graduating. Acceleration improves graduation probabilities (total effects) and marginal effects for students across entire quartile ranges. For accelerated upper quartile females their estimated graduation probability is nearly 78%. Male student outcomes do not equal female graduation outcomes but acceleration improves male student graduation probabilities. The effect of other covariates (High School GPA, First Term Credits, First Term GPA and Gender) on college graduation is also examined. Policy implications are provided at the conclusion of the study[1].

EXECUTIVE SUMMARY

Early college opportunities for high school students, hereinafter referred to as "acceleration", are growing in both the number of opportunities provided and the number of students enrolled in these courses. This analysis studied the educational benefits of student participation in accelerated programs at North Iowa Area Community College from 1996 to 2006. Over 9200 student records were studied within the following logistics model:

$$\Pr ob\left(Graduation = 1 \mid (x)\right) = \lambda \begin{pmatrix} \alpha + \beta_1 HighSchoolGPA + \beta_2 FirstTermCredits + \beta_3 FirstTermGPA + \\ \beta_4 Gender + \beta_5 Acceleration \end{pmatrix}$$

This study affirms that acceleration has important and significant effects on educational attainment. Specifically the major findings from this analysis suggest that:

1. Holding all other independent variables constant, the estimated odds that an accelerated student graduates with a degree compared to a non-accelerated student is 1.61 times (about 61% greater than) the odds of a non-accelerated student graduating. We may say that in comparing accelerated with non-accelerated students, the odds that Graduation occurs increases by a factor of 61%, when other variables are controlled. At the 95% level of confidence degree attainment for accelerated students ranges from a minimum 1.43 times (43% greater than) to at most 1.81 times (81% greater than) the odds of a non-accelerated student graduating.

2. Acceleration improves graduation probabilities and associated marginal effects for students across entire quartile ranges.

3. Female accelerated students experienced the highest graduation probabilities and the greatest change in marginal effects for lower and middle quartile students.

4. For accelerated upper quartile females their estimated graduation probability is nearly 78%. Non-accelerated females with the same inputs experienced a lower graduation probability, 68%.

   The marginal effect of acceleration versus non-acceleration for upper quartile females is 77.86% - 68.58% = 9.28%. Thus, upper quartile females who participated in an accelerated program experienced a 9.28% change in graduation probability compared to their peers who did not participate in an accelerated program.

5. Accelerated middle quartile females and upper quartile males experienced the greatest marginal effects, nearly 12% in both cases. Accelerated lower quartile males experienced the lowest marginal effects (2.39%).

6. Non-accelerated female students experienced higher graduation probabilities than accelerated male students across the entire quartile range. Female accelerated students are only at a disadvantage in comparing the marginal effects with upper level accelerated males. On the other hand, middle quartile accelerated females enjoy the highest marginal effect, 11.87%.

7. It's clear that students with lower input characteristics have lower probabilities to graduate compared to their counterparts who enjoy higher input characteristics. This occurs for both accelerated and non-accelerated students.

   Lower quartile, non-accelerated males experienced the lowest probability for graduation, 4.18%. Acceleration improves their chances for graduation to 6.57%, yielding the lowest marginal effect, 2.39%.

8. For upper quartile accelerated males the estimated probability for graduation is 53.08%. On the other hand, non-accelerated upper quartile males experienced a 41.25 % graduation probability. This gain is one of the highest marginal changes observed as a result of acceleration. Accelerated middle quartile females experienced just a slightly higher marginal effect, 11.87%.

   The marginal effect of acceleration for upper quartile males exceeds the marginal effect of acceleration for upper quartile females. Even so, upper quartile accelerated females enjoy the highest probability (total effect) for graduation, nearly 78%.

9. A one unit increase in "High School GPA," holding all other variables constant, improves the student's odds for graduation by 43%.

10. Each unit increase in "First Term Credits" produces a multiplicative 8.6% increase in the odds to graduate, holding constant all other variables.

11. A one unit increase in "First Term GPA" more than doubles the odds of graduation, holding constant all other variables. In terms of impact "First Term GPA" has the greatest influence on predicting Graduation. Acceleration is the second most important variable.

12. "Gender" is also an important predictor of degree attainment. With all other predictors held constant, the estimated odds that a female will graduate is about 34% greater than the odds of a male student graduating.

Limitations of the study and policy implications are discussed at the conclusion of the analysis.

THE BENEFITS OF ACCELERATION:
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Introduction

In a previous study (Morrison, 2007) it was found that dual enrollment programs, hereinafter referred to as accelerated programs, at North Iowa Area Community College (NIACC) resulted in several positive outcomes:

- Accelerated students experienced higher levels of academic achievement in both high school and in college courses than non-accelerated students.

  - Accelerated students enjoyed higher high school GPAs than non-accelerated students.

  - Accelerated students experienced a .66 ACT Composite advantage over their counterparts who had not participated in NIACC's accelerated program.

  - Accelerated students who eventually matriculated at NIACC had a .48 cumulative grade point advantage at the completion of their program over non-accelerated students.

- Accelerated students graduated earlier with an Associate Degree than non-accelerated students.

  - Accelerated students were more likely to become full-time students rather than part-time students. As such accelerated students enjoyed an 836 day degree completion advantage over all other students who had not participated in NIACC's acceleration program. Structural equation modeling revealed *"Dual Enrollment Credits (acceleration)"* as the most significant variable impacting *"Days to Degree Completion."* Separate analyses provided consistent reasons to believe that acceleration had an important effect on *"Days to Degree Completion."* When constraints were entered into the analysis through the addition of covariates the general linear model predicts that acceleration, holding all other variables constant, yields a 95 day degree completion advantage. The most sophisticated model utilizing structural equation modeling predicts a 78 "Day to Degree Completion" advantage effect for each earned accelerated credit hour.

This study adds to the growing body of research with a focus on the impact of acceleration on the odds of college graduation, controlling for other variables that are known to impact graduation. See Morrison: 2007; Dual Enrollment - What Does the Research Say? for a summary of outcomes-based research dealing with dual enrollment. In addition, Morrison: 2007; Dual Enrollment Recommendations from National Commissions, Think Tanks, State Organizations, and Noted Experts compiles policy recommendations dealing with dual enrollment. Two additional studies are also of interest: Morrison: 2008; The Benefits of Acceleration: An Outcomes Analysis of Dual Enrollment; and Morrison: 2008; The Benefits of Acceleration -Baccalaureate Advantages. Also, The Strategic Value of Dual Enrollment Programs (Morrison: 2008) addresses strategic policy issues associated with dual enrollment.

RESEARCH HYPOTHESES

The following set of null and research hypotheses were tested:

TABLE 1: RESEARCH HYPOTHESES
I. EDUCATIONAL ATTAINMENT IN COLLEGE
A. GRADUATION ODDS: ACCELERATED VERSUS NON-ACCELERATED STUDENTS
H_0 - Accelerated and non-accelerated students have equal odds for attaining a college degree, controlling for other important predictor variables. H_1 - Accelerated and non-accelerated students do not have equal odds for attaining a college degree, controlling for other important predictor variables.
B. GRADUATION ODDS: MALES AND FEMALES
H_0 - Accelerated and non-accelerated males and females have equal odds for attaining a college degree, controlling for other important predictor variables. H_1 - Accelerated and non-accelerated males and females do not have equal odds for attaining a college degree, controlling for other important predictor variables.

DATA

The data for this study was obtained from an analysis of 9,233 student records from 1996 to 2006 at North Iowa Area Community College. The variables in this analysis are summarized in Table 2:

TABLE 2: VARIABLE NAMES, DESCRIPTION AND CODING		
VARIABLE NAME	**DESCRIPTION**	**CODING**
Graduation	Identifies students who had successfully completed all degree requirements for graduation	Dummy coded: 1 = Graduated with an associate degree 0 = Did not graduate with an associate degree
Acceleration	Identifies accelerated vs. non-accelerated students	Dummy coded: Yes - for accelerated student No - not an accelerated student
High School GPA	Students high school grade point	Reported from high school
First Term Credits	College credits earned once fully matriculated at NIACC	Semester hour credits
First Term GPA	First term credits at NIACC (not while in high school)	First term earned credits from NIACC transcript
Gender	Gender	F = Female M = Male

RESEARCH METHODS

LOGISTIC REGRESSION. As the dependent variable, graduation, is a binary categorical variable and because we are interested in controlling for important variables that impact the odds of college graduation the analytical tool of choice is logistic regression. Logistic regression is "the most important model for categorical response data" (Agresti, 2002:165).

Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent variable, graduation, occurring or not). In this way, logistic regression estimates the probability of graduation occurring, controlling for other important predictor variables.

FINDINGS

CHARACTERISTICS OF THE SAMPLE. The sample split for students who participated and who did not participate in NIACC's acceleration program is depicted in Table 3.

TABLE 3: SAMPLE SPLIT: ACCELERATED AND NON-ACCELERATED STUDENTS		
Group	**N**	**Percent**
Non-Accelerated	7,417	80.33%
Accelerated	1,816	19.67%
Total	9,233	100.00%

Table 4 depicts descriptive statistics for accelerated and non-accelerated students.

TABLE 4: DESCRIPTIVE STATISTICS						
	High School GPA	**First Term Credits**	**First Term GPA**	**Gender-Female**	**Acceleration[1]**	**Graduation**
N of Cases	9,233	9,233	9,233	9,233	9,233	9,233
Minimum	0.240	1.000	0.000	0.000	0.000	0.000
Maximum	4.000	29.000	4.000	1.000	1.000	1.000
Mean	2.764	11.727	2.363	0.518	0.197	0.441
SD	0.620	4.527	1.081	0.500	0.398	0.497

[1] For this table Acceleration was coded for descriptive analysis: 1=Acceleration; 0 = Non-Acceleration

GRADUATION ODDS: ACCELERATED VERSUS NON-ACCELERATED STUDENTS

The specified logit model has five predictors of college graduation:

- High School GPA
- First Term Credits
- First Term GPA
- Gender
- Acceleration

The logistics model is formally expressed as follows:

$$\Pr ob(Graduation = 1 | (x)) = \lambda \begin{pmatrix} \alpha + \beta_1 HighSchoolGPA + \beta_2 FirstTermCredits + \beta_3 FirstTermGPA + \\ \beta_4 Gender + \beta_5 Acceleration \end{pmatrix}$$

where $\lambda(\cdot)$ is the logit function, $\exp(x)/(1+\exp(x))$. The effects can be simply stated as the odds ratio.

The logistic regression produced the following parameter estimates (Table 5) and Odds Ratio Estimates (Table 6).

TABLE 5: LOGISTIC REGRESSION PARAMETER ESTIMATES						
		Standard			95 % Confidence Interval	
Parameter	**Estimate**	**Error**	**Z**	**p-value**	**Lower**	**Upper**
Constant	-4.226	0.134	-31.63	0.000	-4.487	-3.964
High School GPA	0.359	0.044	8.169	0.000	0.273	0.445
First Term Credits	0.083	0.006	14.91	0.000	0.072	0.093
First Term GPA	0.726	0.028	26.24	0.000	0.672	0.780
Gender - Female	0.289	0.048	6.04	0.000	0.195	0.383
Acceleration – Yes (1)	0.477	0.061	7.84	0.000	0.358	0.596
Likelihood-ratio (LR) = 1754.24; df = 5; p = .000						
Naglekerke's R-square = 0.232						

Table 6: Odds Ratio Estimates				
	Odds	**Standard**	95 % Confidence Interval	
Parameter	**Ratio**	**Error**	**Lower**	**Upper**
High School GPA	1.432	0.063	1.314	1.561
First Term Credits	1.086	0.006	1.074	1.098
First Term GPA	2.067	0.057	1.958	2.182
Gender - Female	1.335	0.064	1.216	1.466
Acceleration - Yes	1.611	0.098	1.430	1.815

INTERPRETATION

MODEL INTERPRETATION. The logit model is statistically significant. The reported likelihood-ratio (LR) tests that Graduation is jointly independent of the predictors simultaneously; H_o: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$. The LR test statistic of 1754.24 is chi-squared with 5 degrees of freedom and a p-value of 0.000. This demonstrates strong evidence that at least one predictor has an effect on Graduation.

Nagelkerke's R-square is an attempt to imitate the interpretation of multiple OLS R-square based on the likelihood. Nagelkerke's R-square can vary from 0 to 1.

INTERPRETATION OF COEFFICIENTS. Table 5 indicates that all five predictors are significant (p = 0.000 for all five predictors). Nevertheless, it is known that logistic coefficients may be found to be significant when the corresponding correlation is found to be not significant, and vice versa. To make certain statements about the significance of an independent variable, both the correlation and the logit should be significant. This additional test was completed, confirming p = .000 for the five predictors.

All coefficients are large relative to their standard errors and therefore appear to be important predictors of Graduation. However, the interpretation of the coefficients is quite different from ordinary least squares The logit coefficient indicates how much the logit increases for a unit of change in the independent variable, but the probability of a 0 or 1 outcome is a nonlinear function of the logit. It is, therefore, more useful to turn to an evaluation of "odds ratios".

ODDS RATIO INTERPRETATION. The odds ratio table provides a more intuitive and meaningful understanding for the impact of each predictor on Graduation. Table 6 reports odds ratio estimates for each of the five predictor variables as well as their standard errors and confidence intervals. As we are interested primarily in the effect of Acceleration on Graduation we will begin with its impact.

ACCELERATION. The odds ratio is a multiplicative factor by which the odds change when the independent variable increases by one unit, holding constant all other independent variables. The odds ratio for Acceleration is 1.611^2.

Holding all other independent variables constant, the estimated odds that an accelerated student graduates with a degree compared to a non-accelerated student is 1.61 times (about 61% greater than) the odds of a non-accelerated student graduating. We may say that in comparing accelerated with non-accelerated students, the odds that Graduation occurs increases by a factor of 61%, when all the other variables are controlled.

Statistical significance of Acceleration has already been established but "*confidence intervals are more informative than tests*" (Agresti, 2002:172). Table 6 provides confidence intervals for each predictor variable. At the 95% level of confidence degree attainment for accelerated students ranges from a minimum 1.43 times (43% greater than) to at most 1.81 times (81% greater than) the odds of a non-accelerated student graduating.
Given the parameter estimates for the logistics regression:

$$\Pr ob\big(Graduation = 1 \mid (x)\big) = \lambda \left(\begin{array}{l} \alpha + \beta_1 HighSchoolGPA + \beta_2 FirstTermCredits + \beta_3 FirstTermGPA + \\ \beta_4 Gender + \beta_5 Acceleration \end{array} \right)$$

in Table 5 we can predict the logit for any given student with known or with assumed five predictor inputs. For example, what would be the logit and

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[2] Given a logit coefficient, β_i, the odds ratio can be calculated $\exp(\beta_i)$. For example, the logit coefficient for Acceleration equals 0.477. The odds ratio equals $\exp(0.477) = 1.611$.

odds ratio for graduation for an accelerated female with a high school 2.76 GPA, earning 13 semester hours of credit during her first term at NIACC and a first term 2.85 GPA? Substituting the student's inputs into the estimated logit model produces this predicted logit:

$$= -4.226 + (.359)(2.76) + (13)(.083) + (.726(2.85) + (1)(.289) + (1)(.477) = 0.67894$$

This student's probability for graduation can be calculated using the following method:

1. Calculate the odds ratio:

exp(logit) = odds ratio = exp(0.67894) = 1.97178

2. Calculate probability:

$$\Pr obability = \frac{Odd\ Ratio}{(1 + Odd\ Ratio)} = \frac{1.97178}{(1 + 1.9718)} = .664$$

The estimated graduation probability for this student is .664. She has an estimated 66% probability of graduating, given her input characteristics. Checking the database we find that this student did graduate.

Given one of the primary purposes of logistic regression is to generate an equation that can reliably classify observations into one or two outcomes we can check the model's predictive ability through a graphical means, the ROC (Receiver Operating Characteristic) curve. The ROC curve is presented below.

The larger the area below the curve the better the model; that is, the better the predictions (Agresti, 2002). The area under the ROC curve is 0.743, which is identical to another measure of predictive power, the *concordance index, c*. The concordance index estimates the probability that the predictions and outcomes are concordant. A value of 0.5 means predictions are no better than random guessing.

Receiver Operating Characteristic Curve
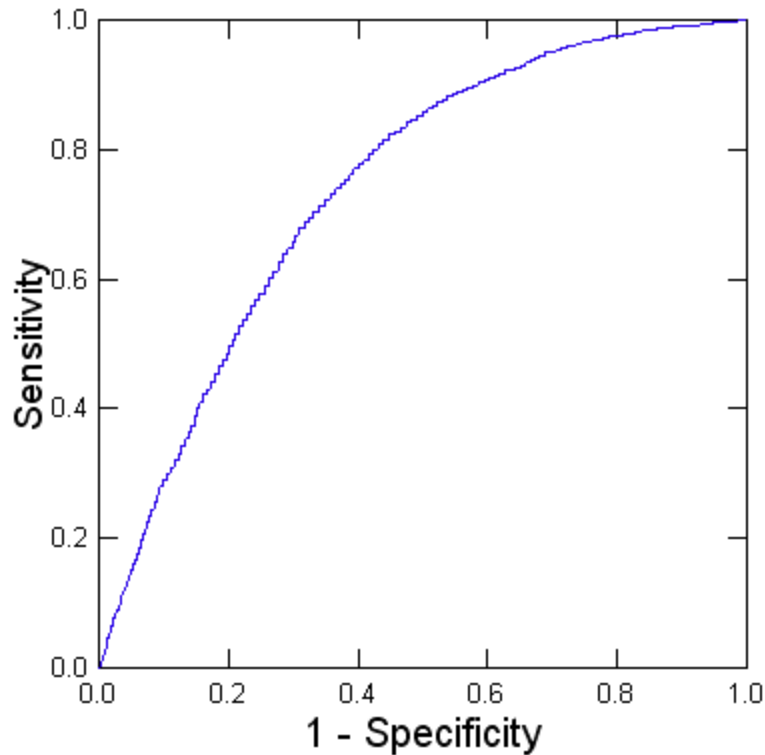
We can gain further understanding of the dynamics of acceleration on graduation odds and probabilities if we set continuous variable inputs to their quartile levels and then estimate a series of logits, odds ratios and probabilities for accelerated and non-accelerated students. Descriptive statistics for the quartiles associated with continuous variables in the logit model are summarized below in Table 7.

TABLE 7: QUARTILES FOR CONTINUOUS VARIABLES IN THE LOGIT MODEL			
Quartiles	**High School GPA**	**First Term Credits**	**First Term GPA**
Lower Quartile	2.29	3	1.78
Middle Quartile	2.74	10	2.62
Upper Quartile	3.21	14	3.31

These quartile statistics were then entered into the logit model for accelerated/non-accelerated males and females. The results of that exercise are depicted in Table 8.
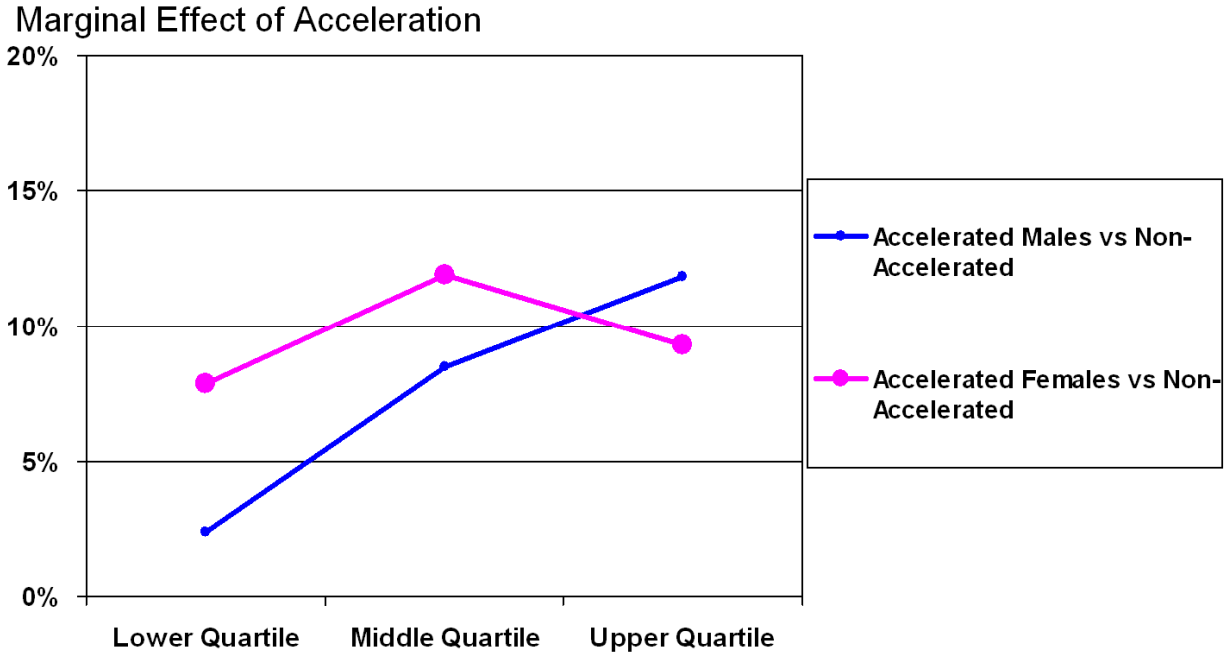
13

Table 8: Estimated Graduation Probabilities and Marginal Effects For Students When Continuous Variable Predictors Are Set At Their Quartile Levels

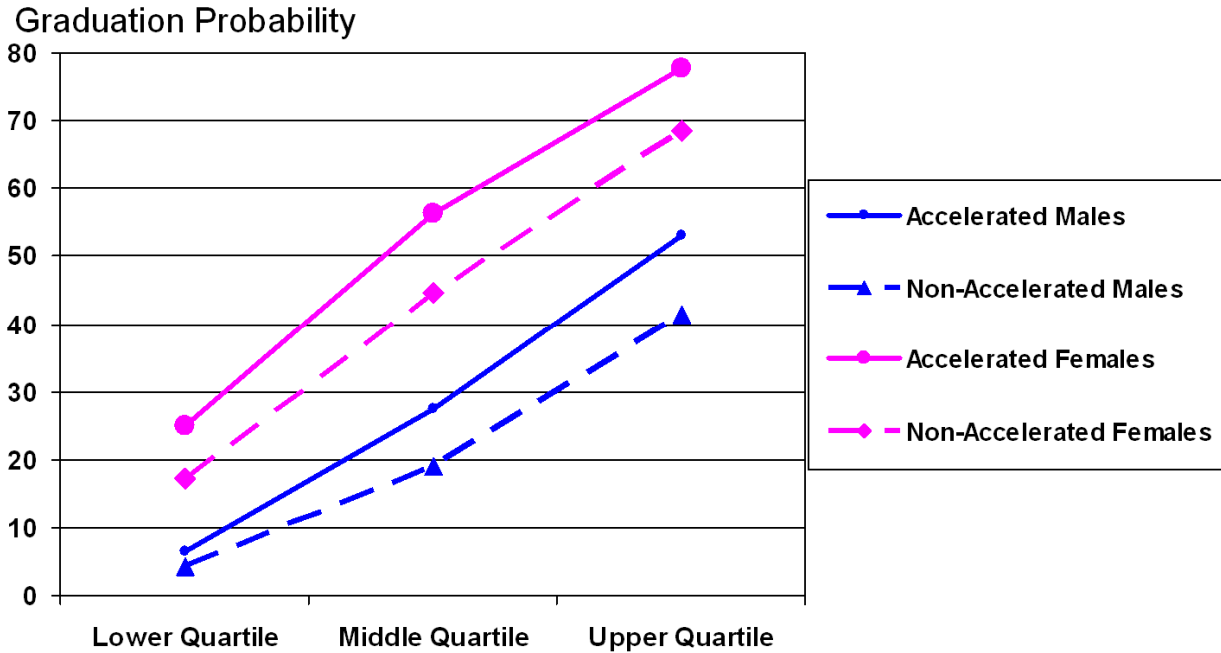|	Accelerated		Non-Accelerated		Marginal Effect of Acceleration
Gender: Female	**Logit**	**Probability**	**Logit**	**Probability**	
Lower Quartile on All Predictors	-1.10	25.04%	-1.57	17.17%	7.87%
Middle Quartile on All Predictors	0.26	56.38%	-0.22	44.51%	11.87%
Upper Quartile on All Predictors	1.26	77.86%	0.78	68.58%	9.28%
Gender: Male					
Lower Quartile on All Predictors	-2.65	6.57%	-3.13	4.18%	2.39%
Middle Quartile on All Predictors	-0.97	27.49%	-1.45	19.04%	8.45%
Upper Quartile on All Predictors	0.12	53.08%	-0.35	41.25%	11.83%

INTERPRETATION: TOTAL AND MARGINAL EFFECTS

Table 8 depicts graduation probabilities (total effects) as well as marginal effects of acceleration on graduation outcomes. The graduation probabilities and marginal effects of acceleration in the above table are more easily interpreted by presenting the same data in Graphs 1 and 2. (It's important to realize that Graphs 1 and 2 are not logistic curves. They are graphical representations of the data in Table 8.)

GRAPH 1: ESTIMATED MARGINAL EFFECTS FOR ACCELERATED AND NON-ACCELERATED MALE AND FEMALE STUDENTS BY QUARTILE INPUTS
A GRAPHICAL SUMMARY OF TABLE 8 PROBABILITY DATA

Marginal Effect of Acceleration

Accelerated Males vs Non-Accelerated

Accelerated Females vs Non-Accelerated

Graduation Probability

We observe the following findings[3] from an analysis of Table 8, Graph 1 and Graph 2:

1. Table 8, Graph 1 and 2 demonstrate that acceleration improves graduation probabilities and associated marginal effects for students across entire quartile ranges.

2. Female accelerated students experienced the highest graduation probabilities (total effects) and the greatest change in marginal effects for lower and middle quartile students.

3. For accelerated upper quartile females their estimated graduation probability is nearly 78%. Non-accelerated females with the same inputs experienced a lower graduation probability, 68%.

   The marginal effect of acceleration versus non-acceleration for upper quartile females is 77.86% - 68.58% = 9.28%. Thus, upper quartile females who participated in an accelerated program experienced a 9.28%

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[3] It's important to use caution in interpreting probability statements. The problem with probabilities is that they are non-linear. Going from .10 to .20 doubles the probability, but going from .80 to .90 barely increases the probability.

change in graduation probability compared to their peers who did not participate in an accelerated program.

4. Accelerated middle quartile females and upper quartile males experienced the greatest marginal effects, nearly 12% in both cases. Accelerated lower quartile males experienced the lowest marginal effects (2.39%).

5. Non-accelerated female students experienced higher graduation probabilities than accelerated male students across the entire quartile range. Female accelerated students are only at a disadvantage in comparing the marginal effects with upper level accelerated males. On the other hand, middle quartile accelerated females enjoy the highest marginal effect, 11.87%.

6. It's clear that students with lower input characteristics have lower probabilities to graduate compared to their counterparts who enjoy higher input characteristics. This occurs for both accelerated and non-accelerated students.

   Lower quartile, non-accelerated males experienced the lowest probability for graduation, 4.18%. Acceleration improves their chances for graduation to 6.57%, yielding the lowest marginal effect, 2.39%.

7. For upper quartile accelerated males the estimated probability for graduation is 53.08%. On the other hand, non-accelerated upper quartile males experienced a 41.25% graduation probability. This gain is one of the highest marginal changes observed as a result of acceleration. Accelerated middle quartile females experienced a slightly higher marginal effect, 11.87%.

   The interesting observation gained in Graph 1 is the marginal effect of acceleration for upper quartile males exceeds the marginal effect of acceleration for upper quartile females. Even so, upper quartile accelerated females enjoy the highest probability (total effect) for graduation, nearly 78%.

INTERPRETATION OF THE EFFECTS OF OTHER PREDICTORS ON GRADUATION

The odds ratio is a measure of effect size. The logit model posits four additional predictors that impact college graduation. In this section we will briefly summarize their important effects.

➢ **HIGH SCHOOL GPA**. The logit coefficient for "High School GPA" is 0.359. The estimated odds ratio between High School GPA and College Graduation equals $exp(0.359) = 1.432$, the same value found in Table 6. Holding all other variables constant, a one unit increase in High School GPA has a multiplicative effect of 1.432 on the odds that Graduation occurs. A one unit increase in High School GPA, holding all other variables constant, improves the student's odds for graduation by 43%. We may say that when High School GPA increases one unit, the odds that Graduation = 1 increases by a factor of 43%, when all other variables are controlled.

➢ **FIRST TERM CREDITS**. With a logit coefficient of 0.083 the odds ratio for "First Term Credits" is $exp(0.083) = 1.086$, signifying that each unit increase in "First Term Credits" produces a multiplicative 8.6% increase in the odds to graduate, holding constant all other variables.

➢ **FIRST TERM GPA**. A 0.726 "First Term GPA" logit coefficient produces an odds ratio equal to 2.07. A one unit increase in First Term GPA more than doubles the odds of graduation, holding constant all other variables. In terms of impact "First Term GPA" has the greatest influence on predicting Graduation. Acceleration is the second most important variable.

➢ **GENDER**. The exponentiated difference between males and females is an odds ratio comparing graduation outcomes. The difference between males and females is a 0.289 logit coefficient. With all other predictors held constant, the estimated odds that a female will graduate is $exp(0.289) = 1.335$ (about 34% greater than) the odds of a male student graduating.

CONCLUSIONS

This study affirms that acceleration, commonly referred to as dual enrollment in the literature, has important and significant effects on educational attainment. Specifically the major findings from this analysis suggest that:

1. Holding all other independent variables constant, the estimated odds that an accelerated student graduates with a degree compared to a non-accelerated student is 1.61 times (about 61% greater than) the odds of a non-accelerated student graduating. We may say that in comparing accelerated with non-accelerated students, the odds that Graduation = 1

increases by a factor of 61%, when other variables are controlled. At the 95% level of confidence degree attainment for accelerated students ranges from a minimum 1.43 times (43% greater than) to at most 1.81 times (81% greater than) the odds of a non-accelerated student graduating.

2. Acceleration improves graduation probabilities and associated marginal effects for students across entire quartile ranges.

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   The marginal effect of acceleration versus non-acceleration for upper quartile females is 77.86% - 68.58% = 9.28%. Thus, upper quartile females who participated in an accelerated program experienced a 9.28% change in graduation probability compared to their peers who did not participate in an accelerated program.

5. Accelerated middle quartile females and upper quartile males experienced the greatest marginal effects, nearly 12% in both cases. Accelerated lower quartile males experienced the lowest marginal effects (2.39%).

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   The interesting observation gained in Graph 1 is the marginal effect of acceleration for upper quartile males exceeds the marginal effect of acceleration for upper quartile females. Even so, upper quartile accelerated females enjoy the highest probability (total effect) for graduation, nearly 78%.

9. A one unit increase in "High School GPA," holding all other variables constant, improves the student's odds for graduation by 43%.

10. Each unit increase in "First Term Credits" produces a multiplicative 8.6% increase in the odds to graduate, holding constant all other variables.

11. A one unit increase in "First Term GPA" more than doubles the odds of graduation, holding constant all other variables. In terms of impact "First Term GPA" has the greatest influence on predicting Graduation. Acceleration is the second most important variable.

12. "Gender" is also an important predictor of degree attainment. With all other predictors held constant, the estimated odds that a female will graduate is about 34% greater than the odds of a male student graduating.

LIMITATIONS

As this analysis included only NIACC students the study's findings are not generalizable to other populations. In addition, the study did not examine other suggested benefits of acceleration. Some people suggest that accelerated students may decide to take a reduced course load to focus their academic attention and improve performance. Other people have observed that accelerated students enroll in more rigorous courses and/or attain more than one associate or baccalaureate degree. These observations are certainly ripe fruit for future research.

DISCUSSION

My observations from a previous study (Morrison, 2007) hold for this study. *"It's clear that acceleration has important and significant effects on educational attainment. It also appears that acceleration can not in itself explain the observed benefits. My personal observations, albeit untested, suggest that successful acceleration raises student/family expectations for both high school and college performance. Early success in college courses for high school students is a powerful motivator and it provides an enhanced self-concept. Family support systems and expectations are mobilized in reinforcing cycles of success. It is probably these increased expectations, enhanced self-concepts and reinforcing success support systems that yield the incredible outcomes observed in this study. These hypotheses point the way to future research."*

POLICY IMPLICATIONS

Policy observations from a previous study (Morrison, 2007) are reinforced from this analysis. Several supporting pieces of the literature associated with acceleration, taken together as a whole, now come together to inform policymakers for future action. These supporting pieces of the literature include:

> ➢ Positive recommendations from national organizations, national commissions, think tanks, state organizations and national experts (Morrison, 2007: Appendix A).
> ➢ Positive academic research findings associated with accelerated student outcomes (Morrison, 2007 Appendix B).
> ➢ Siegelman and Otto's study (2008) demonstrating that acceleration 1) saved the State of Iowa the equivalent of $21.7 million in future assistance at more costly educational institutions; and 2) saved families the equivalent of $30.7 million in future college-related expenses.
> ➢ Findings that accelerated students experienced higher levels of academic achievement in both high school and in college courses and graduated earlier with a NIACC Associate Degree than non-accelerated students (Morrison, 2007).
> ➢ This study's findings that acceleration significantly impacts and improves graduation outcomes for students across all quartiles.

Collectively, the above review supports the following policy recommendations:

1) EXPAND ACCELERATED OPPORTUNITIES. While accelerated programs have grown in numbers they remain prototypes and are not sufficiently scaled up to reach larger numbers of high school students who could benefit from the expansion. Policymakers should provide high schools and their college partners incentives for developing and implementing systemic accelerated programs. Policymakers should assure that each high school offers a minimum number of accelerated credits prior to high school graduation.

2) CONNECT ACCELERATION TO WORKFORCE DEVELOPMENT. Career-technical education (CTE) programs, requiring expensive advanced technology, often require the development and deployment of regional academies, leveraging the assets of community colleges and regional high schools. These CTE regional academies can serve as the backbone for workforce preparation and adult education re-training centers. Policymakers should provide incentives and funding for the creation and deployment of accelerated regional academies.

3) CONNECT ACCELERATION TO COMPETITIVENESS AGENDA. Accelerated programs should be connected to the nation's competitiveness agenda, including economic development initiatives. Human capital development is the engine for success in a competitive, global economy. Accelerated entrepreneurship academies, integrating best practices learned from Iowa's John Pappajohn Entrepreneurial Centers, promise increased business creation, long-term business success and more attractive jobs to retain desired talent.

Over the decades, we have faced major changes in our economy; we have moved from an agricultural to an industrial economy, then to a post-industrial service economy, and now one based on information age technology. Education has been the key to our competitive advantage and long-term survival as the leader in the world economy. Education has enabled us to invent, to innovate and/or to increase productivity through major shifts in the structure of our economy. It's the old social-Darwinists adage – adapt or die. To thrive we have had to be smarter and more productive. Education has always stood and still stands as the necessary pre-requisite for 1) invention, 2) innovation and 3) an adaptable and flexible workforce. Acceleration signals an adaptive and innovative response to the changing world economy.

4) ASSURE SEAMLESS TRANSITION. To increase successful student transition from one level of education to the next policymakers should assure that high school, community and four-year college curricula are aligned and integrated. Professional development opportunities for faculty and staff at all levels of the educational pipeline need to be integrated. Accelerated credits should readily be accepted for meeting two and four-year college graduation requirements.

5) IMPROVE READINESS. Appropriate counseling and planning for successful experiences in accelerated programs must begin in eighth grade. All eighth grade students should complete a career and college plan outlining prerequisite courses for a successful outcome. Progress needs to be appropriately monitored and intervention strategies need to be developed and implemented.

Someone once asked Winston Churchill, *"Mr. Churchill, why are we fighting this terrible war?"* Churchill responded, *"If we don't, you'll understand why later."* The same analogy holds true now for the decisions policymakers must make. Policymakers must now act to improve educational outcomes and efficiency. Acceleration promises to deliver on both improved educational outcomes and efficiency.

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