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Using an early warning system to identify potential high school dropouts

Dawn B. Hillman

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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

USING AN EARLY WARNING SYSTEM TO IDENTIFY
POTENTIAL HIGH SCHOOL DROPOUTS

A Dissertation Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Doctor of Education

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College of Education and Behavioral Sciences
Department of Leadership, Policy and Development:
Higher Education and P-12 Education
Educational Leadership and Policy Studies

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This Dissertation by: Dawn B. Hillman

Entitled: *Using an Early Warning System to Identify Potential High School Dropouts*

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ABSTRACT

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School districts throughout the nation are failing to educate all of its children. A staggering number of students, more than 7,000 a day in the United States of America (Education Week, 2011, p. 23), do not earn a high school diploma. Dropping out of school has a profound impact on the individual as well as the society. Countless prevention programs and interventions have been tried with little success. Too often, by the time educators identify students at risk, it is too late.

This research study used a logistic regression model to identify students at the end of sixth grade who were at risk of dropping out of high school. Predictor variables included course failure in reading, course failure in math, absenteeism, discipline referrals, ethnicity, gender, and disability status. The dependent variable was dichotomous; students either dropped out or graduated. Based on the review of the literature, it was hypothesized that the predictor variables would be significant in identifying students at risk of dropping out of high school. Results revealed significance in the school related factors: course failure in reading, course failure in math, absenteeism, and discipline referrals. Non-school factors (ethnicity, gender, and disability status) were also found to be significant predictive variables. Implications of these findings have the potential to impact future dropout rates. As educators identify students who are at risk of dropping out earlier in their educational experience, strategies can be

put into place to support the student. Educators have the opportunity to change a student's path to graduation through early identification and intervention.

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CHAPTER I

INTRODUCTION

The issue of high school dropouts has been a concern for decades (Jerald, 2006, p. 39). Although the most recent graduation rate in America has shown improvement and is just shy of 75 percent for the class of 2010, Swanson and Lloyd (2013) claimed too many young adults are failing to graduate from high school (p. 22). Sparks (2013) illustrated the harsh reality that 1.8 million young adults between the ages of 16-21 are out of school and have not completed high school (p. 3). The importance of earning a high school diploma should not be taken lightly, and it should be seen as a pathway to college or the work force. In his State of the Union Address on January 27, 2010, President Obama discussed education and emphasized that, “a high school diploma no longer guarantees a good job” (Obama, 2010, para. 50). The staggering number of students who drop out, more than 7,000 a day in the United States of America (Education Week, 2011, p. 23), and who do not earn a high school diploma are at an even greater disadvantage.

Over the past three decades, there has been tremendous research focused on why students drop out of high school; however, the same attention has not been given to identifying potential at-risk students to prevent them from becoming a dropout (Neild, Balfanz, & Herzog, 2007, pp. 28-29). According to Balfanz (2010), approximately 80% of eventual dropouts send distress signals in one or more of these areas: course failure, attendance, and behavior. Balfanz also noted these indicators manifest themselves as

early as sixth grade (p. 55). Adding more specificity to the signals potential dropouts display, Neild, Balfanz, and Herzog (2007) identified course failure in math and English, along with attendance below 80%, and poor behavior in the class as the greatest predictive warning signs (p. 29). Knowing that these predictive indicators exist, an early warning system could help decrease the number of high school dropouts across the United States.

Purpose of Education

The aims and purpose of education have been heavily debated throughout the years; some of the suggested goals include economic efficiency, social equality, citizenship, and self-actualization (Carpenter, 2005, p. 278). Looking back to colonial Massachusetts, one would find that the purpose of education was to teach children to read scripture to ensure they not be corrupted by Satan (Granada, 2009, p. 1). Alexander and Alexander (2009) reminded readers that The Massachusetts Law of 1647 was a historic act often referred to as “the old deluder, Satan, Act” (p. 27). Carpenter (2005) discussed the purpose of education during the 19th century was to create a connection between the educated citizen and the success of the government (p. 280). In 1950, Reverend Sheen delivered a speech in New York which focused on his theme of education being the guardian of the American heritage. Sheen defined the American heritage as respect for human rights and liberties, in particular, the right to life, liberty, and the pursuit of happiness (Sheen, 2001, pp. 285-286). Sheen (2001) explained that these rights would be preserved through education by developing reason and knowledge, freedom, and character (p. 286).

In the 20th century, America rose as a leader in industry and attracted immigrants to the nation; this resulted in a continued emphasis of citizenship and economy in education (Carpenter, 2005, p. 280). Among concerns of a failed American public education system, the 21st century has brought about accountability through assessments, charters, and the cry for reform; while all this occurred, the government continued to look for ways to ensure a continued structure to produce a work force through education (Assessor, 2011, p.73). Sloan (2012) summarized the historical purpose of education by describing its evolution; its primary purpose ranged from instructing youth in religious doctrine, to preparing them to live in a democracy, to assimilating immigrants, to preparing a work force for industry (p. 2). Today, educators prepare students for a future in a world that is rapidly changing, to compete in the global economy, to work collaboratively, and to contribute to the well-being of society (Sloan, 2012, p. 2). Economic Modeling Specialists Incorporated¹ (2012) summed up the importance and purpose of student achievement by explaining that a high school diploma is not only a certificate that documents a graduate's readiness for the workforce, but it also provides a pathway to post-secondary education which is critical for the 21st century (p. 5).

Graduation Rates and Policy

The graduation rate and policy issues of the past have threatened the ability of schools to fulfill their purpose of educating and graduating America's youth and the lack of consistent policy has resulted in an unclear picture of the impact of high school dropouts on society. The Wall Street Journal (Fields, 2008) stated, "Dropout rates are a confusing mishmash of data" (para. 11). Education Week (2011) described that

¹ Economic Modeling Specialists, Incorporated (EMSI) completes various impact studies for educational organizations. In May 2012, EMSI published an Executive Summary describing the investment analysis findings for Communities In Schools.

“methods of calculating and reporting dropout rates may generate vastly different results” (para. 5). The article continued to explain the state may report one set of numbers while a private organization might analyze the same statistics using a different measure (2011, para. 5). The National Center for Education Statistics (2010) described the four methods used to illustrate dropout rates:

- Event dropout rate-estimates the percentage of high school students who left between the beginning of one school year and the beginning of the next school year without earning a diploma.
- Status dropout rate-reports the percentage of individuals in a given age ranges who are not attending school and who do not have a diploma.
- Status completion rate-reports the percentage of individuals in a specified age range who do not attend school yet have earned a diploma.
- Averaged freshman graduation rate-estimates the proportion of high school freshman who graduate earning a diploma within a four-year period. (p. 2)

The data can be further evaluated by the following categories: sex, race/ethnicity, family income, age, and religion (The National Center for Education Statistics, 2010, pp. 5-7).

Prior to federal regulations in 2008, which resulted in a common and more accurate method for graduation rates to be calculated, school districts were able to mask the true scope of the dropout epidemic in the United States (United States Department of Education, 2013). In October 2008, the United States Department of Education established regulations for a uniform and accurate measure of calculating high school graduation rates leading to accountability and transparency of data. The regulations defined the four-year adjusted cohort graduation rate as the number of students who

graduate in four years with a regular high school diploma divided by the number of students who entered high school four years earlier (p. 1). Included in the guidelines were procedures for removing and adding students from a specific cohort, school, or district. This new method of calculating the four-year adjusted cohort graduation rate was first reported in 2010-2011 (p. 2). With consistent and specific regulations, monitoring the graduation rate became transparent and the number of dropouts falling through the cracks of the nation's educational system was no longer invisible. In fact, Stillwell and Sable (2013) reported that in the 2009-2010 school year alone there were 514,238 dropouts from America's public schools; in Colorado alone there were 12,891 (p. 13). The multitude of analysis methods to gather statistics regarding dropout rates does not mitigate the fact that "when students drop out of school, the course of their lives may be totally reset" (Education Week, 2011, para. 1).

The Individual and Societal Impact of High School Dropouts

A decision to drop out of high school can be a disastrous one (Amos, 2008, p. 10). Nevertheless, according to Education Week (2011), more than 7,000 students become dropouts every day in America which results in over 1 million students who do not graduate from high school each year (p. 23). Individuals who do not earn a high school diploma are disadvantaged in many aspects of life. The jobs dropouts obtain are less desirable, the wages they earn are lower, and their senses of emotional and physical well-being are of a lower quality than those with high school diplomas (Christle, Jolivette, & Nelson, 2007, p. 325; Dynarski & Gleason, 2002, p. 43; Hauser & Koenig, 2011, p. 12). Bridgeland, Dilulio and Morison (2006) shared that people who do not graduate from high school are more likely to endure hardships which might include health problems,

unemployment, job turnover, and dependency on the nation's welfare system (p. i). In addition to spending their lifetime periodically on government assistance, dropouts also are likely to cycle in and out of the prison system (Alliance for Excellent Education, June 2011, p.1). Amos (2008) stated, "Individuals potential contributions to the economy increase in accordance with their level of educational attainment" and elaborated that, when a student does not graduate from high school, the economy suffers (p. 31).

Beyond the individual impact, society is disadvantaged when students drop out as these individuals are less likely to contribute to the social and economic welfare of the country (Hauser & Koenig, 2011, p. 12; Wilson, Tanner-Smith, Lipsey, Steinka-Fry, & Morrison, 2011, p. 12). School personnel and policy makers are keenly aware of the negative influence of the nation's dropout problem, and efforts have been made to alleviate the problem; unfortunately, Zachary (2010) lamented that the number of students dropping out of high school remains a serious issue throughout the United States educational system (p. 75). Wise (2008) elaborated on the strain dropouts create on the local and national economies by lowering tax revenues and the ability to attract new business investments because the potential workforce is less educated (pp. 205-206; Amos, 2008, p. 21).

Risk Factors Leading to Dropping Out

Accurately predicting potential dropouts is difficult and daunting for school officials. As Bridgeland, Balfanz, Moore, and Friant (2006) explained, dropping out of high school is a "slow process of disengagement" (p. 6). Throughout that process, students are exposed to many risk factors that may increase the likelihood of dropping out of high school (Suh & Suh, 2007, p. 202). Bridgeland, Balfanz, Moore, and Friant (2010)

conducted research to identify why students did not complete high school and found that the causes of student dropout were “complex and multifaceted” (p. 11). The factors related to dropping out are many and varied, and no single formula can accurately predict who will eventually drop out of high school (Smink & Schargel, 2004, p. 5). Risk factors can be divided into two categories: those that are out of the control of school personnel and those that school personnel may influence and control. Risk factors out of the control of schools include socio-economic status, level of parental involvement, ethnicity, disability status, and English language proficiency. Factors that schools do have impact and control over are attendance, behavior, and academic performance.

Socio-economic Status

Dynarski and Gleason (2002) identified conditions typically associated with low-socio-economic households as key risk factors in dropping out of high school; they included living in a single-parent household, having a low-income, and having parents or siblings that did not graduate (p. 48). Christle et al. (2007) researched school characteristics and dropout rates. They found, in schools with the highest dropout rates, low socio-economic backgrounds was a significant characteristic (p. 329). Smink and Schargel (2004) explained that students living in poverty have a difficult time accessing quality education which perpetuates the cycle of students from low-income families being likely to be poor themselves (p. 34).

Ethnicity

Davis and Cole-Leffel (2009) shared that approximately 6% of White students dropped out, followed by twice as many Black students and three times as many Hispanic students (p. 183). Neild (2009) wrote that Hispanic and Black students were more than

twice as likely to spend an additional year in ninth grade when compared to White students (p. 58). This information is significant as Neild (2009) explained that ninth grade students who do not repeat ninth grade are more successful in making this transition; therefore, they are more likely to graduate (p. 53; see also Jerald, 2006, p. 12). Wilson et al. (2011) found that, in 2007, dropout rates were much higher for minority students (p. 11). Kennelly and Monrad (2007) also stated, “A disproportionate number of minority students leave high school before graduating” (p. 5). Following cohort groups as they moved through the Philadelphia public school system, Neild and Balfanz (2006) learned that only approximately 40% of Hispanic males earned a high school diploma within six years (p. 4), and they concluded that Hispanic and African American students were more likely than White students to drop out of school (p. 12).

Disability Status

Rumberger (2011) wrote that students with disabilities have a higher dropout rate than students without disabilities (p. 43 & 184). Ziomek-Daigle (2013) noted that having a classification of being a student with a disability increased the likelihood of dropping out of high school (p. 381). Tavakolian and Howell (2012) claimed school personnel may not be motivated to help lower achieving students such as those with disabilities because “No Child Left Behind under Title I has set the bar high for schools” (p. 78). They elaborated that these expectations in combination with high stakes testing allowed students with disabilities to fall through the cracks (p. 78).

English Language Proficiency

Dynarski and Gleason (2002) identified a key risk factor as having limited English proficiency (p. 48). According to Smink and Schargel (2004), students from

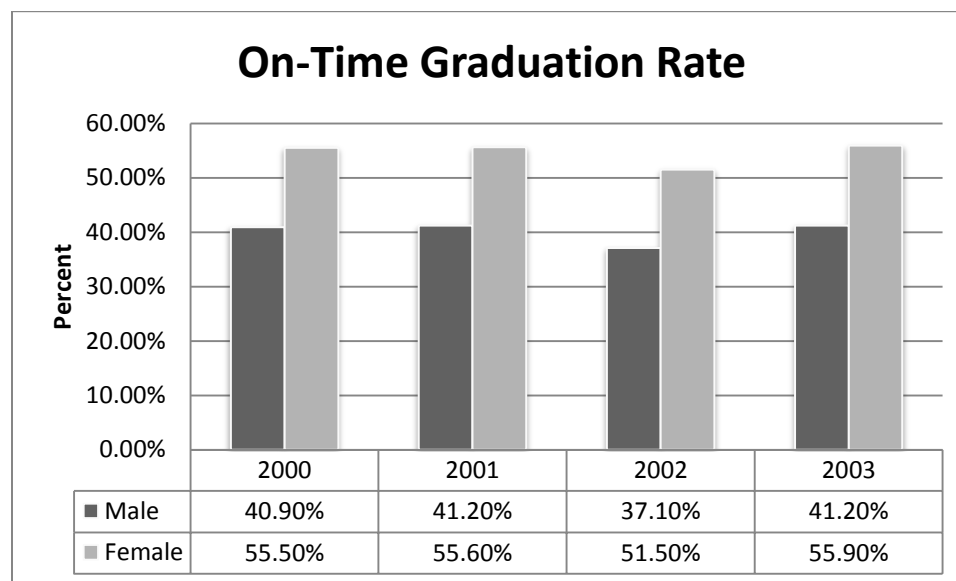
homes where the language is different than English are placed at a disadvantage and are more likely to drop out of school (p. 39; Ziomek-Daigle, 2013, p. 381). Researcher Hamilton-Boone (2011) conducted a qualitative study of English language learners and discovered some of the obstacles they faced in high school. Unfortunately, these students did not feel a sense of belonging at the school, students also felt isolated from their English speaking peers due to limited social and academic connections, and they had limited participation in extra-curricular activities which led to dropping out of school (p. 432). Nielsen (2013) demanded that K-12 education in America take notice and address the disparities that exist for English language learners to better prepare students for the future (p. 76).

Gender

Belfield, Holzer, Lochner, and Moretti (2006) stressed the importance of increasing the male graduation rate by 5 percent could result in a combined savings and increased revenue of almost \$8 billion annually (p. 1). Neild (2009) wrote that ninth grade males were retained at a rate of almost two times that of female students (p. 58). This information is significant as Neild (2009) explained that ninth grade students who are successful in making this transition are more likely to graduate (p. 53). In their study of Philadelphia's public schools, Neild and Balfanz (2006) found that males were more likely than females to drop out of school and about half of African American and White males finished high school (p. 4). Figure 1 illustrates the gender differences uncovered in a Philadelphia study by Neild and Balfanz (2006, p. 21); looking at the bar graph, one can see that female students graduate at a higher percentage than males year after year.

Figure 1

Gender Differences in On-Time Graduation Rate

**Attendance**

Christle et al. (2007) researched school characteristics and dropout rates. They found in schools with the lowest dropout rates, attendance was a significant characteristic (p. 329). Balfanz (2010) explained that being off track in the area of attendance, one of the key indicators his research identified, resulted in a 25% chance “at best” of graduating (p. 55). Johnson and Semmelroth (2010) explained that there was an increased likelihood that a student would drop out of high school due to high absenteeism (p. 121; Kennelly & Monrad, 2007, p. 1). Neild and Balfanz (2006) identified attendance as one of two factors that identified students with a 75% probability of dropping out of school (p. 28) when gathering data in eighth grade. In their study of Chicago public school, Allensworth and Easton (2007) discovered that missing just one week of school increased the likelihood of failure leading to dropping out of school (p. 17).

Behavior

Christle et al. (2007) researched school characteristics and dropout rates. They found in schools with the highest dropout rates, the suspension rate was a significant characteristic (p. 329). Balfanz (2010) explained that being off track in the area of behavior, one of the key indicators his research identified, resulted in a 25% chance “at best” of graduating (p. 55). Johnson and Semmelroth (2010) explained that there was an increased likelihood that a student would drop out of high school due to poor behavior records (p. 121). Kennelly and Monrad (2007) confirmed that behavior problems in school signaled that a student was at risk of dropping out (p. 9). Balfanz (2009) found that students who had no behavior incidents during their middle and high school years graduated in large numbers (p. 6). In their study of Chicago public schools, Allensworth and Easton (2007) found that poor behavior in lower grades led to a gap in academic skills when students reached high school which resulted in course failure for students (p. 15).

Academic Performance

Poor academic performance is one of the major predictors of dropping out of high school (Bridgeland et al., 2006, p. 7; Haynes, 2007, p. 2; Suh & Suh, 2007, p. 299). Christle et al. (2007) researched school characteristics and dropout rates. They found, in schools with the lowest dropout rates, academic performance was a significant characteristic (p. 329). Strom and Boster (2007) discussed attributes of high school dropouts and indicated that low academic achievement was a primary indicator (p. 435). Balfanz (2010) explained that being off track in the area of academic performance, one of the key indicators his research identified, resulted in a 25% chance “at best” of

graduating (p. 55). Johnson and Semmelroth (2010) explained that there was an increased likelihood a student would drop out of high school due to patterns of low grades and course failure (p. 121; see also Jerald, 2006, p. 5; Kennelly & Monrad, 2007, p. 1). Balfanz (2009) identified failing grades as a highly predictive factor in identifying at-risk students (p. 5).

The Economic Impact of High School Dropouts on the Economy

Not only are the effects of the decision to drop out of school devastating for the individual, they can also be catastrophic for the greater economy. According to the Alliance for Excellent Education's "The High Cost of High School Dropouts" (2011), for each of the nearly 7,000 students that drop out every school day, the effect on their financial outlook is significantly impacted (p. 1; see also United States Department of Education, 2013). The majority of high school dropouts see the result of not earning a diploma in the slimness of their wallets; when students drop out of high school, they limit their future employment opportunities and decrease potential income (p. 1). According to Amos (2008), the average yearly income for a high school dropout in 2005 was \$17,299 compared to \$26,933 for a high school graduate, and an even larger disparity emerged when that same high school graduate earned a bachelor's degree and began earning an average of \$52,671 annually (p. 11). It is estimated by Amos (2008) that, in the course of a lifetime, a college graduate will earn \$1 million more than a high school dropout (p. 11). While the impact on individual dropouts and their income is obvious, the impact on our nation becomes even more staggering when looking at the financial effects.

President Obama entered his first Presidential term well aware that the financial meltdown and economic downturn impacted the entire nation leaving politicians,

economists, and citizens alike wondering what would stimulate the economy. The answer, according to the Alliance for Excellent Education (June 2011), is quite simple; it should be a necessity to help all students maximize their potential by earning a high school diploma rather than becoming a high school dropout (p. 1). The United State of America's economic stimulus rests in high school age students; the nation needs them to graduate. In fact, over the course of a lifetime, a high school dropout will cost the nation approximately, \$260,000 in lost earnings, taxes, and productivity (Amos, 2008, p. 11). While that may not seem substantial, The Alliance for Excellent Education (November 2011) further illustrated the point by explaining that "if the students who dropped out of the Class of 2011 had graduated, the nation's economy would likely benefit from nearly \$154 billion in additional income over the course of their lifetimes" (p. 1). Amos (2008) also wrote that "unless high schools are able to graduate their students at higher rates, nearly 12 million students will likely drop out over the next decade, resulting in a loss to the nation of \$1.5 trillion" (p. 2). Overall, America's economy is severely impacted by the number of high school dropouts.

Magnitude of the Effects of High School Dropouts on Society

Dropouts impact society in a multitude of ways. Jerald (2006) explained that dropouts cost millions of taxpayer dollars, decrease tax revenues, and increase crime (p. 2). Bridgeland et al. (2010) concurred that dropouts strain the economy, but they also found that students who do not graduate from high school have a negative impact on the civic well-being of the country (p. 3). Due to the strain high school dropouts place on communities, Englund, Egeland, and Collins (2008) conveyed that dropping out of school

has been an area of concern over the years not only for parents and school-based personnel but also for society (p. 77).

Criminal Justice System

Individuals who do not graduate also place pressure on the nation's social programs such as public assistance and the prison system. Fields (2008) wrote, "Dropouts are disproportionately represented in the criminal justice system, including about 75% of the state prison inmates" (para. 9). Although many dropouts do not participate in criminal behaviors, individuals who are arrested or are incarcerated are more likely to be dropouts than to have earned a diploma (Hauser & Koenig, 2011, p. 15). Amos (2008) shared similar sentiments when he wrote that dropping out of high school did not automatically lead to a life of crime; however, high school dropouts are more likely to be arrested or incarcerated and many spend their life cycling in and out of prison (p. 12; see also Belfield et al. 2006, p. 2). Howard (2012) explained that three fourths of the inmates nationwide are high school dropouts (p. 9). Belfield et al. (2006) noted that 75% of America's state prison inmates, 59% of the federal inmates, and 69% of the jail inmates did not complete high school (p. 1). Haynes (2007) concurred with those findings stating that "two-thirds of prison inmates are high school dropouts" (p. 2). Amos (2008) hypothesized a few theories explaining why individuals with less education commit more crimes:

- People who earn wages through legitimate work may not have the need to commit a crime;
- Professional workers may be ridiculed for criminal behavior;
- Time in the classroom may instill values that oppose criminal behavior; and

- Criminal behavior initiated at a young age may result in keeping students on the street rather than in the classroom (p. 13).

According to Amos (2008), education is related to crime prevention (p. 13). When students are not educated, the financial impact of high school dropouts is costly (Amos, 2008, pp. 13-14). In 2010, the annual cost of incarceration was \$30,000 per inmate (Kyckelhahn, 2012, p. 5). The state spending on corrections was over \$48 billion in 2010 (Kyckelhahn, 2012, p. 1). This amount creates a substantial toll on the nation's economy, and it could be decreased if the number of students graduating from high school increased.

Welfare System

Those who drop out from school are more likely to rely on the various government welfare programs such as Temporary Assistance for Needy Families (TANF), food stamps, and housing assistance (Rumberger, 2011, p. 136). Levin, Belfield, Muennig, and Rouse (2006) explained that teenage pregnancy often led to being a high school dropout which resulted in a dependence on welfare programs (pp. 14-16). For example, in their study of Philadelphia's school system, Neild and Balfanz (2006) found that 68% of the females from the class of 2000 who had a child within four years of starting high school eventually dropped out before earning a diploma (p. 37). The expense to the welfare system to support dropouts based on gender was calculated by Levin et al. (2006), and they found that the lifetime expense per dropout ranged from an average of \$1,725 for males compared to \$5,050 for females (p. 16).

Health System

Bridgeland et al. (2006) explained that at every age range there was a correlation between education and health: “the more education, the healthier the individual” (p. 2). Amos (2008) emphasized that health, as it related to dropouts, was concerning due to the fact that high school dropouts are not as healthy as others and generally die earlier (p. 5). This happens in spite of Americans having access to what Amos (2008) referred to as the finest physicians and facilities in the world (p. 15). Hypothesizing why dropouts face health challenges, Hauser and Koenig (2011) determined that the cause of poor health was a result of a dropout’s inability to understand doctor’s instructions and health-related literature which results in poor health decisions being made (p. 14). The United States Department of Health and Human Services (2009) gathered data that uncovered an alarming statistic; 28% of high school dropouts had no medical visits with a doctor or another health professional in the previous 12 months, compared to only 14% of adults with at least a bachelor’s degree (p. 14). Levin et al. (2006) explained that those with a high school diploma were more likely to gain employment through a company that provides health benefits and were thus more likely to visit a doctor (p. 9). High school dropouts also use public health care systems at a much higher rate than graduates; for example, a white female dropout will receive approximately \$60,800 in Medicaid and Medicare services and payments for a lifetime up to age 65 (Levin et al., 2006, p. 11).

Civic Engagement

Civic engagement, as said by Flanagan and Levine (2010), is a key component to the United States of America’s continued growth and functioning as a democracy, and it develops maturity for the young adults who participate in a variety of functions such as

voting, community service, and activist projects (p. 159). Unfortunately, Rumberger (2011) noted that dropouts are less likely to vote and engage in other civic activities leaving fewer Americans participating in the democratic process (p. 138); this decline in civic engagement was attributed to a lack of stability for individuals who struggled to maintain steady employment (Flanagan & Levine, 2010, p. 160). As Bartels (2008) explained, poor and less-educated citizens are less likely to contact public officials, contribute money and energy to political campaigns, and vote (p. 252). Since high school dropouts are less likely to be involved in the democratic processes of our nation, their interests and needs are not represented, which perpetuates a cycle of disadvantaged communities (Bartels, 2008, p. 253).

Conclusion

Amos (2008) combined the cost of lost revenue and the social service expenditures for the United States to be more than \$300 billion per year due to dropouts (p. 2). Kennelly and Monrad (2007) implied that the impact on the prosperity and competitiveness of America's communities and the nation is significantly handicapped by students who drop out of high school (p. 4). Overall, dropouts impact the nation's bottom line through the necessary support provided by social programs while dropouts are in between employment. Specifically, the nation's criminal justice, healthcare, and welfare systems are overly stressed by high school dropouts. Our nation's educational system must assume the responsibility of graduating students to ensure a productive and competitive work force for the future.

Definition of Terms

In order to create consistency for the reader, several terms found throughout the document are identified and defined below.

High School Dropout

A high school dropout is defined as a student who does not earn a regular high school diploma or who takes longer than four years to graduate (United States Department of Education, 2008, p. 1).

High School Diploma

A high school diploma is defined as the standard high school diploma awarded to students in a state that is fully aligned with the state's academic content standards and does not include a General Equivalency Diploma (GED) credential, certificate of attendance, or any alternative award. The term regular high school diploma also includes a higher diploma which could be awarded to students who complete requirements above those necessary for a regular diploma (United States Department of Education, 2008, p. 13).

Four-year Adjusted Cohort Graduation Rate

The four-year adjusted cohort graduation rate is the number of students who graduate in four years with a regular high school diploma divided by the number of students who form the adjusted cohort for the graduating class. From the beginning of 9th grade, students who are entering that grade for the first time form a cohort that is subsequently 'adjusted' by adding any students who transfer into the cohort later during the 9th grade and the next three years and subtracting any students who transfer out, emigrate to

another country, or die during that same period (United States Department of Education, 2008, p. 2).

Early Warning System

An early warning system provides information to schools and districts that identify students who are displaying risk factors that predict an increased probability of dropping out of high school (Therriault, Heppen, O’Cummings, Fryer, & Johnson, 2010, p. 1).

Purpose of Study

The purpose of this study was to identify the accuracy of predictive variables in determining students who are at risk of dropping out of high school. Ultimately, this study led to an algorithm to be used by school districts to create an early warning system to identify potential high school dropouts. Using the data from the end of the sixth grade school year for the graduating classes of 2010/2011, 2011/2012, and 2012/2013 from a local school district, logistic regression statistics was used to analyze the reliability of the algorithm. For the purpose of this study, the predictive variables were (a) course failure in language arts, (b) course failure in math, (c) number of discipline referrals, and (d) number of absences. The intent of this study was to determine the accuracy of the predictors using school-based data for early identification of students at risk of dropping out of high school.

Significance of Study

Carnevale, Smith, and Strohl (2010) asserted the nation must meet the dropout challenge; without a high school diploma, individuals limit their futures in an ever-changing economy which negatively impacts themselves and society (p. 1). In order to meet this challenge, Kennelly and Monrad (2007) expressed concern that not enough was

known about strategies and interventions that would make a positive impact and shared that interventions would need to be designed around the individual student needs in conjunction with school-wide strategies (p. 3). Similarly, Bridgeland et al., (2006) explained dropout prevention strategies should be tailored to the unique needs of the student and should be comprehensive in addressing the various dimensions: individual, family, school, and community (p. 19). Adding to the challenge, Balfanz, Bridgeland, Bruce, and Fox (2012) confirmed there is not a consistent and reliable funding source to support strategies and interventions (p. 47). This obstacle must not be a barrier to supporting students to help improve their chances of reaching graduation through timely and appropriate interventions; Neild et al. (2007) suggested tailoring programs keeping in mind that only a small percentage of identified students will need intensive, costly support and emphasized the majority of students will need less expensive interventions to address their needs (p. 31).

Alluding to the fact that numerous dropout prevention program and strategies have inundated education, Bridgeland et al. (2006) called for continued and new efforts to be explored in order to address the dropout crisis (p. 20). Schools must create a proactive approach to addressing the dropout problem by focusing on adult actions and how they positively alter students and their path to graduation (Davis & Cole-Leffel, 2009, p. 190). Jerald (2006) recommended that interventions begin at the transition into middle school (p. 21) and suggested creating interventions to support academic performance, particularly in reading and math, and educational engagement measured by attendance and discipline problems (p. 24).

Neild and Balfanz (2006) lamented that, as students get into the upper grades, it becomes difficult to predict dropout rates (p. 9). Fortunately, as Bridgeland et al. (2006) wrote, early warning systems can help identify potential dropouts (p. 15). In order to accomplish this goal, Balfanz et al. (2012) suggested from their research that attendance, course performance in reading and math, and behavior were the most predictive measures for early identification of dropouts (p. 43). Neild, Balfanz, and Herzog (2007) completed a longitudinal study in Philadelphia and found that 80 percent of the dropouts had sent signals as early as middle school and suggested that identifying at-risk students early is critical to help keep them on the path to graduation (p. 30).

A multitude of stakeholders are impacted by the high school dropout epidemic that currently plagues America. Teachers, administrators, students, parents, and the community at large all have a vested interest in addressing this problem throughout the nation's educational system. Smink and Schargel (2004) summed up the challenge by writing:

As students go through school, an accumulation of negative experiences increases the likelihood that they will drop out. Since students cannot physically leave school in the primary grades, the dropout problem first surfaces in middle or high school. However, there is a growing perception that the needs of at-risk students can and should be addressed as soon as they are identified (p. 46).

The impact on individual dropouts over the span of their lifetime is staggering as is the strain it causes on the social and fiscal systems of the country. It will be imperative that as a nation, we band together with focus and intentional planning to overcome this obstacle for our youth. Creating an early warning system that predicts potential high school dropouts accurately is a critical component to combatting the dropout epidemic.

Research Questions

The purpose of this study was to identify an algorithm using predictive variables. Two different types of variables were analyzed throughout the course of the study. The first set of variables focused on dropout factors that schools had a direct relationship with and could impact. A correlational analysis, logistic regression, was completed to determine the relationship between the predictive variables of language arts course failure, math course failure, absenteeism, and number of discipline referrals and high school dropout. These predictive variables were based on the research and further discussed in the literature review. A second set of variables focused on dropout factors that were out of the sphere of influence of a school. These variables were ethnicity, gender, and disability status. An analysis determined the impact of these variables to the dependent variable. The predictive variables were included in an algorithm which determined potential dropouts as early as the end of a student's sixth grade school year. By analyzing the accuracy of the algorithm, the school district could utilize an early warning system which could allow educators to accurately predict potential high school dropouts and intervene appropriately. The research questions guiding this study were as follows:

- Q1 How do language arts course failure, math course failure, number of days absent, and number of discipline referrals predict high school graduation when applied at the end of sixth grade?
- Q2 To what extent do non-school variables (ethnicity, gender, and disability status) affect the accuracy of the predictive variables?
- Q3 When all variables (school and non-school) are analyzed, how does the statistical significance of the variables change?

CHAPTER II

REVIEW OF LITERATURE

This chapter consists of a review of the existing body of knowledge and research surrounding high school drop outs and the use of an early warning system. First, public policy and its role in student achievement will be shared. An overview of the importance of student achievement will be followed by a discussion about the barriers to achievement. Next, the literature review will explore the characteristics of dropouts and identify why students do not graduate from high school. Finally, an examination of dropout prevention programs will conclude this section.

Public Policy and Its Role in Student Achievement

The first policy document requiring review was signed into law by President Lyndon B. Johnson and was titled The Elementary and Secondary Education Act of 1965 (ESEA), which has shaped the face of public education for the subsequent decades (United States Department of Education, 2013, para. 1). Public Papers of the Presidents of the United States documented a speech President Johnson delivered on April 11, 1965, in which he described this monumental event when he stated the following:

Within the past 3 weeks, the House of Representatives, . . . , and the Senate, . . . , have passed the most sweeping educational bill ever to come before Congress. It represents a major new commitment of the Federal Government to quality and equality in the schooling that we offer our young people (p. 412).

ESEA was intended to strengthen and improve educational quality and opportunities in elementary and secondary schools throughout the United States (ESEA, 1965, p. 27),

especially for children who came from low-income households. Title I of ESEA provided federal aid to schools with a significant population of poor children and targeted improving the performance of these children especially in reading (Farkas & Hall, 2000, p. 60). The purpose of ESEA was to increase test scores and encourage academic development so that children from low-income families may have the means to escape poverty (ESEA, 1965, p. 27).

The subsequent significant policy came in 1983. The National Commission on Excellence in Education (1983) published *A Nation at Risk* which passionately claimed, “The educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people” (p. 3). Focused on identifying what would be necessary to eliminate this risk, the report included four findings that led to the decline in American education. These aspects were content, expectations, time, and teaching (p. 11). The report also included recommendations to be carried out by a commission; responsibilities included the following:

- reviewing and synthesizing literature regarding the quality of learning and teaching;
- examining curricula, standards, and expectations;
- studying college admission standards and their relationship to high school standards and expectations;
- reviewing and describing effective educational programs;
- reviewing events in society that had significantly impacted educational achievement;

- holding hearings and listening to testimony and expert advice to improve education practices;
- defining barriers to attaining a level of excellence in American education; and
- making recommendations (National Commission on Excellence in Education, 1983, p. 19).

While *A Nation at Risk* reported the need to improve the educational system in America, it did not specifically address the high school graduation and dropout rates. However, it was a landmark document in America's history that helped draw attention to the need for improvements to the system.

The next noteworthy educational policy was *The Goals 2000: Educate America Act* which had a purpose of improving learning and teaching through a national framework that would create equitable educational opportunities for all students. Specifically addressing school completion, the Act established a goal that by the year 2000, the high school graduation rate would increase to ninety percent; of those students who drop out, 75% would earn a high school degree or its equivalent, and the gap between minorities and non-minority students was to be eliminated (SEC. 102, 1994). Unfortunately, the goals of this Act were not met which led to a cry for reform.

President George W. Bush signed into law the most recent reauthorization of ESEA in January 2002; known as the No Child Left Behind Act (NCLB), significant changes were implemented in hopes of decreasing gaps among student subgroups while increasing achievement for all students (Whilden, 2010, p. 1). The Statement of Purpose for NCLB indicated, "this title is to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum,

proficiency on challenging state academic achievement standards and state academic assessments” (2001, SEC. 1001). In order to accomplish the goals of NCLB, the Act emphasized the importance of the following:

(1) ensuring that high-quality academic assessments, accountability systems, teacher preparation and training, curriculum, and instructional materials are aligned with challenging State academic standards so that students, teachers, parents, and administrators can measure progress against common expectations for student academic achievement; (2) meeting the educational needs of low-achieving children in our Nation’s highest-poverty schools, limited English proficient children, migratory children, children with disabilities, Indian children, neglected or delinquent children, and young children in need of reading assistance; (3) closing the achievement gap between high- and low performing children, especially the achievement gaps between minority and nonminority students, and between disadvantaged children and their more advantaged peers (20 U. S. C. 6301, SEC. 1001).

Two of the three goals addressed above specifically address at-risk students who, according to Balfanz, Bridgeland, Moore, and Fox (2010), were concentrated in a “subset of 1,750 high schools with low graduation rates and their feeder middle-grades schools” and accounted for approximately half of all high school dropouts (p. 7). Publicized as the most far-reaching bipartisan education legislation in American history, NCLB emphasized standardized assessments, local control of schools, and accountability in an effort to increase student achievement for all students (Whilden, 2010, p. 1).

To further motivate school districts throughout the country, President Obama signed into law the American Recovery and Reinvestment Act of 2009 which provided 4.35 billion dollars to support the Race to the Top Fund (U. S. Department of Education, 2009, p. 2). This grant aimed at adopting standards and assessments, building data systems, recruiting effective teachers and principals, and turning around low-performing schools (p. 2). While Race to the Top addressed reform in education, high school dropout was not an identified component. Mention of this law is important as one of its priorities

was to expand data systems to integrate data from a variety of programs including at-risk and dropout prevention programs (U. S. Department of Education, 2009, p. 4).

Importance of Student Achievement

No Child Left Behind shifted the focus of American education to one of accountability and achievement for all students. Wilson, Tanner-Smith, Lipsey, Steinka-Fry, and Morrison (2011) emphasized that student achievement and high school graduation are critical due to the tendency of national and global economic expansion making education a primary factor to a successful entrance into the workforce (p. 11). The Economic Modeling Specialists Incorporated (2012) summarized the importance of achievement by stating, “A diploma is more than the most basic certificate of entry into successful employment; it’s also a portal to a post-secondary education, which is crucial for full participation in the workforce of the 21st century” (p. 5).

Barriers to Student Achievement

Balfanz et al. (2010) suggested that failing to read on grade level as early as fourth grade is an early indicator of a potential high school dropout (p. 16). More recent findings by Balfanz, Bridgeland, Bruce, and Fox (2012) revealed that students who are not proficient readers by the end of third grade are four times more likely to drop out of high school (p. 39). Failure in reading or math as early as sixth grade was one indicator of becoming a potential high school dropout (Balfanz, 2009, p. 4). Davis and Cole-Leffel (2009) described students who drop out as those who have experienced little academic success in school as measured by low course grades and poor achievement scores on standardized assessments (p. 183).

The problems low-achieving students face are often exacerbated by their in-class behavior. Arter (2007) posed the question, “How are students [with habitual problematic behavior] to be successful learners if they are constantly removed from class because of inappropriate behavior?” (p. 38). When students are sent out of the classroom for disruptive behaviors or out-of-school suspensions, they have a difficult time forming relationships with peers and teachers in addition to missing out on valuable instructional time (Arter, 2007, p. 39). Oftentimes a cycle that perpetuated poor behaviors resulted when school personnel gave attention to problematic behaviors in the classroom (Arter p. 41). According to Arter (2007), this resulted in increased noncompliance, insubordination, and disruptive behaviors, and she suggested that educators should correct undesired behaviors with alternatives to traditional consequences (p. 45). Balfanz (2009) found in his study of school districts in Philadelphia that when poor behaviors were not addressed, they led to increased discipline referrals which knocked students off the path to graduation (p. 4).

Chronic absenteeism also negatively impacts a student’s ability to be successful in school (Balfanz et al., 2012, p. 7; see also Bridgeland et al., 2006, p. 15). A study completed by Roby (2003) asked whether or not there was a significant, positive relationship between attendance and student achievement (p. 5) and found that indeed a statistically significant relationship existed between those two factors (p. 13). Roby (2003) concluded that one possible reason leading to this relationship was that when one considers the instructional hours expected per year per student, a student’s absenteeism quickly added up resulting in lost learning time (p. 13). Hauser and Koenig (2011) found through their study of early warning systems that missing ten days in a school year

appeared to be a solid factor in identifying those students on the brink of the high school dropout track (p. 68). Balfanz (2009) was not able to verify what percentage of days missed increased the risk of dropping out; however, his findings did conclude that the number of days a student missed compared to that of his or her peers was a clear indicator that a student was at risk of not graduating (p. 4). Of all the early indicators, Kennelly and Monrad (2007) claimed that excessive absenteeism was the strongest predictor of course failure; this was a significant finding as each indicator a student had increased the likelihood of becoming a dropout (p. 7).

Another barrier to student success is that of parental involvement. In their meta-analysis, Strom and Boster (2007) revealed that the communication between parents and students had a significant impact on student success and influenced that child's decision to stay in school; when parents took the time to share academic expectations and hopes for their student's future, it communicated the message that parents wanted their child to stay in school and succeed (p. 446). Unfortunately, according to Light, Meade, and Ferguson (2012), not all parents are able to articulate academic expectations to their child due to their past experiences with school; negative past situations with school keep them from being involved and supporting their child (p. 19). In some situations, external issues such as gangs and drugs also hinder parent involvement (Light, Meade, & Ferguson, 2012, p. 19). Englund, Egeland, and Collins (2008) shared, based on their study that,

Children whose parents were involved in their school in middle childhood and who experienced good parent-child relationships in early adolescence were more likely to continue on a positive trajectory toward academic success. By contrast, those who had poor relationships with their parents were more likely to drop out of high school (p. 89).

The level and type of involvement parents have with their child's education play a role in the student's success. According to Bridgeland et al. (2006), 68% of dropouts interviewed said their parents became involved in their education only after they were on the verge of dropping out of school (p. iv).

In addition to poor student and parent relationships, a lack of cooperation between the schools and parents leads to further challenges. Bridgeland, Balfanz, Moore, and Friant, (2010) emphasized that parents and teachers must collaborate in order for students to succeed (p. 26). Unfortunately, Balfanz (2009) explained that, typically, relationships between school and parents are not strong due to a lack of or a breakdown in communication (p. 13). Bridgeland et al. (2006) explained that communication between school and parents encouraged parents to make sure students attended school regularly and parents monitored grades and activities more closely (p. 13). For example, Wise (2008) stated, when parents are aware of the academic expectations, it is easier for them to play a role at home by reinforcing what is learned at school (p. 109).

Smink and Schargel (2004) asserted that for a school to assure academic success for all students, an active partnership between the school and community is necessary as well (p. 65). Smink and Schargel (2004) recommended school leaders leverage local community resources to support students by attending events and forming partnerships with local organizations (p. 109). For example, to address chronic absenteeism, schools should work with city agencies, local nonprofit organizations, and the community stakeholders with the common goal of improving attendance (Balfanz et al., 2012, pp. 41-42). Strengthening networks throughout the community leads to more resources and opportunities for students which creates connections and support systems (Davis & Cole-

Leffel, 2009, p.191). Bridgeland et al. (2010) discovered that business and community leaders could serve as resources for teachers by leading workshops or being guest speakers in the classroom (p. 14).

Identification of Dropouts: Who and Why?

Although there are specific indicators, such as attendance, course failure, parental involvement, and behavior, that help predict students who may drop out, there is currently no single formula that will identify all potential dropouts. In identifying who drops out of high school, Smink and Schargel (2004) stated, “No community, no matter how affluent, is exempt” (p. 10) and Strom and Boster (2007) explained that students leave school for a variety of reasons and that there is not a simple profile of a dropout (p. 434). While currently there may not be a one size fits all calculation to identifying potential dropouts, Bridgeland et al. (2006) shared that the dropout epidemic in the United States disproportionately affects students who are from a lower socio-economic status, minority, urban, and single-parent children (p. 1; see also Englund et al., 2008, p. 77). In addition, minority students, including Black, Hispanic, or Native American students, were less likely to complete high school; approximately 50% of students representing those minority groups dropped out of high school (p. 1). Regrettably, students of parents who have not earned a high school diploma are more likely to drop out of school as well (Davis & Cole-Leffel, 2009, p. 183). Cratty (2012) followed a third-grade cohort and confirmed that incoming students who had similar levels of math and reading ability as compared to their upper income peers still dropped out at a rate of three and a half times higher confirming that socio-economic status (SES) impacts the dropout rate (p. 645).

In their report, Bridgeland et al. (2006) named several reasons why students drop out of high school; examples include the following: classes were not interesting, poor attendance, high rate of course failure, discipline and behavior problems, and a lack of parent involvement (pp. 4-10). Similar findings were reported by Christle et al. (2007) when they published their findings; students dropped out of school for the following reasons: poor achievement scores, poor attendance, high number discipline events, poverty, student ethnicity, school climate, and family involvement (p. 333). Smink and Schargel (2004) discovered similar reasons for students to drop out: poor academic performance, poverty, ethnicity, and disruptive students; they also included students who came from homes in which the primary language was not English (pp. 33-43). Although low SES students dropped out at higher rates than their schoolmates, Cratty's (2012) study controlled for characteristics such as SES and found that minority and special education students dropped out at lower rates than their peers with the exception of students who were identified as emotionally and behaviorally challenged (p. 645).

Overview of Dropout Prevention

Over the past several decades, an unprecedented amount of high school dropout prevention programs have been implemented in school districts throughout America. Dynarski and Gleason (2002) shared that school districts have utilized dropout prevention programs without knowing the effectiveness of the programs (p. 44). They wrote an article summarizing the conclusions of an evaluation of dropout prevention programs. A key finding of the evaluation was that most programs did not reduce the number of students dropping out of school (p. 44). Fortunately, there were some programs that did have positive results (Balfanz, 2009, pp.8-12; see also Bridgeland et al., 2006, pp. 14-15;

Kennelly and Monrad, 2007, pp. 16-17). Several of these programs and strategies are described in the following paragraphs.

According to Cohen and Smerdon (2009), the early 21st century brought an unprecedented amount of private resources into high schools to address the dropout crisis along with efforts put forth by federal, state, and local government agencies and personnel to address the fact that America's high schools were hemorrhaging students (pp. 177-178). Wilson et al. (2011) offered hope through their research study which identified a number of high school dropout prevention programs (p. 8). Wilson et al. (2011) also offered advice to those seeking out an intervention as they advocated that one consider the cost-effectiveness, local needs, and the implementer's abilities and resources when analyzing potential programs (p. 10). This section will highlight some of the intervention programs and strategies identified in the literature to help prevent students from dropping out of high school.

Although they examined a variety of programs, Wilson et al. (2011) found that school or class restructuring, which involved small learning communities or lower student to teacher ratios, had the highest positive results (p. 27). For example, Balfanz (2010) described schools that created communities for sixth grade students by having two teachers instruct the content areas of math, science, social studies, and English (p. 55). Balfanz et al. (2012) shared a success story when they described a school that assigned staff to work individually with students to overcome poor attendance (p. 26). Barton (2005) wrote of a school within a school approach that created smaller communities resulting in higher student motivation and teacher commitment leading to an increase in attendance from 66% to 75% (p. 22). Bridgeland et al. (2006) found that smaller learning

communities allowed teachers and students to build a stronger relationship with each other; teachers were also able to provide students with more individualized attention (p. 12).

In addition to more personal attention, students also need aid in transition through the different levels of education. Wise (2008) explained that freshmen students need support during the transition from middle to high school and that schools must dedicate resources to help struggling students (p. 61). McIntosh, Flannery, Sugai, Braun, and Cochrane (2008) confirmed the challenges faced by students during this transitional time in their study which found statistically significant links between academic skills and problem behavior between eighth and ninth grade (p. 250). Kennelly and Monrad (2007) considered ninth grade a “make-it or break-it” moment in a student’s high school experience (p. 5). Neild (2009) elaborated by sharing that students transitioning into ninth grade are facing a critical juncture in their personal and academic realms, and since high school educators are aware of this turmoil, they provide a variety of structures to support students through this period (p. 54). Cohen and Smerdon (2009) identified a plethora of programs ranging from one-time assemblies to on-going comprehensive meetings among teachers, counselors, and administrators; they also suggested informational parent meetings, student shadowing programs, panel discussion, and high school course advising as transitional support strategies (p. 180). Finally, Cohen and Smerdon recommended working with local middle schools to help ease students as they transition into their freshman year (p. 180). Tapping into guidance counselors from the middle grades helped identify specific students with precursors of dropping out, thus ensuring support as students transitioned into high school (Barton, 2005, p. 25).

During this transition and throughout the initial years of high school, supplemental educational services also play a role in keeping students on the path to graduation. Rumberger (2011) described supplemental programs as those that provide services and supports to students within the regular educational setting (p. 208). Sometimes these services can be provided during an elective period, lunch, or after school and are delivered by trained adults from the school and community; the adults serve as tutors, mentors, advocates for students, and liaisons between families and schools (p. 209). Apart from changing things in the building, schools must also connect learning to the community at large.

Research published by the Economic Modeling Specialists Incorporated (EMSI, 2012) defined the Communities in Schools (CIS) network as a non-profit organization using an evidence-based model leading the nation in school dropout prevention and intervention (p. 1). Barton (2005) described CIS as community partnerships formed between schools and local agencies to deliver a variety of services to students (p. 22). The CIS network consists of 187 affiliates in 25 states; of those sites, 113 served high schools (Economic Modeling Specialists Incorporated, 2012, p. 19). Unfortunately, the report from the EMSI (2012) did not include the other 74 sites which were made up of elementary and middle schools; the report mentioned the possibility of a future longitudinal study to track the cohorts of students who received services prior to entering high school (28).

Bridge programs, explained Kennelly and Monrad (2007), provide student supports and create connections between school and home (p. 12). Jerald (2007) described one bridge program called Achievement for Latinos through Academic

Success. One component that made this program successful in keeping students in school was that counselors provided a variety of support such as attendance monitoring, one-on-one communication, feedback to parents on a regular basis about student performance, and problem solving as challenges arose (para. 28-33). Another such program, Puente, specifically followed Latino students throughout their four years in high school; during that time grades were tracked, test scores were monitored, and college applications were submitted (Gándara & Contreras, 2009, pp.151-152) with the sole purpose of supporting the Latino students in Puente throughout high school.

Balfanz, Bridgeland, Moore, and Fox (2010) expressed concern in regards to the negative impact ineffective teachers have on students and that a disproportionate number of these teachers work in low-income schools facing the challenge of keeping students engaged in school (p. 19). They suggested teacher training and professional development to increase effectiveness, thus boosting students' engagement and achievement (p. 19). Kennelly and Monrad (2007) explained that highly qualified teachers comprehend their content and understand the strategies to reach their students which influences student success (p. 12).

Schools and school personnel cannot eliminate the individual, family, or community factors that influence whether or not a student drops out of high school; however, they can provide a safe and stable learning environment, set high academic expectations and monitor student progress towards meeting them which may in turn keep students from dropping out (Christle et al., 2007, p. 334). Identifying future dropouts is difficult and, oftentimes, as Balfanz et al. (2010) explained, by the time these students get into high school, they already have "one foot out the door" due to their disengagement in

school beginning in the middle level grades (p. 16). Balfanz et al. (2010) encouraged school and district personnel to build and use early warning systems beginning in the middle grades and provide on-going monitoring of students identified as dropout risks (p. 17). Kennelly and Monrad (2007) agreed that it is critical for educational stakeholders to use early warning systems to identify potential dropouts so school personnel can intervene (p. 5). Balfanz (2009) identified the first year of middle school, typically sixth grade, as the critical year in determining if a student is off track and in jeopardy of dropping out of school (p. 5).

As mentioned previously, this section highlighted some of the dropout prevention programs and interventions that were discussed in the literature. As Cratty (2012) reiterated, through local, state, and federal mandates, a variety of programs and strategies are utilized in schools and districts throughout the country (pp. 660-661). Ultimately, the best program will be one that is uniquely designed to overcome the challenges and obstacles faced by each individual at-risk student. Kennelly and Monrad (2007) stated the following:

Interventions that have the capacity to be oriented around individual student needs, and that work in tandem with school-wide interventions able to adjust around grade-level needs, hold promise as an effective combination for combating the nation's dropout problem (p. 3).

Early Warning Systems and Indicators

Building an effective early warning system could help school personnel accurately predict potential dropouts which may lead to decreasing the number of high school dropouts in our nation by providing timely intervention and support (Johnson and Semmelroth, 2010, p. 120; see also Kennelly and Monrad, 2007, p. 10). Allensworth and Easton (2007) identified attendance and course performance as two of the most powerful

predictors of high school dropout (p. 25). Through their research, Johnson and Semmelroth (2010) determined the accuracy of an early warning system tool in a high school setting, and they found that grade point average was the highest predictor of dropout (p. 131). However, they suggested that schools look at predictive indicators and use analysis to develop a system within the local context (p. 132). Balfanz et al. (2012) identified key factors as early warning signs; they were attendance, behavior, and course performance (p. 43; see also Balfanz, 2010, p. 55). In their study of the transition from eighth to ninth grade, Cohen and Smerdon (2009) identified course failure in English, math, and attendance to be early predictors of students dropping out of high school and they pondered the impact of recognizing these indicators earlier in an adolescent's educational career (p. 182).

Acknowledging that disengagement in school may begin as early as elementary school, Hauser and Koenig (2011) advised that schools and districts create a system to warn of potential dropouts and then to intervene early enough for there to be a chance for change (p. 61). Balfanz (2009) emphasized the importance of early warning systems when he stated, "It is during the middle grades that students either launch toward achievement and attainment, or slide off track and are placed on a path of frustration, failure, and, ultimately, early exit from the only secure path to adult success" (p. 13). Suh and Suh (2007) established that as students accumulate risk factors, the probability of dropping out of high school becomes more likely which supported their claim that early prevention and intervention programs and support are critical (p. 303). Therefore, the use of an early warning system to collect information for school personnel to analyze is a first step in creating a model that identifies potential dropouts in time for intervention to occur

(Johnson and Semmelroth, 2010, p. 133). Kennelly and Monrad (2007) reminded readers that using an early warning system will allow school personnel to identify high school freshmen who are potential dropouts and immediately intervene (p. 1). Smink and Schargel (2004) illustrated the point when they shared that, although certain characteristics increase the likelihood that a student will drop out, and there is no tool or system that can predict who will or will not dropout with certainty (p. 45). However, Wise (2008) found that when data were used in conjunction with an early warning system, educators were able to determine potential dropouts and intervene to get them back on track (p. 62). Smink and Schargel (2004) clarified that dropouts are a systematic problem that begins as early as the primary grades, and it is the responsibility of schools to identify at-risk students and intervene as early as possible (pp. 46-47).

Contribution of Study

Allensworth and Easton (2007) acknowledged that increasing graduation rates and decreasing dropout rates are urgent issues facing the United States of America (p. 1). They recognized the multitude of variables available to assist in predicting at-risk students but expressed concern that these variables are often not available until the end of a student's freshman year of high school (p. 3). Schools that take a proactive approach and use variables to identify students at risk of dropping out of school must have a screening process to identify potential dropouts in order to provide timely and effective interventions (Johnson and Semmelroth, 2010, p. 120). Jerald (2006) discussed the power of using longitudinal studies beginning as early as sixth grade and contended following a cohort would allow schools to identify potential dropouts at any point in their educational career (p. 9). Longitudinal studies have been completed in urban settings such as

Philadelphia (Neild & Balfanz, 2006) and Chicago (Allensworth & Easton, 2007) where studies followed cohorts beginning in ninth grade through high school end status. Balfanz (2009) discussed his study, also in Philadelphia, which followed a cohort of students beginning as early as sixth grade and was able to show that identification is possible in the middle grades (p. 10). These studies have proven that variables that influence high school end status are identifiable as early as sixth grade, but limited studies have been completed in smaller suburban communities.

Variables such as reading course failure, math course failure, number of days absent, and number of discipline referrals have been identified in the research as the most reliable indicators (Balfanz, 2009, p. 4; see also Johnson & Semmelroth, 2010, pp. 121-122; Neild & Balfanz, 2006, p. 28). It was the intent of this study to use the predictive variables to determine at-risk students in a suburban setting using data available from a selected school district.

Conclusion

Since dropping out of high school is a “slow process of disengagement,” there may be time for educators to intervene in the process and offer support and interventions to at-risk students if identified early (Bridgeland et al., 2006, p. 6). In the last decade, longitudinal studies have analyzed the relationship between student data and the identification of potential high school dropouts. These studies have been completed in large urban settings such as Philadelphia and Chicago (Allensworth & Easton, 2007; see also Neild & Balfanz, 2006). This research study looked specifically at a smaller urban school district to determine if an early warning system using the predictors identified in previous research led to accurate predictions regarding future dropouts. Allensworth

(2013) emphasized the importance of establishing an early warning system in school. She stated, “By keeping track of students who are at risk of failure and reaching out to the students who are struggling, they (schools) can target the students who actually need help in a way that is focused on what matters for graduation” (p. 71).

CHAPTER III

METHODOLOGY

Logistic regression was employed in this quantitative research study. Included in this section is an overview of the study, design of the study, research questions, research setting and participants, data collection methods, data analysis procedures, assumptions, and limitations.

Overview of the Study

The intent of this study was to analyze identified predictor variables and their relationship to high school end status. Quantitative research allows a researcher to make a prediction using statistical procedures (Creswell, 2008, pp. 62-63). The researcher conducted the study using a quantitative correlational design using logistic regression analysis. Logistic regression is multiple regression but with an outcome variable that is categorical and the predictor variables are continuous or categorical (Field, 2009, p. 265). In other words, a researcher can predict which of two categories a person is likely to belong given a set of variables (Field, 2009, p. 265). The study was conducted in a school district that gave approval for the research and has been given the pseudonym Greenfield to protect confidentiality.

The purpose for using this design was to determine the accuracy of an early warning system to predict high school dropouts based on data from the end of the sixth grade school year. Data collection from the end of the sixth grade school year was necessary as Greenfield School District did not have a system to collect and store all the

data being used in the algorithm in grades earlier than sixth grade. If the combination of the predictor variables correlated well with the outcome variable (high school end status), that provided evidence of the efficacy of the early warning system. Factors that contribute to students dropping out of high school were identified through an extensive review of the literature and were, thus, used as predictor variables in the logistic regression model.

Research Design

According to Creswell (2008), correlational research designs are used to describe and measure the degree of association between variables (p. 356). The researcher used a type of correlation analysis called logistic regression to determine the relationship among a set of variables. Using prediction research design, which Creswell (2008) described as a method of predicting an outcome based on identified variables, this study forecasted students who were at risk of dropping out of high school. The predictor variables in this study were defined as either school or non-school related. The school related variables were language arts course failure, math course failure, number of days absent, and number of discipline referrals. The non-school variables were ethnicity, gender, and disability status. Initially, the researcher planned to include English language learner status and socio-economic status. These variables were omitted from the study due to limitations of the data warehousing system, AS400, used in Greenfield School District, the data system did not have the capability to accurately store information for English language learners or socio-economic status. Therefore, these two variables were not included in the model. The criterion variable was either high school dropout or graduation. Logistic regression was used since it allows a “discrete outcome to be

predicted from a set of variables that may be continuous, discrete, and dichotomous, or a mix” (Tabachnick & Fidell, 2007, p.437).

Logistic regression predicts the probability of the dependent variable belonging to one group or another. Probability values must be between 0 and 1. The following equation is used in logistic regression to figure the probability:

$$P = \frac{e^{a+bX}}{1 + e^{a+bX}}$$

Where:

p = the probability that a case is in a particular category,

exp = the base of the natural logarithms (2.72),

a = the constant of the equation, and

b = the coefficient of the predictor variables.

Research Questions

The purpose of this study was to use a logistic regression model to determine the likelihood of high school dropouts. Two different types of variables were analyzed throughout the course of the study. The first set of variables was those which schools have a direct relationship with and can impact. Logistical regression was completed to determine the relationship between the predictive variables of language arts course failure, math course failure, absenteeism, and number of discipline referrals and high school end status. Another set of variables used was those outside of the influence of a school. Those variables were ethnicity, gender, and disability status. According to the literature, socioeconomic status and limited English language are also variables that may predict potential dropouts; however, the data available to the researcher from the district

did not include those variables due to the limitations of the data warehousing system. The predictive variables held the researcher develop an algorithm which could be used in the future to determine potential dropouts at the end of sixth grade. By using logistic regression, the researcher was able to predict the probability of a student graduating from high school given the model of predictor variables. Logistic regression can be a very useful tool when trying to predict membership between two different categories (Field, 2009, p. 265). By using a logistic regression model, the school district may have a tool to utilize as an early warning system to accurately predict potential high school dropouts and intervene appropriately. Since these data included the population of students who met the predetermined selection criteria, there was enough external validity to make inferences about future students based on the past data. If the model predicted accurately, future interventions could be developed and tested within the school district. The research questions guiding this study were:

- Q1 How do language arts course failure, math course failure, number of days absent, and number of discipline referrals predict high school graduation when applied at the end of sixth grade?
- Q2 To what extent do non-school variables (ethnicity, gender, and disability status) affect the accuracy of the predictive variables?
- Q3 When all variables (school and non-school) are analyzed, how does the statistical significance of the variables change?
- H1 There is no statistically significant relationship between high school end status (criterion variable) and sixth grade language arts course failure, math course failure, number of days absent, and number of discipline referrals (predictor variables).
- H2 There is no statistically significant relationship between high school completion (criterion variable) and non-school factors including ethnicity, gender, socioeconomic status, disability, and limited English language (predictor variables).

- H3 There is no statistically significant relationship between high school completion (criterion variable) and the predictor variables which include sixth grade language arts course failure, math course failure, absenteeism, number of discipline referrals, ethnicity, gender, and disability status.

The level of significance used for this study was .05. Creswell (2008) described what the level of significance means when he explained that a .05 means that 5 out of 100 times, “an extremely low probability value will actually be observed if the null hypothesis is true (p. 196).

Research Setting and Sample

This research was conducted in a public school district in Colorado. The school district consists of nearly fifteen elementary schools, a handful of middle schools, a couple kindergarten through eighth grade schools, less than five high schools, and a few alternative educational settings including online middle and high school, and numerous charter schools. According to the Points of Pride (2013), based on the October 1, 2012 official count, the district supported over 19,000 students consisting of 55-60% Hispanic, 35-40% Caucasian, 2-5% African American, 2-5% Asian, and less than 5% Native American. Information from Points of Pride (2013) also documented that approximately 60% of the student population received free or reduced lunch. Of the total student population, more than 5,000 were English language learners, over 1,800 received special education services, and just over 1,000 received gifted and talented services.

Greenfield School District serves two suburban cities with a combined population of almost 115,000 (United States Census Bureau, 2012). The median household income for these two cities is roughly \$45,000, which is below the state’s average of nearly \$58,000, and the amount of people living below the poverty level is approximately 10% higher than the state of Colorado (United States Census Bureau, 2012).

The sample for this study involved students from the graduating class of the 2010/2011, 2011/2012, and 2012/2013 school years in a selected district in Colorado. Both graduates and non-graduates were included in this data set as a sixth grade cohort. The combined graduating classes for the high schools in the selected district were approximately 1,400. Looking back at the cohort of students that met the predetermined selection criteria and analyzing data at the end of the sixth grade year will allow future intervention strategies to be employed earlier in a student's career to prevent at-risk students from dropping out of high school. Neild and Balfanz (2006) found that of those eighth grade students in Philadelphia who failed math and/or English, 77 percent dropped out of high school (p. 28). Based on research, a significant relationship between predictive variables and high school dropout at the end of the eighth grade was identified; thus, the researcher analyzed data using a logistic regression model to predict the probability of high school dropout using end of year data from sixth grade (Allensworth, 2013; see also Allensworth & Easton, 2007; Balfanz, 2009; Neild & Balfanz, 2006; Neild, Balfanz, & Herzog, 2007).

From the total sample, the researcher excluded student data if the student transferred into the district after the start of sixth grade. Data were also removed for students who transferred out of the district and enrolled in another school during or after the sixth grade. The district's data warehousing system, Infinite Campus, was able to track students who actively enrolled in a district school; once a student moved outside of the district, that student was dropped. If a student death occurred in the selected graduating classes at any point from sixth grade to graduation, that student's data were

also removed from the sample. For this study, dropouts were defined using the criteria based on research from Balfanz, Bridgeland, Bruce, and Fox (2012):

- Students who did not officially withdraw from school but were removed from school rosters due to non-attendance;
- Students who were removed from the rosters but did not enroll in another school;
- Students who were incarcerated in a facility not associated with the public school system; and
- Students who were expelled from school and did not return after the expulsion was completed (p. 83).

Instrumentation and Materials

The following four school-based predictor variables were in this study: course failure in language arts, course failure in math, number of days absent, and number of discipline referrals. There were also non-school variables; those were ethnicity, gender, and disability status. All of these data were warehoused in either the AS400 or Infinite Campus (IC) data system. Two different warehousing systems were used to pull data from as Greenfield transitioned from the AS400 to IC within the past few years. As students transition into middle school, they earn numerical percentages for the first time in their educational career in the selected district. The district uses a standard grading scale from A to F, and teachers record student grades electronically each grading period. Attendance is recorded daily by each teacher each class period electronically as well. When a student receives a discipline referral, it is also documented electronically. From the AS400 and Infinite Campus, the researcher worked with a district level data technician to create a report that converted into an Excel document.

Each of the variables discussed were documented in Greenfield's data warehouse systems, AS400 and Infinite Campus. Data entry is completed at each school site by a registrar. In order to identify inaccurate or incomplete data entry, the system runs an Infinite Campus Data Integrity Violations Report on a weekly basis (Flick, personal communication, April 28, 2014). The report identifies violations that need to be fixed at the school site. There are numerous areas monitored to ensure accurate records. Data monitored specific to this research study include the following: ethnicity, enrollment, end status, and discipline referrals. When missing data are found, the registrar at the school site communicates with parents or school personnel to update the system with accurate information. Flick (personal communication, April 28, 2014) explained that there is ongoing training for registrars to help ensure accurate record keeping and data entry. Finally, the greatest compliance control is the Colorado Department of Education state report collection which occurs when the official October 1 count takes place as well as biannual audits (Flick, personal communication, April 28, 2014).

The AS400 and Infinite Campus allow school personnel to input data regarding attendance, grades, discipline, ethnicity, disability status, and gender. Subjectivity may influence these data. For example, work in math and language arts is oftentimes assessed using a rubric. Although rubrics have clear descriptors for the components of the assignment being assessed, there is subjectivity and one teacher may grade differently than another. However, there are common assessments given for each grade level in each core subject. This provides consistency between the schools in the district which is also reflected in overall grades. Another area that may be influenced by human input is discipline. A district discipline matrix is used at each level: elementary, middle, and high

school. This provides building level administrators a guide to use when addressing discipline referrals. However, teachers may write referrals that need to be addressed which do not align with the matrix. This may lead to referrals not being addressed and documented in Infinite Campus. To help create consistency throughout the district in addressing behavior, assistant principals and deans of students from each building attend monthly meetings. Attendance records are also maintained electronically. Teachers take attendance at the beginning of each class period and document it within the data warehousing system. Each secondary school has an attendance secretary who monitors that attendance is being taken and that it is accurate. Even though teachers and other school personnel input data regarding grades, attendance, and discipline referrals, monitoring systems and training are utilized within the district to assist in maintaining consistent and accurate data.

Data Collection

Prior to conducting this study, the researcher sought approval from the University of Northern Colorado's Institutional Review Board (IRB) and Greenfield School District. In addition to completing the IRB process, the researcher also met with a district level administrator to ensure district research protocols were followed as well. Once approval was earned, the researcher began data collection. Data were obtained from a data technician employed by the school district. The data collected was from the data systems available through the district, the AS400 and Infinite Campus. To maintain confidentiality, the data only identified the student by a random number; the researcher will never know the students' identities.

Coding for the non-school predictors of ethnicity, gender, and students with disability was completed as categorical variables. Ethnicity categories included Hispanic which was coded as a 1 or non-Hispanic which was coded as a 0. Gender was another categorical variable with all students either in the male or female group. Males were coded as “0” and females were coded as “1.” Students who have a disability have an Individualized Education Plan (IEP). If a student was identified as having a disability, that student was coded as “1” and if a student was not on an IEP, the student was coded as “0.”

Prior to describing the coding process to be used for the school related variables, rationale for choosing the attendance rate for this research study will be explained. The district has the following components in its attendance policy:

Excused absences

- Excused absences are defined as any absence from school due to temporary illness or injury and any other reason deemed acceptable by the school administrator.
- When a student has reached four excused absences from school in any month or ten excused absences during any school year, the school shall either require a meeting or other form of communication between the student’s parent/guardian and appropriate school personnel to review and evaluate the reasons for the student being habitually absent from school.

Unexcused absences

- An unexcused absence is defined as an absence that is not covered by one of the foregoing exceptions [excused absence].

- The maximum number of unexcused absences a student may incur before judicial proceedings are initiated to enforce compulsory attendance is ten during any calendar year or school year (Greenfield Attendance Policy).

According to Greenfield's calendar, there are 174 student contact days. If a student misses 10 days in a school year, that would be 6%; therefore, an acceptable attendance rate for a school year would be 94%. This attendance rate is higher than suggested by Balfanz (2009) as his research found that if students attended less than 80%, it increased the likelihood of high school dropout (p. 4). Conversely, Balfanz (2009) claimed that students who attended school 95% of the time graduated in higher numbers than those that attended school less than 95% of the time (p. 6). In Philadelphia, Neild et al. (2007) completed a study that identified attendance as an early warning indicator, and determined attendance below 80% was a reliable predictive variable.

Data for course failure in language arts and math was described using Greenfield's grading policy and expectations. In middle school, grading periods were referred to as quarters and each one consisted of nine weeks. Each quarter stands alone as a grading period and was not combined or averaged with other quarters, thus there are no cumulative grades in middle school. In order to be consistent with the data the researcher used the following steps:

- Each quarter had a letter grade (A, B, C, D, or F) when provided to the researcher.
- The researcher assigned numerical values to each letter grade as follows: A = 4, B = 3, C = 2, D = 1, and F = 0.
- Next, the four grading periods were averaged together to come up with one numerical value.

- Finally, the data were coded. If the average value was between 0 and .99, it was considered failing. If the average value was above .99, it was considered passing.

Another component that needed consideration was the grading scale used throughout the district. The breakdown of grades is as follows:

- A: 90-100%
- B: 80-89%
- C: 70-79%
- D: 60-69%
- F: Below 59%

Grades earned between 60-100% are considered passing and grades 59% or below are failing.

Discipline referrals were another predictive variable used in this study. Typically, students are referred to a school's administration on office referral forms for serious or habitual behavior offenses. Examples of behaviors that result in an office referral include truancy, bullying, fighting, insubordination, possession of drugs or alcohol, and repeated classroom disruption. Consequences for office referrals range from counseling to suspensions. Unfortunately, in rare instances a student may be expelled from school based on the severity of the behavior incident. This variable was continuous since it ranged from zero to ten based on the individual student.

Since the criterion variable (student end status) was either dropout or graduate, it was considered a categorical variable and was coded as dropout "0" or graduate "1." The first variable, course failure in language arts was a categorical predictor variable, was coded as fail "0" or pass "1," and the second variable, course failure in math, was also a

categorical predictor variable; it was coded as fail “0” or pass “1.” Attendance was also calculated as a categorical predictor variable. If the attendance rate was lower than 94%, it was coded as “0.” If the attendance rate is 94% or higher, it was coded as “1.” The last variable, number of discipline referrals was continuous ranging from zero to ten based on the student’s record.

After coding, the data were put into data sets, and the data spreadsheets were constructed using Excel. Statistical Package for Social Sciences (SPSS) was used to run a logistic regression analysis. A forced entry method was used to conduct the logistic regression model. As described by Fields (2009), “All the predictors are placed into the regression model in one block, and parameter estimates are calculated for each block” (p. 271).

To run the analysis using logistic regression, the data were entered into the data editor. Each column represented a different variable from the model. The coding used was as follows:

- Criterion variable (student end status)-a categorical variable was coded as dropout “0” or graduate “1.”
- Predictor variable-Course failure in language arts was a categorical predictor variable and will be coded as fail “0” or pass “1,”
- Predictor Variable-Course failure in math, was also a categorical predictor variable, and it will be coded as fail “0” or pass “1.”
- Predictor variable-Attendance was also calculated as a categorical predictor variable. If the attendance rate was lower than 94%, it was coded as “0.” If the attendance rate was 94% or higher, it was coded as “1.”

- Predictor variable-The number of discipline referrals was a continuous variable since it ranged from zero to ten based on the student's record.

After entering all the variables and the appropriate numbers to represent categories, the dialog box for logistic regression was opened and a method of logistic regression was selected. Next, categorical variables were selected and placed in the proper box within the SPSS window. A confidence interval of .95, which sets the level of significance at .05, was selected and a Hosmer-Lemeshow goodness-of-fit statistic was also calculated. These items were used to assess how the logistic regression model fits the data (Field, 2009, p. 281).

Data Analysis

Using SPSS, the researcher tested each of the hypotheses using the logistic regression model. Since logistic regression predicts the probability of an event occurring for a given person (Field, 2009, p. 267) based on a set of predictors, the researcher denoted dropout as "0" and graduate as "1." First, the researcher assessed whether the model fit the data using the observed and predicted values. The measure that was used was the log-likelihood which summed the probabilities associated with the predicted and actual outcomes. In order to compare different models by looking at their log-likelihoods to provide a baseline model, the frequency of zeroes and ones was used in place of the mean. The importance of this baseline model was to determine what provided the best prediction when all the researcher knew was the outcome. Basically, in logistic regression this is the outcome which occurs more often, either dropout or graduate. According to Field (2009) as predictors are added to the model, the researcher can compute the improvement of the model (p. 268).

Next, the model was assessed using the r -statistic which is the partial correlation between the outcome variable and each predictor variable (Field, 2009, p. 268). The r -statistic was between -1 and 1. Field (2009) explained that a positive value indicates, as the predictor variable increases, so does the likelihood of the event occurring. In contrast, a negative value implies that as the predictor variable increases, the likelihood of the outcome decreases (p. 268). Field (2009) warned that researchers should use caution when interpreting the r -statistic. Therefore, the researcher also used SPSS to run the Cox and Snell's R^2_{cs} with the suggested amendment by Nagelkerke's R^2_N . This provided a gauge for the significance for the model.

The Wald statistic provides information about the significance for each predictor variable. Using the chi-square distribution, the Wald statistic helps the researcher determine whether a variable is a significant predictor of the outcome (Field, 2009, p. 270). When analyzing the Wald statistic, Field (2009) warned that researchers should be careful to avoid making a Type II error.

Using an odds ratio is more crucial to logistic regression than the r -statistic and the Wald statistic. This ratio can be interpreted in terms of a change in a predictor variable. Field (2009) described the interpretation of the odds ratio by explaining that "if the value is greater than 1 then it indicates that as the predictor increases, the odds of the outcome increases. Conversely, a value less than 1 indicates that as the predictor increases, the odds of the outcome occurring decrease" (p. 271).

Once the SPSS output was generated, the researcher interpreted the results. SPSS predicted whether a student would become a dropout or graduate based on the fit of the most basic model. Using this model, the researcher was able to learn what percent of the

outcome variable the model correctly predicted. Next, each predictor variable was analyzed to determine significance. The next part of the SPSS output provided the estimates for the coefficient for the predictors (course failure in math, course failure in language arts, absenteeism, number of discipline referrals, ethnicity, gender, and disability status) in the model. This was important as it provided the equation for predicting the probability that a case falls into a certain category (dropout or graduate). Finally, looking at the odds ratio output, the researcher calculated the change in odds of a student graduating given the set of predictor variables and the odds of a student dropping out given the set of predictor variables.

Assumptions

The researcher checked the assumptions the data must meet in order to get valid results. Leech, Barrett, and Morgan (2008) explained that logistic regression has very few assumptions (p. 114). First, when running a logistic regression analysis, the researcher must make sure the dependent variable is dichotomous. For this study, the dependent variable was high school end status which was dichotomous since it could have either been dropout or graduate. Second, the independent variables are either continuous or categorical. All independent variables in this study were categorical with the exception of discipline referrals which was continuous. Finally, observations must be independent and independent variables must be linearly related to the logit of the dependent variable (Leech, Barrett, & Morgan, 2008, p. 114). Neter, Wasserman, and Kutner (1983) explained that logistic regression is easily linearized since the dependent variable is categorical (p. 362).

Limitations

There were limitations to this study. First, the sample was collected from the district in which the researcher is currently employed. Since this sample was taken from one specific school district, it lacked external validity. Second, the district used a combination of two specific data warehousing systems and protocols which may vary from other districts. The accuracy of the data were dependent upon the registrar at each of the district's school to follow data entry procedures. Lastly, the student population represented a diverse community.

Conclusion

The purpose of this quantitative study was to provide statistical evidence to determine the reliability of predictor variables in order to develop a predictive model for identifying potential high school dropouts as early as the end of a student's sixth grade school year. The methodology for this study logistic regression as the researcher was analyzing the relationship between the predictor variables and the criterion variable.

CHAPTER IV

ANALYSIS

The purpose of this study was to determine the impact multiple predictor variables have on the criterion variable of high school end status. The predictor variables were: course failure in reading, course failure in math, absenteeism, number of discipline referrals, ethnicity, gender, and disability status. The sample size for this study was 1,436 students. The data were gathered from three different sixth grade cohorts that were scheduled to graduate during the 2010-2011, 2011-2012, and 2012-2013 school years. Data were provided to the researcher from a district level data technician after being retrieved from two different data warehousing systems. These systems were the AS400 and Infinite Campus.

Logistic regression analysis using Statistical Package for Social Sciences (SPSS) was used to analyze the variables included in the study. Three different statistical models were run. The first model included the school related factors of course failure in reading, course failure in math, absenteeism, and number of discipline referrals. The next model included non-school variables including ethnicity, gender, and disability status. Finally, the third model included both the school and non-school variables. Data screening was conducted prior to running the statistical analysis.

Data Screening

Prior to the analysis of data, the researcher examined the raw data to remove students from the selected school years who met any one of the following three conditions:

- Students who entered the district after the start date for their sixth grade school year.
- Students who transferred out of the district after their sixth grade school year were also removed from the data.
- Students who earned a General Equivalency Diploma (GED) were also removed from the data; these students were removed because it was not documented if they earned the GED prior to or after the expected graduation date.

Using descriptive statistics, frequency was used to determine if data were missing or if any outliers existed. Crosstabulations were also used to get a more descriptive look at the data used in the analysis.

Descriptive Statistics

Frequency analysis indicated that 1,276 (88.9%) of the students in the study passed reading while 160 (11.1%) failed reading their sixth grade year. In math, 1,249 (87%) students passed while 187 (13%) failed their sixth grade year. At the end of their sixth grade year, 1,018 (70.9%) of the students missed 10 or fewer school days, thus meeting the district's attendance expectations while 481 (29.1%) of the students did not meet the attendance expectations. The variable for number of discipline referrals was continuous and ranged from zero to ten. The number of students who earned no referrals was 1,167 (81.3%). The remaining referral data broke down as follows: 1 – 156 (10.9%),

2 – 46 (3.2%), 3 – 27 (1.9%), 4 – 14 (1%), 5 – 18 (1.3%), 6 – 1 (.1%), 7 – 3 (.2%), 8 – 1 (.1%), 9 – 1 (.1%), and 10 – 2 (.1%). Ethnicity was a categorical variable. There were 506 (35.2%) Hispanic students in the sample compared to 930 (64.8%) non-Hispanic students. Gender was similar with male students making up 50.9% (731) of the sample and females making up 49.1% (705) of the sample. The number of students without a disability was 1,330 (92.6%), and the number of students with a disability was 106 (7.4%). Finally, the number of students who graduated from high school was 1,292 (90%) compared to 144 (10%) of students who dropped out.

Descriptive data were also examined by completing a crosstabulation analysis. Each of the predictive variables in the study was compared with the dependent variable, high school end status, in the crosstabulation analysis. The first analysis was of the independent variable reading and high school end status. The null hypothesis was there is no difference between failing or passing in reading in sixth grade when compared to high school end status. This analysis is presented in Tables 1 and 2.

Table 1

Crosstabulation: Reading and End Status

		End Status		Total
		0	1	
Rdg	0			
	Count	47	113	160
	Expected Count	16.0	144.0	160.0
	% within Rdg	29.4%	70.6%	100.0%
	Std. Residual	7.7	-2.6	
	Count	97	1179	1276
	Expected Count	129.0	1148.0	1276.0
	% within Rdg	7.6%	92.4%	100.0%
	Std. Residual	-2.7	.9	
Total	Count	177	1292	1436
	Expected Count	144.0	1292.0	1436.0
	% within Rdg	10.0%	90.0%	100.0%

Note. Definition of abbreviations: Rdg=Reading.

Table 2

Reading and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	74.704 ^a	1	.000		
Continuity Correction ^b	72.310	1	.000		
Likelihood Ratio	55.317	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	74.652	1	.000		
N of Valid Cases	1436				

Both the dependent and independent variables were categorical. In Table 1, failing reading was represented by a 0 and passing reading was represented by a 1. There were 160 students in the sample who failed reading the sixth grade year. Of the total who failed, 47 of those students also dropped out of high school, which was 29%. Conversely, only 8% of students who passed reading their sixth grade year ended up dropping out of high school. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected. Students who pass reading are more likely to graduate high school as reported in ($\chi^2 = 74.704$, $df = 1$, $p \leq .000$).

The second analysis was of the independent variable math and high school end status. The null hypothesis was there is no difference between failing or passing in math in sixth grade when compared to high school end status. This analysis is presented in Tables 3 and 4.

Table 3

Crosstabulation: Math and End Status

		End Status		Total
		0	1	
Math	0			
	Count	60	127	187
	Expected Count	18.8	168.2	187.0
	% within Math	32.1%	67.9%	100.0
	Std. Residual	9.5	-3.2	
	1			
	Count	84	1165	1249
Total	0			
	Expected Count	125.2	1123.8	1249.0
	% within Math	6.7%	93.3%	100.0%
	Std. Residual	-3.7	1.2	
	Count	144	1292	1436
	Expected Count	144.0	1292.0	1436.0
	% within Math	10.0%	90.0%	100.0%

Table 4

Math and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	115.941 ^a	1	.000		
Continuity Correction ^b	113.148	1	.000		
Likelihood Ratio	85.006	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	115.861	1	.000		
N of Valid Cases	1436				

Both the dependent and independent variables were, again, categorical. In Table 3, failing math was represented by a 0 and passing math was represented by a 1. There were 187 students in the sample who failed math the sixth grade year. Of the total who failed, 60 of those students also dropped out of high school which was 32%. Conversely, only 7% of students who passed math their sixth grade year ended up dropping out of high school. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is

rejected. Students who pass math are more likely to graduate high school as reported in ($\chi^2 = 115.941$, $df = 1$, $p \leq .000$).

The third analysis was of the independent variable absenteeism and high school end status. The null hypothesis was there is no difference between students who met the district's attendance policy as compared to those students who did not meet the attendance expectations during sixth grade when compared to high school end status.

This analysis is presented in Tables 5 and 6.

Table 5

Crosstabulation: Absenteeism and End Status

		End Status		Total	
		0	1		
Absent	0	Count	81	337	418
		Expected Count	41.9	376.1	418.0
		% within Absent	19.4%	80.6%	100.0%
		Std. Residual	6.0	-2.0	
	1	Count	63	955	1018
		Expected Count	102.1	915.9	1018.0
		% within Absent	6.2%	93.8%	100.0%
		Std. Residual	-3.9	1.3	
Total		Count	144	1292	1436
		Expected Count	144.0	1292.0	1436.0
		% within Absent	10.0%	90.0%	100.0%

Table 6

Absenteeism and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	57.135 ^a	1	.000		
Continuity Correction ^b	55.683	1	.000		
Likelihood Ratio	51.761	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	57.095	1	.000		
N of Valid Cases	1436				

Both the dependent and independent variables in this analysis were categorical. In Table 5, failing to meet the district's attendance policy was represented by a 0 and meeting the attendance expectations was represented by a 1. There were 418 students in the sample who did not meet the attendance expectation the sixth grade year. Of that total, 81 of those students also dropped out of high school which was 19%. Interesting also was that 337, or 81%, of the students who did not meet attendance expectations overcame their absenteeism and graduated from high school. Conversely, 6% of the students who met the attendance expectations their sixth grade year ended up dropping out of high school. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected. Students who attend school regularly are more likely to graduate high school as reported in ($\chi^2 = 57.135$, $df = 1$, $p \leq .000$).

The fourth analysis was of the independent variable discipline referrals and high school end status. The null hypothesis was there is no difference in the number of referrals a student receives in sixth grade when compared to high school end status. This analysis is presented in Tables 7 and 8.

Table 7

Crosstabulation: Referrals and End Status

		Crosstab		
# of Referrals		End Status		Total
		0	1	
0	Count	76	1091	1167
	Expected Count	117.0	1050.0	1167.0
	% within Referrals	6.5%	93.5%	100.0%
	Std. Residual	-3.8	1.3	
1	Count	27	129	156
	Expected Count	15.6	140.4	156.0
	% within Referrals	17.3%	82.7%	100.0%
	Std. Residual	2.9	-1.0	
2	Count	13	33	46
	Expected Count	4.6	41.4	46.0
	% within Referrals	28.3%	71.7%	100.0%
	Std. Residual	3.9	-1.3	
3	Count	6	21	27
	Expected Count	2.7	24.3	27.0
	% within Referrals	22.2%	77.8%	100.0%
	Std. Residual	2.0	-.7	
4	Count	6	8	14
	Expected Count	1.4	12.6	14.0
	% within Referrals	42.9%	57.1%	100.0%
	Std. Residual	3.9	-1.3	
5	Count	13	5	18
	Expected Count	1.8	16.2	18.0
	% within Referrals	72.2%	27.8%	100.0%
	Std. Residual	8.3	-2.8	
6	Count	1	0	1
	Expected Count	.1	.9	1.0
	% within Referrals	100.0%	0.0%	100.0%
	Std. Residual	2.8	-.9	
7	Count	0	3	3
	Expected Count	.3	2.7	3.0
	% within Referrals	0.0%	100.0%	100.0%
	Std. Residual	-.5	.2	
8	Count	0	1	1
	Expected Count	.1	.9	1.0
	% within Referrals	0.0%	100.0%	100.0%
	Std. Residual	-.3	.1	
9	Count	1	0	1
	Expected Count	.1	.9	1.0
	% within Referrals	100.0%	0.0%	100.0%
	Std. Residual	2.8	-.9	
10	Count	1	1	2
	Expected Count	.2	1.8	2.0
	% within Referrals	50.0%	50.0%	100.0%
	Std. Residual	1.8	-.6	
Total	Count	144	1292	1436
	Expected Count	144.0	1292.0	1436.0
	% within Referrals	10.0%	90.0%	100.0%

Table 8

Referrals and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	162.376 ^a	10	.000
Likelihood Ratio	102.980	10	.000
Linear-by-Linear Association	120.004	1	.000
N of Valid Cases	1436		

Data represented in Table 7 illustrate how discipline referrals impact high school end status. The number of referrals earned by students during the sixth grade year ranged from zero to ten. Although it appeared that the number of students who earned zero referrals while still dropping out of high school was large, it only represented 6%, or 76 students, from the total number of students (1,167). This was minimal when compared to the percent of students who earned five referrals and also dropped out of school, which was 72% of the total number. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected. Students who earn more discipline referrals also increase the likelihood of dropping out of high school as reported in ($\chi^2 = 162.376$, $df = 10$, $p \leq .000$).

The fifth analysis was of the independent variable ethnicity and high school end status. The null hypothesis was there is no difference between students who are Hispanic compared to those who are not Hispanic when looking at high school end status. This analysis is presented in Tables 9 and 10.

Table 9

Crosstabulation: Ethnicity and End Status

		End Status		Total	
		0	1		
Ethnicity	0	Count	75	855	930
		Expected Count	93.3	836.7	930.0
		% within Ethnicity	8.1%	91.9%	100.0%
		Std. Residual	-1.9	.6	
	1	Count	69	437	506
		Expected Count	50.7	455.3	506.0
		% within Ethnicity	13.6%	86.4%	100.0%
		Std. Residual	2.6	-.9	
Total		Count	144	1292	1436
		Expected Count	144.0	1292.0	1436.0
		% within Ethnicity	10.0%	90.0%	100.0%

Table 10

Ethnicity and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.276 ^a	1	.001		
Continuity Correction ^b	10.667	1	.001		
Likelihood Ratio	10.871	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	11.268	1	.001		
N of Valid Cases	1436				

Both the dependent and independent variables were categorical. In Table 9, non-Hispanic students were represented by a 0 and Hispanic students were represented by a 1. The percent of Hispanic students who dropped out of high school was 13%. Those students who were non-Hispanic who dropped out of high school represented 8%. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected.

Hispanic students are more likely to drop out of school as reported in ($\chi^2 = 11.276$, $df = 1$, $p \leq .001$).

The next analysis was of the independent variable gender and high school end status. The null hypothesis was there is no difference between male and female students when looking at high school end status. This analysis is presented in Tables 11 and 12.

Table 11

Crosstabulation: Gender and End Status

		End Status		Total
		0	1	
Ethnicity	0			
	Count	105	626	731
	Expected Count	73.3	657.7	731.0
	% within Gender	14.4%	85.6%	100.0%
	Std. Residual	3.7	-1.2	
	1			
	Count	39	666	705
	Expected Count	70.7	634.3	705.0
Total	% within Gender	5.5%	94.5%	100.0%
	Std. Residual	-3.8	1.3	
	Count	144	1292	1436
Total	Expected Count	144.0	1292.0	1436.0
	% within Gender	10.0%	90.0%	100.0%

Table 12

Gender and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	31.028 ^a	1	.000		
Continuity Correction ^b	30.057	1	.000		
Likelihood Ratio	32.177	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	31.006	1	.000		
N of Valid Cases	1436				

Both the dependent and independent variables were categorical. In Table 11, male students were represented by a 0 and female students were represented by a 1. Based on the numbers represented in Table 11, 14% of male students dropped out as compared to only 6% of female students. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected. Male students are more likely to drop out of school as reported in ($\chi^2 = 31.028$, $df = 1$, $p \leq .000$).

The final crosstabulation analysis was of the independent variable disability status and high school end status. The null hypothesis was there is no difference between students who had a disability when compared to students who did not have a disability and their high school end status. This analysis is presented in Tables 13 and 14.

Table 13

Crosstabulation: Disability and End Status

		End Status		Total
		0	1	
Disability	0			
	Count	123	1207	1330
	Expected Count	133.4	1196.6	1330.0
	% within Disability	9.2%	90.8%	100.0%
	Std. Residual	-.9	.3	
	1			
	Count	21	85	106
	Expected Count	10.6	95.4	106.0
Total	% within Disability	19.8%	80.2%	100.0%
	Std. Residual	3.2	-1.1	
	Count	144	1292	1436
Total	Expected Count	144.0	1292.0	1436.0
	% within Disability	10.0%	90.0%	100.0%

Table 14

Disability and End Status Chi-Square

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.142 ^a	1	.000		
Continuity Correction ^b	10.999	1	.001		
Likelihood Ratio	9.945	1	.002		
Fisher's Exact Test				.002	.001
Linear-by-Linear Association	12.133	1	.000		
N of Valid Cases	1436				

Both the dependent and independent variables were categorical. In Table 13, students who were identified as having a disability were represented by a 1 and students without a disability were represented by a 0. Based on the numbers represented in Table 13, 20% of students who had a disability dropped out as compared to only 9% of students without a disability. Based on the model, the p value of .000 is less than .05; therefore, the null hypothesis is rejected. Students with a disability are more likely to drop out of school as reported in ($\chi^2 = 12.142$, $df = 1$, $p \leq .000$).

Logistic Regression Analysis

A logistic regression analysis was conducted on high school end status (dropping out or graduating) as a criterion variable. The seven predictor variables in this study were course failure in reading, course failure in math, absenteeism, number of referrals, ethnicity, gender, and disability status. The data analysis was performed using SPSS.

Logistic regression provides each predictor variable with a coefficient 'b' which measures the variable's relationship to the dependent variable. The dependent variable can only take one of two different values (0 or 1) because it was dichotomous. By using

the equation for logistic regression, the researcher was able to determine a student's probability of graduating high school. If the probability was closer to 1, then it was more likely the student would graduate; if the probability was closer to 0, it was more likely the student would drop out of high school.

$$P = \frac{e^{a+bX}}{1 + e^{a+bX}}$$

Where:

p = the probability that a case is in a particular category,

exp = the base of the natural logarithms (2.72),

a = the constant of the equation, and

b = the coefficient of the predictor variables.

The purpose of this study was to address three research questions. Results of each statistical analysis will be presented as each question is answered. The first research question was: How do language arts course failure, math course failure, number of days absent, and number of discipline referrals predict high school graduation when applied at the end of sixth grade? A logistic regression analysis was performed to ascertain the accuracy of the predictive variables (language arts course failure, math course failure, number of days absent, and number of discipline referrals) for calculating the possibility that a student would drop out of high school. The logistic regression model was significantly significant, $\chi^2(4) = 144.538$, $p < .05$. The model explained 20% (Nagelkerke R^2) of the variance in high school end status and correctly identified 90.2% of the cases. Sensitivity is the probability that a student who is predicted to graduate from high school actually does achieve that goal. Sensitivity was 98.8%. Specificity is the probability that a

student will drop out of high school and actually does drop out. Specificity was 12.5%. A positive predictor value is the percentage of correctly predicted cases for high school graduation. A positive predictor value is the percentage of correctly predicted cases for high school graduation. In this model, this would be calculated as follows:

$$1,277/(126 + 1277) = 91\%$$

This means that of all the cases (1,436) predicted as graduating, 91% were correctly predicted. Negative predictive value is the percent of predicted cases of students who dropout. For this model, this would be calculated as follows:

$$18/(18 + 15) = 55\%$$

This can be interpreted as 55% of the students predicted to dropout using this model are accurately predicted.

Of the four predictive variables each was found to be statistically significant; however, as shown in Table 15, reading was the least significant factor. Students who passed math were 2.947 times more likely to graduate, and students who met the district's attendance expectations were 2.237 times more likely to graduate. Finally, the null hypothesis for this model was rejected as each of the predictor variables was found to be statistically significant. Therefore, one would conclude that course failure in math, course failure in reading, absenteeism, and discipline referrals may be used to accurately predict high school end status.

Table 15

Significance of School Related Variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower
Rdg(1)	.568	.261	4.740	1	.029	1.764	1.058
Math(1)	1.081	.244	19.693	1	.000	2.947	1.828
Step 1 ^a Absent(1)	.805	.199	16.376	1	.000	2.237	1.515
Referrals	-.334	.067	25.117	1	.000	.716	.629
Constant	.611	.236	6.707	1	.010	1.842	

Note. Definition of abbreviations: Rdg=Reading.

Using this statistical model and analysis, the following equation could be used to predict high school end status using language arts course failure, math course failure, number of days absent, and number of discipline referrals as predictor variables:

$$Y = .611 + .568(\text{Language Arts}) + 1.081(\text{Math}) + .805(\text{Absenteeism}) - .334(\text{Referrals})$$

In order to use these coefficients, the researcher created a scenario and used the equation for logistic regression to predict a sixth grade student's probability of high school graduation. This hypothetical student passed reading, failed math, met the district attendance policy, and earned no discipline referrals. The predictor variables were coded and plugged into the equation to determine the exponent:

$$Y = .611 + .568(1) + 1.081(0) + .805(1) - .334(0)$$

$$Y = 1.98$$

Next, the researcher calculated the probability using the formula below:

$$P = \frac{e^{a+bX}}{1 + e^{a+bX}}$$

Where:

p = the probability that a case is in a particular category,

\exp = the base of the natural logarithms (2.72),

a = the constant of the equation, and

b = the coefficient of the predictor variables.

The probability is equal to $7.24/8.24$ which is .878. Therefore, for this student, the probability that she would graduate from high school was 88%.

The second research question was: To what extent do non-school variables (ethnicity, gender, and disability status) affect the accuracy of the predictive variables? A logistic regression analysis was performed to ascertain the accuracy of the predictive variables (ethnicity, gender, and disability status) for predicting a student would potentially drop out of high school. The logistic regression model was significantly significant, $\chi^2(3) = 49.875$, $p < .05$. The model explained 7% (Nagelkerke R^2) of the variance in high school end status and correctly identified 90% of the cases. Sensitivity was 100% while specificity was 0%. The positive predictive value for this model is as follows:

$$1,292/(144 + 1,292) = 90\%$$

This means that of all students predicted to graduate, 90% were correctly predicted. Of the three predictive variables each was found to be statistically significant: ethnicity, gender, and disability status as shown in Table 16. Female students were 2.733 times more likely to graduate than males. The null hypothesis for this model was rejected as each of the predictor variables was found to be statistically significant. Therefore, one would conclude that ethnicity, gender, and disability status may be used to accurately

identify high school end status. However, these predictors are not accurate when looking at predicting students at risk of dropping out of high school.

Table 16

Significance of Non-school Related Factors

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower
Ethnicity(1)	-.600	.180	11.141	1	.001	.549	.386
Gender(1)	1.005	.198	25.896	1	.000	2.733	1.856
Step 1 ^a IEP(1)	-.747	.268	7.754	1	.005	.474	.280
Constant	2.123	.141	226.09 0	1	.000	8.356	

Note. Definition of abbreviations: IEP=Disability Status.

Using this statistical model and analysis, the following equation could be used to predict high school end status using ethnicity, gender, and disability status as predictor variables:

$$Y = 2.123 - .600(\text{Ethnicity}) + 1.005(\text{Gender}) - .747(\text{Disability Status})$$

The last research question addressed all seven variables (school and non-school) in the logistical regression analysis by asking: How does the statistical significance of the variables change? A logistic regression was performed to ascertain the effects of course failure in reading, course failure in math, absenteeism, number of referrals, ethnicity, gender, and disability status on the likelihood that a student would drop out of high school. The logistic regression model was statistically significant, $\chi^2(7) = 159.441$, $p < .05$. The model explained 22% (Nagelkerke R^2) of the variance in high school end status and correctly identified 90.2% of the cases. Sensitivity was 98.9%. Of the 1,278 students predicted to graduate, all students reached that milestone. Specificity was 11.8%. Of the

127 students predicted to drop out, only 17 students did drop out. The positive predictive value for this model is as follows:

$$1,278/(127 + 1,278) = 91\%$$

This means that of all students predicted to graduate, 91% were correctly predicted. The negative predictive value in this value is as follows:

$$17/(17 + 14) = 55\%$$

This means that 55% of the students predicted to drop out actually drop out of high school.

Of the seven predictive variables, five were statistically significant: math, absenteeism, discipline referrals, ethnicity, and gender as shown in Table 17. If students passed math in sixth grade, they were 2.709 times more likely to graduate from high school than those who did not pass. In addition, students who met the district's attendance expectation of 94% or better were 2.153 times more likely to graduate high school than students who did not meet the district's attendance policy. In this model, disability status was the least significant variable with a p-value of .510. Based on the established level of significance of .05, one would also reject the null hypothesis that reading is significant. However, with a p-value of .088, this variable is close to .05, and a solid body of literature and research identifies reading as a significant predictor variable.

Table 17

School and Non-school Related Factors Combined

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower
Step 1 ^a	Rdg(1)	.448	.263	2.912	1	.088	1.566 .936
	Math(1)	.997	.245	16.509	1	.000	2.709 1.675
	Absent(1)	.767	.200	14.650	1	.000	2.153 1.454
	Referrals	-.303	.068	19.954	1	.000	.738 .646
	Ethnicity(1)	-.441	.195	5.129	1	.024	.644 .439
	Gender(1)	.652	.212	9.497	1	.002	1.919 1.268
	IEP(1)	-.215	.326	.434	1	.510	.807 .425
	Constant	.730	.270	7.318	1	.007	2.076

Note. Definition of abbreviations: Rdg=Reading, IEP=Disability Status.

Using this statistical model and analysis, the following equation could be used to predict high school end status:

$$Y = .730 + .448(\text{Reading}) + .997(\text{Math}) + .767(\text{Absenteeism}) - .303(\text{Referrals}) - .441(\text{Ethnicity}) + .652(\text{Gender}) - .215(\text{Disability})$$

Conclusion

The findings of the logistic regression analysis models run were presented in this chapter. The data used for the analysis was provided to the researcher by Greenfield school district and included numerous variables: course failure in reading, course failure in math, absenteeism, discipline referrals, ethnicity, gender, and disability status. In total, three different models were run and the data analyzed. Descriptive statistics were presented and the models were tested for their ability to accurately predict high school end status. The outcome of the logistical regression model containing the school related factors found that all four factors were significant. After analyzing the model run for the

non-school factors, the researcher found that each of those variables were significant as well. When all of the school and non-school factors were combined into a logistical regression model, five of the seven factors were found significant: math, absenteeism, discipline referrals, ethnicity, and gender.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The implications and consequences of dropping out of high school for individuals, the school system, the community, and society have drawn the attention of school officials as well as decision-makers throughout the United States (Christle, Jolivette, & Nelson, 2007, p. 325). After reading the literature, the researcher of this study drew the following conclusions. First, the tightening up of reporting high school dropout and graduation rates has led to consistent and more accurate reporting on the part of school districts. Second, decades of research and program development designed to decrease the number of students dropping out of high school has had little success. Lastly, what success there has been in decreasing the dropout rate, has not been consistently replicated. Therefore, more recent research has focused on early identification of students who are at risk of dropping out of high school (Allensworth & Easton, 2007; Jerald, 2006; Neild & Balfanz, 2006). The focus of this study looked at a cohort of students at the end of the sixth grade school year and using variables to accurately predict potential dropouts.

A review of the literature, presented in Chapter II, provided information on the body of research regarding factors related to students dropping out of high school as well as the need for early identification. The literature review provided support for including the school related variables of course failure in reading, course failure in math,

absenteeism, and number of referrals (Allensworth & Easton, 2007; Jerald, 2006; Neild & Balfanz, 2006). In addition to the school related factors, non-school factors including gender, ethnicity, disability status, socio-economic status, and English language learners were also identified as predictor variables. The body of literature included research about the use of early warning systems in large urban settings such as Chicago and Philadelphia (Allensworth & Easton, 2007; Neild & Balfanz, 2006). By determining the accuracy of predictor variables in a suburban educational setting, the researcher of this study hopes to contribute to the body of literature about dropout prevention through early identification.

Three research questions led to hypotheses being developed in order to study the accuracy of predictor variables on high school end status. The first research question was: How do language arts course failure, math course failure, number of days absent, and number of discipline referrals predict high school graduation when applied at the end of sixth grade? The null hypothesis was: There is no statistically significant relationship between high school end status (criterion variable) and sixth grade language arts course failure, math course failure, number of days absent, and number of discipline referrals (predictor variables). The second research question was: To what extent do non-school variables (ethnicity, gender, and disability status) affect the accuracy of the predictive variables? The null hypothesis was: There is no statistically significant relationship between high school completion (criterion variable) and non-school factors of ethnicity, gender, and disability (predictor variables). The last research question addressed all seven variables (school and non-school) in the logistical regression analysis by asking: How does the statistical significance of the variables change? The null hypothesis was: There is no statistically significant relationship between high school completion (criterion

variable) and the predictor variables which include sixth grade language arts course failure, math course failure, absenteeism, number of discipline referrals, ethnicity, gender, and disability status.

Findings

The major findings related to the predictor variables and high school end status confirmed that the school variables significantly impact a student's path to graduation. Three different models were analyzed and conclusions were drawn. Each model is briefly discussed below.

The first model included the school related variables: course failure in reading, course failure in math, absenteeism, and discipline referrals. When these four variables were included in the model, 90.2% of the students' end status was predicted accurately. The null hypothesis for this model was rejected as each of the predictor variables was found to be statistically significant. Therefore, one would conclude that course failure in math, course failure in reading, absenteeism, and discipline referrals may be used to accurately predict high school end status.

The second model included only the non-school variables of ethnicity, gender, and disability status. When these three variables were included in the model, 90% of the students' end status was predicted accurately. The null hypothesis for this model was rejected as each of the predictor variables was found to be statistically significant. Therefore, one would conclude that ethnicity, gender, and disability status may be used to accurately identify high school end status. However, these predictors are not accurate when looking at predicting students at risk of dropping out of high school.

The final model included all predictor variables. When all seven variables were included in the model, 90.2% of the students' end status was predicted accurately. This model confirmed the significance of five of the predictor variables: math, absenteeism, discipline referrals, ethnicity, and gender. Based on the established level of significance of .05, one would also reject the null hypothesis that reading is significant. However, with a p-value of .088, this variable is close to .05, and a solid body of literature and research identifies reading as a significant predictor variable; therefore, this researcher would consider reading a significant predictor variable.

Implications

Research

The results of this study contribute to the body of knowledge regarding the use of predictive variables to identify students at risk of dropping out of high school. The results also support previous research that indicates student records maintained at the school and district level can be used as early as the end of sixth grade to identify students who may drop out of high school (Allensworth & Easton, 2007; Neild & Balfanz, 2006). Schools maintain data regarding grades, attendance, and behavior, which may be used to predict students who are at risk (Therriault, O'Cummings, Heppen, Yerhot, Scala, & Perry, 2013, p. 11).

Researchers may find the results of this study useful in designing future research to refine and further define how the use of predictive variables can be used to decrease the high school dropout rate through early identification and intervention. For example, since absenteeism was a significant predictive variable in this study to predict potential

dropouts, it would be advantageous for educators to consider the various aspects that influence attendance rates and implement strategies to improve attendance.

Educators can use the information from this study to identify potential at-risk students earlier in their educational careers. This will be critical to schools and districts as interventions are implemented to decrease the dropout rate. Schools can be more strategic in the identification students who need support. After students are identified, a variety of interventions are available to assist school personnel in changing a student's trajectory towards a positive outcome. When considering interventions, one should keep in mind that there are no simple solutions to the dropout crisis; however, a wide array of supports could be helpful to students (Bridgeland, Dilulio, & Morison, 2006, p. 11).

Finally, the researcher explored implications specific to the role of a middle school principal. Sloan (2012) explained that today's educators prepare students for a future in a world that is rapidly changing, to compete in the global economy, to work collaboratively, and to contribute to the well-being of society (p. 2). The principal is a leader in this effort at a school site as well as within a district setting. Working collaboratively within a district, middle school principals have the capability and access through data to closely monitor student performance. By identifying students who are at risk based on predictive variables, principals can lead teachers in the implementation of interventions. Ideally, at-risk students would be identified at the end of the sixth grade school year. Next, counselors, teachers, and administration would then identify potential interventions specific to the student's individualized needs. Throughout the next school year, the student would be monitored along with the implementation of the interventions. At the conclusion of the student's seventh grade year, the same predictive model would

be used to see if the student's trajectory towards high school end status was altered. This model, if used in conjunction with interventions, has the potential to help decrease the number of students who drop out of high school.

Application for Educators

In reading the literature available about high school dropout prevention and intervention, it became obvious that there is no easy fix to this epidemic facing the nation. Oftentimes, educators adopt programs and interventions to help struggling students, but these strategies fail to keep students from dropping out of high school. A couple of reasons the education system falls short of achieving graduation goals is because of failed implementation due to a lack of fidelity and the simple fact that not all at-risk students need the same interventions. Throughout my research it became apparent that interventions must be individualized to each student in order to lead to positive change in a student's trajectory. Some students will need more support than others so effectively allocating resources is critical to help change a student's path. Finally, whatever programs or interventions are put into place to support at-risk students must be monitored on two different levels. First, the adult actions need to be monitored to ensure interventions are being implemented with fidelity. Second, educators must take the time to progress monitor students along the way to determine if progress is being made. If progress is not being made, these formative assessments would allow educators the opportunity to reassess the student's needs and try another strategy. Educators, teachers and administrators, must do their due diligence in order to positively affect change for students.

Limitations

This study contributes to the current body of research available regarding predictive variables that can be used in middle school to identify students who are at risk of dropping out of high school. However, some limitations exist that impact the generalizability of the results. The sample for this study was drawn completely from one school district; therefore, the results can only be generalized to the population of students in Greenfield School District. While predictive variables were identified through an extensive review of the literature, there are variables that were omitted from the study that could contribute to a student's eventual high school end status. For example, the body of literature strongly suggested that socio-economic status and English language development are significant predictive variables. Unfortunately, the data warehousing system, AS400, used in Greenfield School District did not have the capability to accurately store that information which resulted in those two variables not being included in the study. Even with those variables being left out due to limitations with record keeping, there are numerous other factors that play a role in a student's success or failure in school. Strom and Boster (2007) explored the impact of communication in the home and how it communicated expectations about graduation (p. 438). Another factor that may influence a student's decision to drop out could be the quality of his or her non-school supports as well as in-school networks (Davis & Cole-Leffel, 2009, p. 186). Johnson and Semmelroth (2010) suggested that the relationship developed between a teacher and a student can play a role in whether or not a student drops out of high school (p. 121).

Future Research

While the purpose of this study was to analyze how accurately variables predicted high school end status, future studies could continue to look at variables to refine an algorithm. A study which included the variables of English language development and socio-economic status would be beneficial to the research field. A longitudinal study that looked at the same cohort of students at the end of sixth, seventh, and eighth grade might help to determine if the algorithm becomes a more accurate predictor of high school end status as the student progresses through the educational system. An additional longitudinal study that followed a cohort all the way from the end of sixth grade through high school end status would also be beneficial as it would allow a researcher to monitor factors that may influence high school end status.

Conclusion

The logistical regression analysis led to several conclusions about the influence and significance of predictor variables on high school end status. A discussion of the meaning of the findings was presented in this chapter. The implications of these results and the limitations of the study were also explored. Finally, recommendations for future research were provided.

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APPENDIX

APPROVAL LETTER



Institutional Review Board

DATE: January 27, 2014

TO: Dawn Hillman
FROM: University of Northern Colorado (UNCO) IRB

PROJECT TITLE: [558895-1] Using an Early Warning System to Identify Potential High School Dropouts
SUBMISSION TYPE: New Project

ACTION: APPROVAL/VERIFICATION OF EXEMPT STATUS
DECISION DATE: January 27, 2014

Thank you for your submission of New Project materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

Dawn -

Hello and thank you for a very clear and thorough IRB application for such an interesting topic.

Best wishes with your analyses. If any IRB-related questions or concerns arise please don't hesitate to contact me.

Sincerely,

Megan Stellino, UNC IRB Co-Chair

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.