DETERMINING THE OUTCOMES OF AN INNOVATIVE SOLUTION FOR AT RISK STUDENTS: USING THE TRI–SQUARED TEST AS ADVANCED STATISTICAL ANALYSIS TO VERIFY THE IMPACT OF NINTH GRADE FRESHMAN ACADEMIES, CENTERS, AND CENTER MODELS UPON MINORITY STUDENT RETENTION AND ACHIEVEMENT

By

JAMES EDWARD OSLER * CARL WADEN **

** North Carolina Central University, Carl Waden, Southeastern Baptist Theological Seminary.*
*** Assistant Principal, Eastern Alamance High School, Mebane.*

ABSTRACT

This paper discusses the implementation of the Tri–Squared Test as one of many advanced statistical measures used to verify and validate the outcomes of an initial study on academic professional's perspectives on the use, success, and viability of 9th Grade Freshman Academies, Centers, and Center Models. The initial research investigation published in i-manager's Journal on School Educational Technology determined that academician's view these types of academic programs as positive solutions that aid in the retention and projected completion of High School minority "At–Risk" students. This advanced approach to data analysis is a transformative mixed methods research design that involves the in–depth comparison of the initial research qualitative and quantitative outcomes and establishes the validity and reliability of the researcher's instrument.

Keywords: Advanced Statistics, At–Risk, Cramér's V, Drop–Out, Goodman & Kruskal's Lambda, 9th Grade Freshman Academies, Centers, Center Models, Meta–Cognitive Analysis, and Tri–Squared Test.

INTRODUCTION

One of the most challenging dilemmas facing High School educators today is the attrition of students due to dropout. The dropout rates in the North Carolina public schools have been a major concern to academicians, parents, and industry in preparing young people for future success in this ever–changing global society (Waden, 2011). In the current job market, the completion of high school is a necessity. It provides young people with the opportunity to compete in job markets and opens the door to acquire a college education. Moreover, "some employers have expressed disappointment because many high school graduates lack the skills necessary to be successful or even compete for the best jobs in today's society" (Gough–Perkins, 2005). Recent statistics suggest that educators must find new and innovative strategies to retain ninth graders and eventually help them graduate in four years. Scholars and stakeholders in education (i.e., legislators, industry, government agencies, and organizations) argue for educational change, mandating a call for more rigorous and relevant educational experiences for student learners in public high schools. In the U.S., educators recognize the influence of political pressure and the enormity of the challenge. At the same time they must make logical, economical, and research–based decisions when it comes to where and how their schools must reform. As educational researcher Quint states, "We must summon the political will to demand changes if we are to be competitive in the global community" (Quint, 2008).

Identification of the Problem

In the U.S. more than 1.2 million drop out of school every year, roughly 7,000 each school day. Forty two percent of freshman in community colleges and twenty percent of

freshman in public four year institutions require remedial courses in reading, writing, or math to handle college level work" (Wise, 2008). In a survey, employers expressed disappointment because many high school graduates lack the necessary skills to compete for jobs in the U.S. In 2005, sixty percent of U.S. manufacturing companies surveyed said that high school graduates were poorly prepared for entry–level jobs. Our nation faces a choice: do nothing to fix a broken high school system and watch our competiveness further decline in this current global economy or devise strategies designed to help prepare young people to compete after high school (Wise, 2008). A strategy under consideration redesigns high schools so that students can acquire the necessary skills to compete in four year institutions or in job markets. In order to see real school reform scholars suggest that schools must be redesigned because we are in a constant battle due to the gravitational pull of "school as usual" (Donegan, 2008). School systems across this nation have been trying to operate school at a twentieth century pace without upgrading or implementing their respective "best" and "next" practices. Most ninth grade high school courses retain the shape of decades of outdated strategies and methods that are ineffective in today's classrooms (Quint, 2008). Educators must do a better job in preparing young people for college and life after high school. As Darling & Friedlaender state, "The right design features and polices can promote exceptional high schools on a broad scale" (Darling & Friedlaender, 2004). Ultimately, there must be a mission to prepare high school students to apply knowledge to issues and problems that they will face in the future. The aim of U.S. secondary education should be focused on ensuring that young people are prepared to face life from a position of strength. This strength should be grounded in knowledge, skills, and dispositions that are problem–solving, ubiquitous, and global.

The initial research study explored the impact of ninth grade centers, ninth grade academies or ninth grade models designed to help ninth graders succeed academically and to stay on track for graduation within four years in the state of North Carolina. According to statistical data taken from North Carolina Department of Public Instruction website in 2011, "graduation rates of all those students who entered the ninth grade in the 2004–05 school years, seventy point three percent left high school four years later with a diploma in the 2007–08 school years" (data extracted from NCDPI: Websites, 2011). According to the NCDPI data, the previous year was even worse with a graduation rate of 71.8 percent leaving school in five years from the measured 2003–04 high school cohorts. These startling statistics did not include those students with disabilities. According to a report released to the North Carolina State Board of Education by the North Carolina Department of Public Instruction dated February 9, 2009, "African Americans and Hispanics graduation rates combined at 59.5 percent was considered one of the major challenges by educators, parents, and other stakeholders (legislators, industry, government agencies, and organizations) and must find ways to help increase these rates" (extracted from NCDPI: Websites during the 2011 academic year).

Identifying the At–Risk High School Population in North Carolina

As a result of the aforementioned data, the initial research investigation focused on the graduation rates of At–Risk African American and Hispanic students who ethnically comprise the two largest student subgroups of students in North Carolina. American Indian and multi–racial students were also included in the research data. Moreover, the statistical data compiled by the North Carolina Department of Public Instruction gives a vivid account of the state dropout rates for the 2007–2008 academic school years. The data begins with the state average dropout rate for all students in North Carolina at 4.97%. The report also illustrated the minority student's dropout rates that were exceeding the state average at the time. Starting with American Indian student's dropout rate at 6.99%, Hispanic students left school at a rate of 6.92, and African American students dropped out at a rate of 5.95% respectably. For the first time, dropout rates for multiracial students moved slightly above the state average at 5.06%. North Carolina state wide results of the 4–year cohort graduation rate report 2004–05 entering 9th graders graduating in 2007–08 or earlier were reported in the initial research design as shown in Table1.

Subgroup	Denominator	Numerator	Percent
All Students	108852	76561	70.3
Male	55113	36458	66.2
Female	53737	40101	74.6
American Indian	1709	920	53.8
Asian	2125	1722	81.0
African American	32390	20303	62.7
Hispanic	6367	3593	56.4
Multi-Racial	2037	1394	68.4
White	64219	48627	75.7
Economically Disadvantaged	34616	20480	59.2
Limited English Proficient	2976	1486	49.9
Students with Disabilities	9307	5264	56.6

Table 1. Identifying the At-Risk High School Population in North Carolina

Reported subgroup information was based on data collected when a student is last seen in the high school cohort. North Carolina collects a four–year graduation rate each year that indicates the percentages of first–time ninth graders who graduated from high school four years later. The complete dropout report and local school district numbers can also be found included in a table in the initial research investigation. The initial research investigation found that "Local School Districts" have had to be creative with finding strategies to keep high school students on track for graduation. There are some strategies considered-smaller learning communities such as Early College and Middle College models, as well as online recovery programs housed within high schools such as Nova Net and North Carolina Virtual Public School. The study also found that there are alternative learning programs for students suspended for behavior issues, and other smaller learning communities that help students acquire the necessary credits needed to stay on track to graduate in four years. However, the primary focus of the initial research investigation was to determine the efficacy of a particular strategy implanted by some high schools called "Ninth Grade Models". Ninth Grade Models are designed to help ninth graders make a better transition to and through high school. In addition there are models called "Ninth Grade Academies" also referred to as "Ninth Grade Centers" (the name varies from school to school), but the aim of all models is to help all ninth graders graduate within four years upon entering the ninth grade. The initial research design explored efficacy (from a faculty and administrative perspective) of the models that were "currently in use in some high schools in the state of North Carolina" (Osler & Waden, 2012).

Research Methodology of the Initial Study

The initial study examined the impact of ninth grade models on the success of At–Risk minority students in North Carolina via analysis of the faculty and administrators perspectives. A specific researcher designed instrument was created and delivered to the sample which consisted of faculty and administrators that had worked with Ninth Grade Academies, Centers, and Center Models in North Carolina. The data was recorded via the instrument qualitatively and and via NCDPI reports on graduation rates quantitatively. The data was then analyzed using a novel mixed methods approach called: Meta–Cognitive Analysis. The Meta–Cognitive Data Analysis method was pioneered by educational scientists Marsh and Snell (Snell & Marsh, 2003). In addition, interviews were conducted with key school personnel such as principals, assistant principals, and other stakeholders (parents, guardians, legislators, industry, government agencies, and organizations) in an effort to answer guided research questions concerning the impact of ninth grade centers, freshman academies, and similar models upon At–Risk minority student's academic success. The following list highlight the initial research study methodology:

- Initial Research Assumptions: (i) The literature researched is assumed to be accurate and true data taken from reports of the North Carolina Department of Public Instruction websites, including data retrieved from local Education Associations and specific schools included in the study; and (ii) The data accurately reflected the graduation rates, retention rates, dropout rates, passing rates with reference to End of Course assessments at the secondary level in North Carolina high schools pertaining to minority ninth grade students.
- Initial Research Limitations: Participants of this study came from the minority high schools that had active Ninth Grade Academies or Similar Models in central North Carolina. The study was limited to a comparison of the academic traits and characteristics of ninth grade minority students, specifically identified by ethnicity as: African American, Hispanic, Native American and Multi–Racial. Data on the historic academic events regarding minority students was extracted from the North Carolina

Department of Public Instruction yearly reports.

- Initial Research Value: Present statistical data has shown that ninth and ten grade students are dropping out of high school at alarming rates. In North Carolina, these students are deemed "At–Risk" amongst minority populations and have dropout rates that are above average. The research provided data on Ninth Grade Centers and Models as in–depth interventions that are immediate solutions that educators can implement. The study shows that these solutions are having a positive impact upon ninth grade minority students in terms of retention and academic success.

- Initial Research Sample: The sample in this study consisted of North Carolina public schools that had implemented 9th Grade Academies, Centers, and Center Models. Data was also acquired from The North Carolina Department of Public Instruction (NCDPI) reports recorded during the 2004–2005 to 2007–2008 academic years. In addition, administrators from the same institutions were interviewed.

- Initial Research Hypotheses: H_0: There are significant differences in the perception of the success of Ninth Grade Academy Models in terms of graduation rates, dropout rates, high stakes testing, retention, and attendance by high school administrators; and H_1: There are no significant differences in the perception of the success of Ninth Grade Academy Models in terms of graduation rates, dropout rates, high stakes testing, retention, and attendance by high school administrators. The Initial Research Meta–Cognitive Data Analysis Mathematical Hypotheses were:

$$H_0: \chi^2 = 0$$
$$H_1: \chi^2 \neq 0$$

- Initial Research Instrument: The investigators used interviews derived from a novel researcher–designed "9th Grade Academies, Centers, and Center Models Assessment Instrument" (Figure 1 in the Appendix). The instrument was given to schools that had 9th Grade Academies, Centers, and Center Models. The instrument and interview questions derived from the instrument obtained data from authoritative high school personnel: Principals and Assistant Principals. The instrument was also obtained from administrator's answers to research questions relating to the impact of Ninth Grade Centers, Academies or similar models on minority ninth grade student academic achievement. The purpose of this instrument was to provide data on 9th Grade Academies, Centers, and Center Models for non–parametric quantitative data analysis. Data that was not responded to was reported as "Missing" (a separate Categorical Variable designed to report all research results, and added in balanced objective data reporting). The instrument was qualitative in nature analyzed quantitatively to accurately statistically analyze the level of significance of participant's responses to the research questions.

Results of the Initial Study

The research methods used in this study to analyze the data were a combination of qualitative (as assessment–based

The Osler–Waden 9th Grade Academies, Centers, and Center Models Assessment Instrument ©

A. Has the 9th Grade Academy, Center, or Center Model been:

	Yes	No	Missing
1. Successful?	☐	☐	☐
2. Made a Difference?	☐	☐	☐
3. Aided in Retention?	☐	☐	☐

How as the Academy/Center been successful, made a difference, or aided in retention, if at all?

A. Did the 9th Grade Academy, Center, or Center Model Result in the following:

	Yes	No	Missing
4. Positive Impact?	☐	☐	☐
5. Active Participation?	☐	☐	☐
6. Decline in Dropout Rate?	☐	☐	☐

How as the Academy/Center been positive, aided in participation, or decreased the dropout rate, if at all?

A. How did the 9th Grade Academy, Center, or Center Model have an impact on the following:

	Yes	No	Missing
7. Positively Effect Standardized Testing?	☐	☐	☐
8. Increase Graduation Rate?	☐	☐	☐
9. Increase Attendance?	☐	☐	☐

How as the Academy/Center positively affected testing, graduation rates, and attendance, if at all?

How long has the model/program (freshman/Ninth Grade Academy been operation in your school?

How long has the interviewee (yourself) been (working) there and what is the level of his or her involvement in the program such as Assistant Principal, Principal, teacher or other staff member?

What is the role of those interviewed during the interviews, and their knowledge of the program, whether their knowledge was medium knowledge low level of knowledge etc.

Figure 1. The Osler-Waden 9th Grade Academies, Centers and Center Models Assessment Instrument

interviews were used) and quantitative (featuring the comprehensive Meta–Cognitive Analysis of the researcher–designed instrument via the Chi Square Goodness of Fit non–parametric statistical test). The study examined schools in North Carolina which had operational ninth grade academies, ninth grade centers, or similar models to determine their impact on the academic success of ninth grade students. The Meta–Cognitive Analysis using the Chi–Square Goodness of Fit Statistical Analysis procedure was used to analyze data in the study. An alpha–level of 0.10 was considered in light of the research context that was evidence–based in the prescribed schools that had restricted and controlled learning environments that allowed for very few chance factors to affect the outcomes of the research investigation. This was coupled with the extrapolation of data from administrators that again allowed for minimal chance factors to affect research outcomes. It was therefore concluded that the 0.10 estimate was reasonable for this particular study. In addition, due to the exploratory context and nature of the research investigation (in an area where little previous research has been done regarding 9th Grade Academies, Centers, and Center Models) a less stringent level of significance of 0.10 best fit the research study. The study yielded the following final results using the Chi–Square Goodness of Fit statistical analysis procedure in tabular format: Rejection of Null Hypothesis, thereby resulting in an acceptance of the Alternative Hypothesis thus indicating that 9th Grade Academies, Centers, and Center Models do have an effect on the academic success, make a positive difference, and aid in the retention of students. For d.f. = 4, the critical χ^2 value for $p > 0.10$ is 7.779. The calculated Chi Square value is 8.180, thus we can reject the null hypothesis (H0) by virtue of the hypothesis test which yields the following: critical χ^2 value of $7.779 < 8.180$ the calculated χ^2 value. The responses to the items on the assessment were dichotomous with an added area for any and all missing data. Thus, respondents (i.e. research participants) were afforded the opportunity to respond in either an affirmative or negative capacity. The vast majority of responses were overwhelming 'yes or positive' as indicated in the Chi–Square Table first row on responses. As a result the research participants for the most part agreed that 9th Grade Academies, Centers, and Center Models were effective in their respective schools. This outcome is supported by the final results of the Chi–Square analysis which yielded the following: critical χ^2 value of $7.779 < 8.180$ the calculated χ^2 value. The research Null Hypothesis can thus be rejected and it can be stated that 9th Grade Academies, Centers, and Center Models do have an effect on the academic success, make a positive difference, and aid in the retention of students. What follows is a summary of what the research yielded resulting from the initial survey data analysis using the research assessment instrument.

The data yielded the following results: 9th grade academies or similar models have indeed made a positive impact upon ninth grade student achievement in North Carolina. Large percentages of respondents overwhelmingly agreed that ninth grade academy models have contributed to reducing retention rates, attendance rates, made a difference on student academic outcomes in the schools identified in the study (this positive outcome was also replicated in the interviews with stakeholders and verified in the retention rates for high school graduation for the schools that took part in the initial research investigation). Ninth grade models also contributed to the decline in the dropout rates of At–Risk ninth grade students in the schools identified in the study. A particularly significant statistic is illustrated by the majority of minority student's dropout rate in the schools that were in the study. This statistic as a whole was well above the NC state average for the academic year 2004–05 (as identified by NCDPI). The Tri–Squared Test and advanced statistical measures follows as an advanced statistical measure to analyze the aforementioned results of the initial research investigation.

Validating Initial Research Outcomes: Tri–Squared Test Results

The Tri–Squared Test statistical analysis procedure was used to analyze and validate the initial data outcomes that were a result of the initial study (Osler, 2012). An alpha–level of 0.10 was considered in light of the research context that was evidence–based in the prescribed schools that had restricted and controlled learning environments that

allowed for very few chance factors to affect the outcomes of the research investigation ($n_{Tri} = 17$ with $17 \times 3 = 51$ items per the outcomes of the Trichotomous Variables on the Inventive Investigative Instrument). This was coupled with the data gathered from administrators that allowed for minimal chance factors to affect research outcomes. The 0.10 estimate was reasonable for this particular study based on the calculated Tri–Squared Effect Size. In addition, due to the exploratory context and nature of the research investigation (in an area where little previous research has been done regarding 9th Grade Academies, Centers, and Center Models) a less stringent level of significance of 0.10 best fit the research study. The study yielded the following final results using the Tri–Squared Test in tabular format (Tables 2&3).

Outcomes of the Tri–Squared Test

Data was analyzed Using the Trichotomous–Squared Three by Three Table designed to analyze the research questions from an Inventive Investigative Instrument with the following Trichotomous Categorical Variables: a_1 = Successful via: Impact, and Positive Testing [the summation of the outcomes of the assessment instrument item 1]; a_2 = Made a Difference via: Participation, and Graduation Rate [the summation of the outcomes of the assessment instrument item 2]; and a_3 = Aided in Retention via: Drop Out Rate, and Attendance [the summation of the outcomes of the assessment instrument item 3]. The 3×3 Table has the following Trichotomous Outcome Variables: b_1 = Yes; b_2 = No; and b_3 = Unknown. The Inputted Qualitative Outcomes are reported as follows.

The Tri–Square Test Formula was used for the Transformation of Trichotomous Qualitative Outcomes into Trichotomous Quantitative Outcomes to Determine the Validity of the Research Hypothesis.

$$Tri^2 = T_{Sum}\left[\left(Tri_x - Tri_y\right)^2 : Tri_y\right]$$

Tri^2 *d.f.* $= [C-1][R-1] = [3-1][3-1] = 4 = Tri^2_{[\bar{x}]}$

Trichotomous Categorical Variables				
		a_1	a_2	a_3
Trichotomous Outcome Variables	b_1	48	43	38
	b_2	2	4	5
	b_3	1	4	8

$n_{Tri} = 17$ $\alpha = 0.975$

Table 2. Outcome of the Tri-Squared Test

Table 2 illustrates the qualitative mathematical application of the Trichotomous–Squared ("Trichotomy–Squared", "Tri–Squared" or "Tri–Square") statistical analysis procedure. The results are: Tri^2 Critical Value Table = 8.131 (with d.f. = 4 at $\alpha = 0.975$). For d.f. = 4, the Critical Value for $p > 0.975$ is 0.484. The calculated Tri–Square value is 8.131, thus, the null hypothesis (H_0) is rejected by virtue of the hypothesis test which yields the following: Tri–Squared Critical Value of $0.484 < 8.131$ the Calculated Tri–Squared Value. The (Table 2) 3×3 Table reports the qualitative outcomes based on the Inventive Investigative Instrument Trichotomous Categorical Variables according to participant responses as the Trichotomous Outcome Variables. Table 2 shows that participants primarily and overwhelmingly selected the "Yes" Categorical Variable ($a_1b_1 = 48$, $a_2b_1 = 43$, and $a_3b_1 = 38$) rather than the alternative Categorical Variables of either "No" or "Unknown" (the "Unknown" C. V. indicated unselected or inapplicable responses to an item). The mathematical formula for the Tri–Squared is reported illustrating the final outcome of the research hypothesis test: the null hypothesis (H_0) is rejected at $p > 0.975$ is 0.484. Table 3 follows and provides the outputted quantitative outcomes of the Tri–Squared Test.

Quantitative Outcomes of the Tri–Squared Test Calculation

The quantitative mathematical application of the Trichotomous–Squared ("Trichotomy–Squared", "Tri–Squared" or "Tri–Square") statistical analysis procedure (Osler, 2012) had the following results: Tri^2 Calculated Tri–Squared = [0.581] + [0] + [0.581] + [0.760] + [0.030] + [0.482] + [2.561] + [0.025] + [3.111] = 8.131 (with d.f. = 4 at $\alpha = 0.975$). For d.f. = 4, the Critical Value for $p > 0.975$ is 0.484. Thus, we can reject the null hypothesis (H_0) by virtue of the hypothesis test: Tri–Squared Critical Value of $0.484 < 8.131$ the Calculated Tri–Squared Value. "Tri–Squared" is the mathematical transformation of qualitative data into quantitative data for the purpose of validating a research hypothesis (clearly illustrated in this Table). Table 3 illustrates and validates the process of transforming qualitative data into quantitative data as a means of in–depth mixed methods for the purposes of discrete data analysis. The (Table 3) 3×3 Table reports the transformed quantitative

outcomes based on the Inventive Investigative Instrument Trichotomous Categorical Variables according to participant responses as the Trichotomous Outcome Variables. Table 3 data displays that participants primarily and overwhelmingly selected the "Yes" Categorical Variable ($a_1b_1 = 48$, $a_2b_1 = 43$, and $a_3b_1 = 38$) rather than the alternative Categorical Variables of either "No" or "Unknown" (the "Unknown" C. V. indicated unselected or inapplicable responses to an item). The mathematical formula for the Tri–Squared is reported illustrating the final outcome of the research hypothesis test: the null hypothesis (H_0) is rejected at $p > 0.975$ is 0.484 because the Tri–Squared Test Critical Value of $0.484 < 8.131$ the Calculated Tri–Squared Test Value.

Validating the Outcomes of the Initial Research Study: Omnibus Post Hoc Statistical Measures

Conducting Cramér's V for the Tri–Squared Test

Cramér's V is a methodology for calculating correlation [relationships] in statistical tables (such as Chi–Square, Tri–Square, etc.) which have an increase in cells, i.e., a table with more than 2×2 rows and columns (Chi–Square Table > 2 Rows and Columns and Tri–Square Standard 3×3 Table). It is also used as a post–test to determine strengths of association after Chi–Square has determined significance. Cramér's V is used in this study as previously stated to determine post–test strengths of association after the Meta–Cognitive Data Analysis (which used Chi–Square

Crosstabulation of Variables		Independent Variables: Categorical Variable 1	Categorical Variable 2	Categorical Variable 3
Dependent Variables	Outcome Variable 1	a_1b_1	a_2b_1	a_3b_1
	Outcome Variable 2	a_1b2_2	a_2b_2	a_3b_2
	Outcome Variable 3	a_1b_3	a_2b_3	a_3b_3

Table 3a. Cramér's V Tabulation Table Legends

Crosstabulation of Variables		Independent Variables: Categorical Variable 1	Categorical Variable 2	Categorical Variable 3
Dependent Variables	Outcome Variable 1	48	43	38
	Outcome Variable 2	2	4	5
	Outcome Variable 3	1	4	8

Table 3b. Cramér's V Results

Data Entry	a_1	a_2	a_3
b_1	48	43	38
b_2	2	4	5
b_3	1	4	8

Table 3c. Quantitative Outcomes of the Tri-Squared Test

	a_1	a_2	a_3
b_1	+11.6%	0%	– 11.6%
b_2	– 45.5%	+9.1%	+36.4%
b_3	– 76.9%	– 7.7%	+84.6%

Table 4. Tri–Squared Percentage Deviations

Level of Association	Verbal Description	Comments
-1.00+	Perfect Negative Relationship.	The independent variable cannot perfectly predict the dependent variable. They are complete opposites.
-.50 to -.99	Redundantly Negative	The two variables are obviously are not measuring the same concept.
-.40 to -.50	Extremely Strong	Either an extremely negative relationship or the two variables are not measuring the same concept equally.
-.35 to -.40	Very Strong	Extremely negative.
-.30 to -.35	Strong	Strongly negative.
-.25 to -.30	Moderately Strong Negatively	Generally negative.
-.20 to -.25	Moderately Negatively	Moderately negative.
-.15 to .20	Weak Negative	Minimally negative.
.00 to-.15	Very Weak Negative	Weakly negative.
0.00	No Relationship	Knowing the independent variable does not help in predicting the dependent variable.
.00 to .15	Very Weak	Not generally acceptable.
.15 to .20	Weak	Minimally acceptable.
.20 to .25	Moderate	Acceptable.
.25 to .30	Moderately Strong	Desirable.
.30 to .35	Strong	Very Desirable.
.35 to .40	Very Strong	Extremely Desirable.
.40 to .50	Worrisomely Strong	Either an extremely good relationship or the two variables are measuring the same concept.
.50 to .99	Redundant	The two variables are probably measuring the same concept.
1.00+	Perfect Relationship.	The independent variable can perfectly predict the dependent variable.

Table 5.Interpreting the Value of the Level of Association between Trichotomous x and y Variables for the Cramér's V Reliability Index for the Osler–Waden Instrument © Based Upon the Tri–Squared Standardized Residuals

	a_1	a_2	a_3
b 1	+0.76	0.00	– 0.76
b 2	-0.87	+0.17	+0.7
b 3	-1.60	-0.16	+1.76

Table 6. Tri–Squared Standardized Residuals

[χ^2]):

Cramér's V for this research study is computed by taking the square root of the calculated Chi–Square statistic divided by the sample size and the length of the minimum dimension ("k" is the smaller of the number of Rows = "r" or Columns = "c"). V is calculated by first calculating chi-square, then using the following calculation: = Cramér's V. V is calculated by first calculating Chi–Square, then using the following calculation:

Cramér's V = $\sqrt{\chi^2 - [n(k-1)]}$

Where,

χ^2 = Chi–Square; and

k = the number of rows or columns in the table.

Results

- Tri–Squared Calculated Value = 8.131
- Tri–Squared Degrees of Freedom = 4
- Tri–Squared Probability = 0.0869
- Cramér's V Calculated Value = 0.163

Percentage deviation and standardized residual (Tables 4-6) are both measures of the degree to which an observed Tri–Squared cell frequency differs from the value that would be expected on the basis of the null hypothesis.

The standardized residual for a cell in a Tri–Squared table is a version of the standard normal deviate, "z_{Tri}", calculated as follows:

$$z_{Tri} = \frac{Tri_x - Tri_y}{\sqrt{Tri_y}}$$

Where,

z_{Tri} = The Tri–Squared Calculated Standard Normal Deviate;

Tri_x = Trichotomous Qualitative Outcomes; and

		Independent Variables			Results:
Crosstabulation of Variables		Categorical Variable 1 = a1	Categorical Variable 2 = a2	Categorical Variable 3 = a3	=
Dependent Variables	Outcome Variable 1 = b1	48	43	38	129
	Outcome Variable 2 = b2	2	4	5	11
	Outcome Variable 3 = b3	1	4	8	13
Results:	=	51	51	51	153

Table 7. Goodman & Kruskal's Lambda (λ) Tri–Squared

Tri_y = Trichotomous Quantitative Outcomes.

Assuming the null hypothesis to be true, values of the standardized residual belong to a normally distributed sampling distribution with a mean of zero and a standard deviation of ±1.0.

Goodman & Kruskal's Lambda (λ) Tri–Squared Results

Goodman & Kruskal's Lambda (λ) is a cross tabulation analysis measure of proportional reduction in error. Lambda indicates the extent to which the modal categories and frequencies for each value of the independent variable differ from the overall modal category and frequency. The Goodman-Kruskal Values for Lambda range from zero (indicating that there is "no association" between independent and dependent variables) to one (indicating a "perfect association" between independent and dependent variables). It is calculated with the following equation:

$$\lambda = \frac{\varepsilon_1 - \varepsilon_2}{\varepsilon_1}$$

Where,

ε_1 = is the overall non–modal frequency; and

ε_2 = is the sum of the non–modal frequencies for each value of the independent variable (Tables 7-9).

Conclusion

The purpose of this study was to determine if the initial research outcomes were valid through the use of the Tri–Squared Test as follow–up to the initial Meta–Cognitive Analysis as an advanced statistical measure to determine the impact of academic technical solutions called: Ninth Grade Academies, Freshman Academies, and similar models upon ninth grade minority student achievement.

Lambda (λ) for Predicting	Standard Error	.95 Confidence Interval Limits Upper	Lower
a from b:	0	—	—	—
b from a:	0.098	0.0559	0	0.2075

Table 8. Goodman & Kruskal's Lambda (λ) Tri–Squared Results: Index of Predictive Association

a without knowledge of b:	0.8431
a from b:	0.8431
b without knowledge of a:	0.3333
b from a:	0.3987

Table 9. Estimated Probability of Correct Prediction when Predicting

This study also examined the impact of Smaller Academic Learning Communities such as Ninth Grade Academies, Freshman Academies, and similar models on attendance rates, dropout rates, retention rates, and the success rate on end of course or high stakes tests, the graduation rates and overall success of minority ninth grade students as they begin their high school careers. As a result this research study it was determined that the research participants for the most part agreed that 9th Grade Academies, Centers, and Center Models were effective in their respective schools (thus, validating the research outcomes of the initial research study). The Tri–Squared Analysis yielded the final outcome of the research hypothesis test: the null hypothesis (H_0) is rejected at $p > 0.975$ is 0.484 because the Tri–Squared Test Critical Value of $0.484 < 8.131$ the Calculated Tri–Squared Test Value. This outcome is supported by the final results of the Chi–Square analysis in the initial study. Thus, the rejection of the initial research Null Hypothesis can be supported and it can be accurately stated that 9th Grade Academies, Centers, and Center Models do have a perceived (by professionals who engage in the implementation of these models) and an actual effect on At–Risk student academic success and retention. Thus, the initial research and its associated outcomes are validated and the results of additional statistical measures provide support and more insight into the efficacy of the researcher designed instrument used in the research investigation.

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ABOUT THE AUTHORS

A native of North Carolina, James Osler was born and raised in the City of Medicine. An accomplished artist, Osler enjoys using art as a tool to empower others. He completed his B.A. at NCCU with a concentration in Studio. Osler adores teaching. He has always been interested in how information is delivered and continues to explore the many different methods, models, and modes of instruction. After completing a M.A. in Educational Technology he completed a doctorate in Technology Education at North Carolina State University (NCSU). He has authored a series of books and e-books on the creation of empowering entrepreneurial educational experiences. His research focuses on Fundamental Christian Education from the holistic perspective of Qualitative and Quantitative Instructional Design (Osler, 2010). He has authored the Online Graduate Program in Online Instructional Design that is currently a part of the Online Educational Technology Program in the NCCU School of Education. His interests include: a life filled with a love of Almighty GOD and ministry to his fellow man through: teaching, the research, and service. He has been awarded two of the highest honors at NCCU as an employee and as faculty: The Employee Recognition Award for Outstanding Service in 2001 and The University Award for Teaching Excellence in 2008.

Rev. Dr. Carl Waden is a native of High Point, North Carolina. Rev. Waden attended the public schools of High Point and is a graduate of High Point Central High School. He is an advocate for social justice and education. He has taught in the Durham (North Carolina: NC) Public School System at James E. Shepard Magnet Middle School. Waden also served as an Assistant Principal at Southern Lee High School in Sanford, NC, and Assistant Principal at Eastern Alamance High School in Mebane, North Carolina. Waden attended Shaw University Divinity School and received his Doctorate of Education degree from Southeastern Baptist Theological Seminary, in Wake Forest, NC. Currently, Reverend Waden serves as the Union President of the Wake Missionary Baptist Association, is a member of the Raleigh Interdenominational Ministerial Alliance of Wake County, and is the Pastor of Mount Pleasant Baptist Church in Raleigh, NC. Recently, Rev. Waden was conferred the Honorary Doctor of Divinity Degree from Eastern Carolina Christian College and Seminary, located in Roanoke Rapids, North Carolina. Waden is a faculty member of Christian Education and History in the Certificate and Doctor of Ministry Programs at Eastern Carolina Christian College and is an Adjunct Professor of History at Southeastern Baptist Theological Seminary.