TRANSFORMATIONAL RESEARCH ENGINEERING: RESEARCH DESIGN METRICS FOR IN–DEPTH AND EMPOWERING K–12 TEACHER PROFESSIONAL DEVELOPMENT

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ABSTRACT

This paper discusses the implementation of the Tri–Squared Test as an advanced statistical measure used to verify and validate the research outcomes. This type of statistical measure is ideal for teachers professional development as educators can create and validate instruments for educational settings. The initial research investigation published in i-manager's Journal on School Educational Technology determined that these types of research on academic programs provide an active solution that validates in–depth educational researches by teachers to positively impact the educational settings. The research methodology used in this paper further validates the outcomes of an initial study that used Meta–Cognitive Analysis followed up by an in–depth Tri–Squared Test on that same area to determine the reliability of educator–based investigative inquiry. This advanced approach to data analysis is a transformative mixed methods research design that involves the in–depth comparison and transformation of qualitative outcomes into quantitative data.

Keywords: 9thGrade Freshman Academies, Algorithmic Model, Algorithmics, At–Risk, Cartesian Coordinates, Centers, Center Models, Drop–Out, Geometric Vectors, Mathematical Models, Meta–Cognitive Analysis, Research Engineering, Triangulation, Trichotomy, Tri–Squared, Tri–Squared Test and Vectors.

INTRODUCTION

One of the most challenging areas of research in education involves the construction of specific instruments that are designed to measure qualitative outcomes and data. Although there are a great many measurement tools that analyze the cognitive and psychomotor domains, there remains a vacuum in the number of instruments especially designed to accurately measure the affective domain (the learning domain that contains attitudes, opinions, emotions, perception, and perspectives). This void is further expanded when the specific event under investigation is unique, specialized, has specific characteristics, serious legal constrictions, and issues regarding time. This often requires the research investigator to design an instrument that ideally measures the variables under investigation.

The process of designing instruments for the purposes of assessment and evaluation is called "Psychometrics". Psychometrics is broadly defined as the science of psychological assessment (Rust and Golombok, 1989).The Tri–Squared Test pioneered by the author, factors into the research design a unique event–based "Inventive Investigative Instrument". This is the core of the Trichotomous–Squared Test. The entire procedure is grounded in the qualitative outcomes that are inputted as Trichotomous Categorical Variables based on the Inventive Investigative Instrument. The specific assessment of the variables is completely dependent upon the outcomes determined by the researcher's instrument. The creation, production, and deployment of the trichotomous Inventive Investigative Instrument requires that the research investigator adopt the role of a "Trichotomous Psychometrician". A "Trichotomous Psychometrician" is an Educational Scientist that uses trichotomous–based psychometrics to develop a qualitative Inventive Investigative Instrument specifically designed to capture qualitative responses during a specific event. A description of the entire Tri–Squared research process follows and is

described in detail to provide the reader of the precise steps undertaken in the process of developing, designing, and ultimately implementing an Inventive Investigative Instrument (Osler, 2013).

Defining the Field of Educational Science

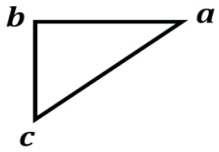
The field of "Education Science" is also represented by the term "Eduscience" which is a portmanteau of the two terms "Education" and "Science". Similar to the field of "Bioscience", Eduscience is the study of education wherein applicable sciences (such as ergonomics, statistics, technology, etc.) are applied to enhance and improve learning. The primary purpose of the field of Eduscience is the study and application of solutions to improve and enhance the learning environment and learning in general. Eduscience is solution–driven and is actively concerned with the transfer and dissemination of knowledge. Education Science is a broad field and its professionals are directly involved in the field. Those who are actively involved in Eduscience can be referred to as "Education or Educational Scientists". Educational Scientists or "Eduscientists" are multifaceted professionals who have a variety of areas of expertise. They can assume multiple roles in the educational environment and can serve in a variety of offices and in a multitude of capacities. The primary positions that Eduscientists assume are in the following areas: Administration (as Leaders, Organizational Heads, and Organizational Management Professionals), Instruction (as Teachers, Professors, and Facilitators), Practice (as Practitioners in a variety Specified Areas and Arenas), and Technology (as Educational Technologists, Instructional Technologists, and Information Technologists). In these positions Eduscientists effectively use, analyze, study, and deploy novel instructional learning theories, methodologies, strategies, solutions, tools, and techniques in both traditional or virtual (pedagogical and andragogical) settings to bring about learning (Osler, 2012).

The Triangulation Testing Model for the Tri–Squared Test

The Algorithmic Model of Triangulation is of the form:

Where,

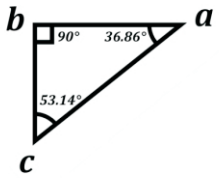
Vertex a =∠a = "authoring" = The Initial Tri–Squared Instrument Design;



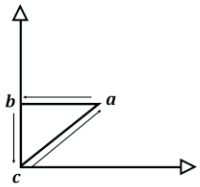
Vertex b =⌞b = "building" = The Tri–Squared Qualitative Instrument Responses; and

Vertex c =∠c = "conveying" = The Final Tri–Squared Test Outcomes in a Quantitative Report.

Thus, the Triangulation Model is symbolized by a Right Triangle written as: "◤abc" This symbol called "Trine" (meaning a group of three) is written mathematically as "◤=abc" and is simplified into the mathematic geometric expression: ◤abc (meaning "Triangulation Model abc" or more simply "Trine abc")



The angles have the following angular measurements in degrees: ∠a = 36.86, ⌞b = 90, and ∠c = 53.14, that all add up to the standard 180° of a traditional triangle (36.86° + 90° + 53.14° = 180°). The connective points (i.e., the lines between points a, b, and c respectively are geometric "vectors" (lines with both size [magnitude] and direction) making the model a systemic or cyclic process. This is illustrated in terms of Cartesian Coordinates as follows:



In terms of vectors, the Triangulation Model Right Triangle ◤abc is equal to three vectors that illustrate the movement in direction and magnitude from one completed task into another. The entire process is both cyclical and sequential with a "Trine Vector Equation" written as:

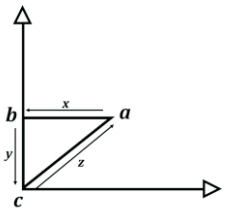
◤= [←x]→[↓y]→[↑z]

Defined as Trine = "Concentration of Vector x into Concentration of Vector y into Concentration of Vector z", which is simplified into a more standardized Trine Vector

Equation form written as:

$\nabla \overleftarrow{x} \rightarrow \overleftarrow{y} \rightarrow \overleftarrow{z} \rightarrow$

Where vectors x, y, and z respectively are indicated on the "Algorithmic Triangulation Data Model" as:



Indicating that the standardized form of the vectors x, y, and z are equivalent to the following geometric vectors that are the sequential Cartesian Coordinates relative to the size and magnitude of the research engineering phases that sequentially connect the respective angles a, ⌞b, and c. This is written as follows:

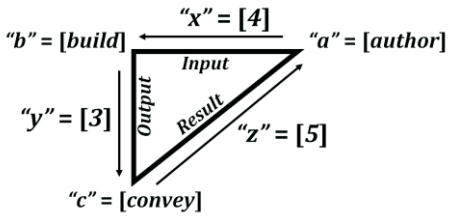
$\overleftarrow{x} = \overleftarrow{ab}$

$\overleftarrow{y} = \overleftarrow{bc}$

$\overleftarrow{z} = \overleftarrow{ac}$

The Complete Tri–Squared Algorithmic Triangulation Model

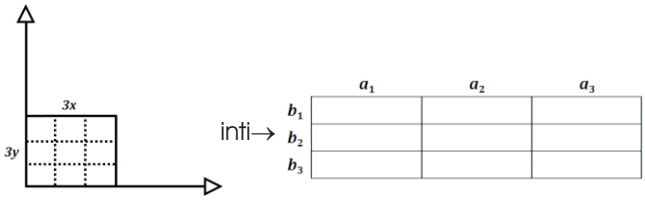
The three numeric Vector Operational Phases of the Triangulation Model are defined in the following manner:



The entire Triangulation Model as a Research Engineering methodology begins with a breakdown of the Trine [∇] Operational Research Engineering Parameters and Geometric Vectors in the following manner:

The Tri–Squared Triangulation Model Research Engineering Process (highlighting the Operational Parameters and Phases of the Tri–Squared Test)

Geometric Vertex a =a = "authoring" = The Initial Tri–Squared Instrument Design = Operational Parameter "a" = "author" = absolute value of a = "modulus a" = |a| = "Trine a" = ◤a = The creation of the Tri–Squared Inventive Investigative Instrument. This process can be seen in the following model:



This in turn, leads into [→] vector x = Geometric Vectorx = "← x" = $\overleftarrow{x} = \overleftarrow{ab}$ = The Initial Tri–Squared Instrument Construction = Operational Phases "x" = absolute value of vector x = "norm x" = ||x|| = "◤x" = ◤ab The creation of the Tri–Squared Inventive Investigative Instrument = The Pythagorean Triple of the Triangulation Model = "4" = The 4 Phases of Tri–Squared Inventive Investigative Instrument Construction which is composed of the following 4 Operational Phases:

1. a_0 = The Instrument Name (Asset Security Optional);

2. a_1 = Section 1 of the Research Instrument. Constructed from the first series of instrument items (a. through c.) derived from the research investigation questions as the Qualitative Trichotomous Categorical Variables (as the Initial Investigation Input Variables), evaluated via the Qualitative Trichotomous Outcomes (as the Resulting Outcome Output Variables = b_1, b_2, and b_3 respectively);

3. a_2 = Section 2 of the Research Instrument. Constructed from the second series of instrument items (d. through f.) derived from the research investigation questions as the Qualitative Trichotomous Categorical Variables (as the secondary Investigation Input Variables), evaluated via the Qualitative Trichotomous Outcomes (as the Resulting Outcome Output Variables = b_1, b_2, and b_3 respectively); and

4. a_3 = Section 3 of the Research Instrument. Constructed from the third series of instrument items (g. through i.) derived from the research investigation questions as the Qualitative Trichotomous Categorical Variables (as the tertiary Investigation Input Variables), evaluated via the Qualitative Trichotomous Outcomes (as the Resulting Outcome Output Variables = b_1, b_2, and b_3 respectively);

The table in Figure 1 provides the metrics for the construction of the Inventive Investigative Instrument following the parameters indicated in phases 1 through 4 of the first vector [$\overleftarrow{x} = \overleftarrow{ab}$ = 4] of the Triangulation Model

(Figure 1.):

This Tabular Triangulation Model can be fully exemplified in the aforementioned example provided by Figure 2.

Thus, Figure 2. is provided again (in an enlarged form) to illustrate a sample Inventive Investigative Instrument:

Where, the Operational Geometric Vector phases are defined respectively as:

a0=The Osler–Waden 9th Grade Academies, Centers, and Center Models Assessment Instrument ©;

a_1=Has the 9th Grade Academy, Center, or Center Model been;

a_2=Did the 9th Grade Academy, Center, or Center Model Result in the following;

a_3=How did the 9th Grade Academy, Center, or Center Model have an impact on the following;

b_1= Yes;

b_2= No; and

b_3= Missing

This is followed by:

Geometric Vertex b =∟ b = "build" = The Tri–Squared Qualitative Instrument Responses = Operational Parameter "b" = "build" = absolute value of b = "modulus b" = lbl = "Trine b" = ◤b = The effective deployment of the Tri–Squared Inventive Investigative Instrument elicit responses and aggregate the response data. This process can be seen in the following model (Figure 4.):

This defined in the first Operational Geometric Vector as (Figure 3). A Standard 3 × 3 Tri–Squared Table of Comprehensive Inputted Qualitative Research Responses would resemble the following model represented by Figure 5. Where, Tn = The Total Number of Responses (based upon

a0=	Inventive Investigative Instrument Name [Optional Asset Security]			
a1=	Section 1. Research Question One. The First Series of Questions from the Qualitative Trichotomous Categorical Variables are listed below.			
	Responses: [Select only one from the list.] ▶	b1	b2	b3
	a. Item One	..	..	..
	b. Item Two	..	..	..
	c. Item Three	..	..	..
a2 =	Section 2. Research Question Two. The Second Series of Questions from the Qualitative Trichotomous Categorical Variables are listed below.			
	Responses: [Select only one from the list.] ▶	b1	b2	b3
	d. Item Four	..	..	..
	e. Item Five	..	..	..
	f. Item Six	..	..	..
a3=	Section 3. Research Question Three. The Third and Final Series of Questions from the Qualitative Trichotomous Categorical Variables are listed below.			
	Responses: [Select only one from the list.] ▶	b1	b2	b3
	g. Item Seven	..	..	..
	h. Item Eight	..	..	..
	i. Item Nine	..	..	..

Figure 1. Construction of the Inventive Investigative Instrument

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?

B. 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?

C. 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 2. A Sample Inventive Investigative Instrument

a_0=	The Osler-Waden 9th Grade Academies, Centers, and Center Models Assessment Instrument © [with Asset Security = ©]				
a_1=	Has the 9th Grade Academy, Center, or Center Model been:				
	Responses: [Select only one from the list.] ▶		b_1 = Yes	b_2= No	b_3= Missing
	a. = 1.	Successful?	☐	☐	☐
	b. = 2.	Made a Difference?	☐	☐	☐
	c. = 3.	Aided in Retention?	☐	☐	☐
a_2=	Did the 9th Grade Academy, Center, or Center Model Result in the following:				
	Responses: [Select only one from the list.] ▶		b_1 = Yes	b_2= No	b_3= Missing
	d. = 4.	Positive Impact?	☐	☐	☐
	e. = 5.	Active Participation?	☐	☐	☐
	f. = 6.	Decline in Drop Out Rate?	☐	☐	☐
a_3=	How did the 9th Grade Academy, Center, or Center Model have an impact on the following:				
	Responses: [Select only one from the list.] ▶		b_1 = Yes	b_2= No	b_3= Missing
	g. = 7.	Positively Effect Standardized Testing?	☐	☐	☐
	h. = 8.	Increase Graduation Rate?	☐	☐	☐
	i. = 9.	Increase Attendance?	☐	☐	☐

Figure 3.The First Operational Geometric Vector

a one to one ratio of each Trichotomous Testing Input Variables contrasted directly with each Trichotomous Results Output Variable) in each of the individual cells of the Standard 3 × 3 Tri–Squared Table.

Where Figure 5. is defined as,

Ta1b1 = Total Number of Responses for Cell One in the Standard 3 × 3 Tri–Squared Table;

Ta2b1 = Total Number of Responses for Cell Two in the Standard 3 × 3 Tri–Squared Table;

Ta3b1= Total Number of Responses for Cell Three in the Standard 3 × 3 Tri–Squared Table;

Ta1b2= Total Number of Responses for Cell Four in the Standard 3 × 3 Tri–Squared Table;

Ta2b2= Total Number of Responses for Cell Five in the Standard 3 × 3 Tri–Squared Table;

Ta3b2= Total Number of Responses for Cell Six in the Standard 3 × 3 Tri–Squared Table;

Ta1b3 = Total Number of Responses for Cell Seven in the Standard 3 × 3 Tri–Squared Table;

Ta2b3 = Total Number of Responses for Cell Eight in the Standard 3 × 3 Tri–Squared Table; and

	a_1	a_2	a_3
b_1	a_1b_1	a_2b_1	a_3b_1
b_2	a_1b_2	a_2b_2	a_3b_2
b_3	a_1b_3	a_2b_3	a_3b_3

Figure 4. The process of Effective Deployment of the tri-squared Inventive Investigative

	a_1	a_2	a_3
b_1	$T_{a_1b_1}$	$T_{a_2b_1}$	$T_{a_3b_1}$
b_2	$T_{a_1b_2}$	$T_{a_2b_2}$	$T_{a_3b_2}$
b_3	$T_{a_1b_3}$	$T_{a_2b_3}$	$T_{a_3b_3}$

Figure 5. Total Number of Responses

Ta3b3 = Total Number of Responses for Cell Nine in the Standard 3 × 3 Tri–Squared Table;

This leads into [→] vector y = Geometric Vectory = "↓y" = y bc = The Initial Tri–Squared Instrument Construction = Operational Phases "y" = absolute value of vector y = "norm y" =Ilyll = "Trine y" = ◤y = The creation of the Tri–Squared Inventive Investigative Instrument = The Pythagorean Triple of the Triangulation Model = "3" = The 3 Phases of Tri–Squared Inventive Investigative Instrument Deployment which is composed of the following 3 Operational Phases:

1. Inventive Investigative Instrument Deployment;

2. Inventive Investigative Instrument Completion; and lastly

3. Inventive Investigative Instrument Data Aggregation;

An Example of Triangulation: The Inventive Investigative Instrument extracted from the initial Trichotomous Research Questions and Associated Categorical and Outcome Variables used in the Research Study.

In this sample research study, the researcher's Inventive Investigative Instrument items were derived from the aforementioned research questions and outcome variables. The instrument was used to obtain data from administrators as responses to research questions relating to the impact of Ninth Grade Centers, Academies or similar models on minority ninth grade students. The purpose of this instrument was to provide data from 9th Grade Academies, Centers, and Center Models for non–parametric Tri–Squared analysis. Data that was not responded to was reported as "Missing" (a separate Categorical Variable designed to report all research results). The Inventive Investigative Instrument was a qualitative method of data collection designed to accurately provide responses to carefully answer research questions. Ultimately, the research data analysis methodology (Tri–Squared) qualitatively and quantitatively determined the academic success of ninth grade students who participated in ninth grade centers or similar models at four year high schools in North Carolina based upon the research hypothesis. A sample Inventive Investigative Instrument containing all three outcome variables is provided to illustrate how the 3 × 3 Trichotomous Table is constructed from the Inventive Investigative Instrument

(Osler 2013).

Introduction to the Example Study

One of the most challenging dilemmas facing educators today is the elimination or reduction of dropout rates in North Carolina. The dropout rates in the North Carolina public schools have been a major concern of educators, parents and other stakeholders in preparing young people for future success in this ever-changing global society (Waden, 2011). High school is on absolute necessity for young people to have every opportunity to realize their dreams of competing in the job markets or acquiring 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 help ninth graders graduate in four years. Scholars and other stakeholders argue for educational change, mandating a call for more rigorous and relevant educational experiences for student learners in the classrooms of public high schools. Educators across the state of North Carolina have been creative and have employed innovative strategies in order to address the academic challenges faced by some minority ninth grade students. Educators need to recognize the enormity of the challenge and must make sound decisions when it comes to school reform; as one writer suggests, "We must summon the political will to demand changes if we are to be competitive in the global community" (Quint, 2008).

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 and said that the high school graduates were poorly prepared for entry-level jobs. The 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). Educators must do a better job in preparing young people for college or life after high school. One of the strategies that must be considered is to look at redesigning high schools so that students can acquire the necessary skills to compete in four year institutions or in the 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 the nation have been trying to operate school at a twentieth century pace without upgrading best practices. Most ninth grade courses retain the shape of former decades of outdated strategies and methods that is ineffective in today's classrooms (Quint, 2008). The right design features and polices can promote exceptional high schools on a broad scale" (Darling&Friedlaender, 2004).

Whatever direction school reform leads, there must be a mission to prepare students so that they can apply what they have learned to issues and problems they will face in the future. The aim should be to ensure that young people are prepared to face life with all its situations and possess the necessary skills to solve problems and find solutions to the challenges they will face in this ever changing complex global community. This study explored some recent strategies such as 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 of entering the ninth grade. According to statistical data taken from North Carolina Department of Public Instruction, out of the "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"(North Carolina Department of Public Instruction [NCDPI] website, 2011). The previous year was even worse with a graduation rate of 71.8 percent leaving school in five years from the 2003-04 cohorts. These startling statistics did not include those students with disabilities. According to a report released to the 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 and educators, parents, and other stakeholders must find ways to help increase these rates" (North Carolina Department of Public Instruction [NCDPI] website, 2011).

This 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 will also be 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 show minority students dropout rates exceeding the state average starting with American Indianstudent'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%. NC state wide results of the 4-year cohort graduation rate report the 2004-05 entering 9th graders graduating in 2007-08 or earlier as reported.

Subgroup information is based on data collected when a student is last seen in the 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. This complete dropout report and local school district numbers can also be found included in a table in chapter three. Local School Districts have to be creative with finding strategies to being high school students on track for graduation. There are some strategies considered, such as 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 NC Virtual Public School.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.Some high schools have created what is called Ninth Grade Models designed to help ninth graders make a better transition to high school. Models like ninth grade academies, also called ninth grade centers, will vary from school to school, but the aim is to help all ninth graders graduate within four years of entering the ninth grade. Educators have made great strides in recent years in an effort to close what is known as "the achievement gap." Ninth grade models are one such strategy designed to help close the gap and help ninth graders stay on track for graduation in four years. This project will explore related models that are currently in use in some high schools in the state of North Carolina (Osler &Waden, 2012).

Ninth Grade Academies, Centers, and Center Models

One of many strategies educators have employed in an effort to improve student achievement at the high school level are an academically technical intervention model called ninth grade models; these smaller learning communities are sometimes called freshman academies, ninth grade academies and other transitional strategies that had innovative intervention and technological solutions designed to help ensure that first year freshman (ninth graders) have every opportunity to be academically successful in all areas (and earn their diploma four years later). "The Talent Development High School program, supported by John Hopkins University describes a ninth grade academy as: "It is 'a separate transitional program providing for students in their first year of high school that places them with small interdisciplinary teams of 4 or 5 teachers who share the same 150 to 180 students and a block schedule with common planning time. This unit has its own part of the building with its own clearly labeled entrance, including the computer labs needed for ninth grade courses. A separate management team (the Academy Principal and Academy Instructional Leader) is in charge of the Ninth Grade Success Academy" (Partland, 2012). The author further points out that these academies' major responsibility was to "find solutions to individual student attendance, discipline, and learning problems which rest with the teacher teams, where each team leader uses regular data to set goals and monitor trends in student behavior"(Partland, 2012).

These intervention strategies lay a foundation for the last three years of the high school career. James Partland further identified several high schools with this ninth grade model of ensuring that students are giving every opportunity of making a successful transition during their first year of high school. Patterson High School in Baltimore Maryland was identified as a school that made great strides in increasing 9th grade student's chances of promotion to the 10th grade. The article goes on to explain how five Philadelphia inner-cities high schools that were involved in a transitional model of helping first year students in the ninth grade succeed and stay on track to graduate in four years with a diploma. Partland, points out some encouraging data about the success of these innovative strategies called ninth grade academies, ninth grade centers or similar models with the following:

1. Schools implementing the model for two or more years have seen their 9th grade attendance improve by fifteen percentage points, while the number of students with 90% or more attendance has doubled.

2. The number of students to reach the 11th grade in the first two schools to implement Talent Development has nearly doubled.

3. Across all five schools, course pass rates are up while suspensions, fires, and arrest are down.

4. A substantial number of students have begun to close achievement gaps in both reading and math. Nearly a third of the 9th graders, for example, have gained at least two years in mathematics.

These statistics are encouraging when it comes to analyzing data available about whether or not these innovative strategies do indeed make a positive impact upon student achievement beginning with ninth grade students. The source gives another reference about ninth grade models at Salem High School in Salem, Virginia. This school has implemented, what is known as "Freshman Transition Teams", designed to help incoming freshman to experience a successful transition from middle to high school. The website given for additional information is located at http://www.salem.k12.va.us/shs/. The article list some detail strategies that educators are implementing in order to ensure that students are successful during their first year transition to high school. Educators at Salem high school implemented several critical success strategies that contributed to the academic success of students in Salem Virginia that are listed below.

1. A team of teachers representing the core curriculum in areas such as English, Mathematics, Science and World History, in which they were to meet daily during a common planning period to standardized expectations, develop possible cross curriculum assignments, and when necessary have conference with students and/or parents.

2. Each student has the same four classes with the same four teachers, but not necessarily in the same order, ensuring that the student's peer interactions are varied from class to class.

3. The team has established a common system of class rules, procedures, and expectations.

4. The team works to identify common problems and to discuss solutions, such problems include, but not limited to classroom discipline and meeting the special needs of individual students.

5. General meetings of teachers of ninth grade students have been designed to help share ideas and strategies that could benefit a freshman.

The Salem high school in Salem, Virginia, used specific strategies in order to help their ninth graders have a smooth transition to high school. The article also gives a website whereby one can explore effective transition strategies designed to help Low-achieving Middle Grades Students succeed in high school. Many students find the transition from middle school to high school challenging because they lack the academic skills needed in order to compete at the high school level. Ninth grade academies, centers or similar models are designed for those students struggling to cope with the demands of high school. These strategies also can be viewed as a safety net in an effort of ensuring that there are support systems in place to help these students who are for the first time entering secondary education. This article identifies fifteen examples of transitional programs that work in raising academic achievement and keeping students in school. There are other strategies listed by the article such as "summer school for incoming freshman, multiyear programs in the middle

grades to accelerate achievements; double doses of English and Mathematics in grade nine; programs that provide extra help and extra time; academics and small learning communities of students within a school; a special school to prepare ninth graders for high school; and assignments of the best teachers to plan and lead the transition initiative".

The article gives specific strategies for effective transition from various schools across the country; for an example, POLYTECH High School in Woodside, Delaware, requires all incoming ninth graders who have scored well below state standards on the eighth grade assessment to attend a special summer program that emphasizes mathematics and reading. Tri County Regional Vocational Technical School in Franklin, Massachusetts, organized a summer academy to help incoming freshman raise their academic skills and adjust to the expectations of high school. Freshman at South Grand Prairie High School in Texas take a special 12 week course to get off to a good start in the first semester of high school. Taught by the school's best teachers, this course is reducing the number of freshmen who are retained. Rockcastle County High School and Rockcastle County Middle School in Kentucky work together on a yearlong support program for eight graders considered to be at risk of failure or dropping out. The support class for at risk students at Lemon Bay High School in Englewood, Florida, is showing results in terms of retention and achievement. The freshman academy at Henry County High School in Kentucky focuses on English, Mathematics and Science. There are other special schools designed to prepare students for high school and beyond, they use separate buildings for spaces allowed, where ninth graders can focus on their academic studies in the first year of high school. This strategic plan of utilizing the freshman academy can certainly help ninth grade student's transition to high school thereby building a good academic foundation for success. Researchers have identified the transition into high school as a crucial time in a student's life (Kelly, 2010).

In the 2008 article "Easing The Transition To High School, the authors Cook, Fowler and Harris state, "That ninth grade is a major transition year where twenty five percent of students in the ninth grade are held for another year" (Cook, Fowler, and Harris, 2008). The aim is to improve student performance and decrease retention rates that have emerged over the last four decades. One such strategy that is utilized by many schools in North Carolina is the implementation of Ninth Grade Academies, "these academies provide incoming ninth students with additional resources and personalized support to overcome transitional obstacles'" (Cook, Fowler, and Harris, 2008). Cook, Fowler and Harris contend "designing catalog data on all existing Ninth Grade Academies in North Carolina and then analyzing the comprehensive catalog to determine their impact on student retention, non-promotion, and student proficiency". The article also points out that that over the last "thirty years the national average for ninth grade non-promotion has more than tripled from four percent to thirteen percent. This retention creates what is termed a "Ninth Grade Bulge" and "tenth grade dip" as fewer students are promoted to the next grade. The state wide data in North Carolina indicate the non-promotion rate for students in 2004-2005 was fourteen percent, a significant leap from eight point four percent thirty years ago". The rising numbers of non-promotions both nationally and locally has become a critical focus pointamong all educators. Statistics indicate that "the importance of creating Ninth Grade Academies, centers or similar models, as schools with operational transition programs reflect a dropout rate of only eight percent on average compared to schools without transition programs at an average of twenty four percent, three times higher (Cook, Fowler and Harris, 2008).

According to the literature on ninth grade academies a more simple definition is given as "A Ninth Grade Academy is defined as a yearlong, uniquely designed school program that provides ninth graders with the resources and support they need. According to Cook, Fowler and Harris, secondary educators can be creative in the use of various ninth grade models designed to support ninth grade students in their academic goals". Fowler and Harris identified three leading models of smaller learning communities, particularly ninth grade academies or similar models and they are "High Schools That Work" (HSTW), secondly, Career Academies and The Talent Development

model. The first model "High Schools That Work is developed from the Southern Regional Education Board initiative that is dedicated in obtaining 85% of career bound high school students to complete a rigorous course of study and to meet or exceed the High School Work performance goals in mathematics, reading and science" (www.sreb.org). The model was developed for the entire school population; several schools are using HSTW as a framework for implementing Ninth Grade Academies (Cook, Fowler and Harris, 2008).

Career Academies are defined as "schools within schools that connect students with peers, teachers, and community partners in a controlled environment which fosters academic success and improved mental and emotional health. The career academy concept encompasses three key elements which include: small learning communities; a college preparatory curriculum with a career focus and collaborations with employers, community members and higher education facilities" (Dedmond, 2008). Career Academies are designed to engage students in a rigorous academic curriculum that will make their high school experience and future career aspiration relevant thereby motivating the student to stay in school and graduate with the necessary skills and disposition for success.

The third strategy is called "The Talent Development model that is designed to transform school facilitation and structure by providing a revised plan for management, organization, and curriculum and to provide professional development for faculty". The model is a solution for schools that have problems with student's attendances, discipline, achievement scores and dropout rates (Balfanz, R. Legters, N., & Jordan, W. 2004). Talent Development models of design is certainly one of the emerging strategies School systems are using in creating smaller learning communities. These transitional strategies are designed to help ninth grade students to be successful academically and remain on track for graduation four years later. The contention for implementing Ninth Grade or Freshman Academies, centers, or other similar models indicates great flexibility for academic success. There are "four themes that emerge as critical ingredients for sustaining smaller learning communities and they are "Authentic Learning Communities, Personalization, Rigorous and Relevant Instruction, and Professional Learning and Collaboration". Cook, Fowler, and Harris contentions were that these ingredients are imperative in sustaining smaller learning communities because "Authentic Learning experiences are necessary for students to be able to connect their learning in school to the outside world beyond the classroom. The scholars provide ideal examples such as internships, community outreach, college and business partnerships and research projects that require students to be knowledgeable of and investigate societal challenges". Personalization is needed for students to receive the kind of one on one attention many may need, also this concept involves smaller class sizes, more classroom based staff and student teacher interaction and communication with parents. This incorporated with rigorous and relevant instruction is a strategy that enables students to overcome the barriers often associated with race, poverty, language or initially low academic skill. Authentic learning experiences, personalization and relevant instruction work interdependently with one another, promoting a greater chance to engage students academically. Professional learning and collaboration provides for teachers an opportunity for them to collaborate and gain insights from one another, especially when it comes to curriculum and instructional design. This strategy builds morale among teachers and helps transcend the learning environment, which will ultimately benefit the students (Cook, Fowler, and Harris, 2008).

Research Methodology of the Initial Study

This study examined the impact of ninth grade models on the success of At–Risk minority students in North Carolina. A specific researcher designed instrument was created and delivered to the sample. The data was recorded qualitatively and quantitatively. The data was then analyzed using a novel mixed method approach called: Meta–Cognitive analysis. The Meta–Cognitive data analysis method was pioneered by educational scientists Marsh and Snell (Snell & Marsh, 2003). Interviews were conducted with key school personnel such as principals,

assistant principals, and other stakeholders 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:

a. Initial Research Assumptions: (1) The literature researched is assumed to be accurate and true data taken from reports of the North Carolina Department of Public Instruction web site, including data retrieved from local Education Associations and specific schools included in the study; and (2) The data will accurately reflect 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 of minority ninth grade students.

b. Initial Research Limitations: Participants of this study came from the minority high schools that the had been active ninth grade academies or similar models in central North Carolina. The study was limited to the 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.

c. 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. This research provides data on ninth grade centers and models as 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.

d. 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.

e. Initial Research Hypotheses: H0: 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 H1: 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.

f. Initial Research Instrument: The investigators used interviews derived from a novel researcher–designed "Disposition Assessment Instrument" (Figure 1.). 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 high school personnels: 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 from 9th Grade Academies, Centers, and Center Models for non–parametric quantitative data analysis. Data that was not responded was reported as "Missing" (a separate Categorical Variable designed to report all research results). The instrument was qualitative in nature and analyzed quantitatively to accurately statistically analyze the level of significance of participant's responses to the research questions (Figure 2.).

Results of the Initial Study

The research methods used in this study to analyze the data were a combination of qualitative (as assessment–based 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 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 $7.779 < 71.57$ 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 $7.779 < 71.57$ 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 in strument.

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. 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. It was this data which initially prompted the researchers to seek out effective technical models to meet this highly critical component that is a prominent At–Risk need. The Tri–Squared Test follows as an advanced statistical measure to analyze the aforementioned results of the initial research investigation.

Results of the Follow Up Study: The 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

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

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 (nTri = 17 with 17 × 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 analysis procedure in tabular format (see Tables 1 and 2 respectively).

Qualitative Outcomes of the Tri–Squared Test

data 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: $\boldsymbol{a_1}$= Successful via: Impact, and Positive Testing [the summation of the outcomes of the assessment instrument item 1]; $\boldsymbol{a_2}$= Made a difference via: Participation, and Graduation Rate [the summation of the outcomes of the assessment instrument item 2]; and $\boldsymbol{a_3}$= 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: $\boldsymbol{b_1}$ = Yes; $\boldsymbol{b_2}$ = No; and $\boldsymbol{b_3}$= Unknown. The Inputted Qualitative Outcomes are reported as follows:

The Tri–Square Test Formula for the Transformation of Trichotomous Qualitative Outcomes into Trichotomous Quantitative Outcomes to determine the validity of the

TRICHOTOMOUS CATEGORICAL VARIABLES

$n_{Tri} = 17$
$a = 0.975$

TRICHOTOMOUS OUTCOME VARIABLES	a_1	a_2	a_3
b_1	48	43	38
b_2	2	4	5
b_3	1	4	8

Table 1. Qualitative Outcomes of the Tri–Squared Test

research hypothesis:

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

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

Table 1 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 α = 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 1 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 1 shows that participants primarily and overwhelmingly selected the "Yes" Categorical Variable ($\boldsymbol{a_1b_1}$ = 48, $\boldsymbol{a_2b_1}$ = 43, and $\boldsymbol{a_3b_1}$ = 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 2 follows and provides the outputed quantitative outcomes of the Tri–Squared Test.

Quantitative Outcomes of the Tri–Squared Test

data analyzed using the Trichotomous–Square 3x3 table designed to analyze the research questions from an Inventive Investigative Instrument with the following Trichotomous Categorical Variables: $\boldsymbol{a_1}$= Successful via: Impact, and Positive Testing [the summation of the outcomes of the assessment instrument item 1];$\boldsymbol{a_2}$= Made a Difference via: Participation, and Graduation Rate [the summation of the outcomes of the assessment instrument item 2]; and $\boldsymbol{a_3}$= 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: $\boldsymbol{b_1}$ = Yes; $\boldsymbol{b_2}$ = Negative No; and$\boldsymbol{b_3}$ = Unknown. The Outputted Quantitative Outcomes are reported as follows:

The Tri–Square Test Formula for the Transformation of

Trichotomous Qualitative Outcomes into Trichotomous Quantitative Outcomes to determine the validity of the research hypothesis:

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

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

Table 2 illustrates the quantitative mathematical application of the Trichotomous–Squared ("Trichotomy–Squared", "Tri–Squared" or "Tri–Square") statistical analysis procedure (Osler, 2012). The results are: 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 2 illustrates and validates the process of transforming qualitative data into quantitative data as a means of in–depth mixed methods for the purpose of discrete data analysis. The Table 2 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 2 data displays that participants primarily and overwhelmingly selected the "Yes" Categorical Variable ($a_1b_1 = 43$, $a_2b_1 = 43$, and $a_3b_1 = 43$) 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.

$n_{Tri} = 17$
$a = 0.975$

TRICHOTOMOUS OUTCOME VARIABLES	TRICHOTOMOUS CATEGORICAL VARIABLES a_1	a_2	a_3
b_1	43	43	43
b_2	3.67	3.67	3.67
b_3	4.33	4.33	4.33

Table 2. Quantitative Outcomes of the Tri–Squared Test

Discussion of Results: Validity and reliability of the Tri–Squared Test [validating the research study Battery of Instruments: Omnibus Post Hoc Statistical Measures conducted using Standardized Residuals and Goodman &Kruskal's Lambda (λ) Post Hoc Instrument Contingency Statistical Measures. Results: (1.) Tri–Squared Calculated value = 8.131; (2.) Tri–Squared Degrees of Freedom = 4; and (3.) Tri–Squared Probability = 0.8415

The Tri–Squared Percentage Deviation and Standardized Residuals are both measures of the degree to which an inputed Tri–Squared cell incidence differs from the value that would be outputed (or transformed after the Tri–Squared Test calculation) there by providing the basis for the acceptance or rejection of the null hypothesis (H_0) Table.3

Interpreting the value of the level of association between Trichotomous x (Input) and y (Output) variables via the reliability index forThe Osler–Waden 9th Grade Academies,

	a_1	a_2	a_3
b_1	+10.5%	–1.2%	–11.6%
b_2	–31.8%	–4.5%	+36.4%
b_3	–76.9%	–7.7%	+84.6%

Table 3. Calculated Tri–SquaredPercentage Deviations

Level Of Association	Verbal Description	Comments
-1.00+	Perfect Negative	The
-.50 to -.99	Redundantly	The
-.40 to -.99	Extremely Strong	Either
-.35 to -.40	Very Strong	Extremely
-.30 to -.35	Strong	Strongly
-.25 to -.30	Moderately	Generally
-.20 to -.25	Moderately	Moderately
-.15 to -.20	Weak Negative	Minimally
.00 to -.15	Very Weak Negative	Weaklynegative
0.00	No Relationship	Knowing
.00 to .15	Very Weak	Not
.15 to .20	Weak	Minimally
.20 to .25	Moderate	Acceptable
.25 to .30	Moderately Strong	Desirable
.30 to .35	Strong	Very
.35 to .40	Very Strong	Extremely
.40 to .50	Worrisomely Strong	Either
.50 to .99	Redundant	The
1.00+	Perfect Relationship.	The

Centers, and Center Models Assessment Instrument © based upon the Tri–Squared Standardized Residuals:

The standardized residual for a cell in a Tri–Squared table is a version of the standard normal deviate, "zTri", (a transformation of the non–normal Tri–Squared Distribution into a "normal Tri–Squared Distribution" with a mean of zero

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

where,

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

Tri_x = Trichotomous Qualitative Outcomes; and

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.

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

where,

ε_1 = is the overall non–modal (non–frequent) incidence (frequency of a variable occurring in a given cell); and

ε_2 = is the sum of the non–modal frequencies for each value of the independent variable (Trichotomous Categorical Variables 1–3).

Goodman &Kruskal's Lambda (λ) Tri–SquaredTable

Discussion of Results

The Tri–Squared Test in this study was used as an advanced statistical research measure to determine if the research questions and outcomes were valid as designed and triangulated in the research instrument. The research instrument [The Osler–Waden 9th Grade Academies, Centers, and Center Models Assessment Instrument] was developed to conduct in–depth qualitative interviews with academicians that participated in the research investigation. The sample size was relatively small (nTri = 17) due to the number of North Carolina public schools that had implemented 9th Grade Academies, Centers, and Center Models at the time the study was conducted. The Tri–Squared Test calculations factor in sample sizes that are small and large into the test. This allows researchers to conduct research unique to individual case studies upto larger institutions. Thus, the Tri–Squared Test is ideally suited for the unique conditions attributed to socio–behavioral research investigations. The results of this study clearly illustrates that the 9th Grade Academies, Centers, and Center Models are effective and make a difference in the schools were they are actively in use. As an advanced statistical measure, the Tri–Squared Test analyzed education administrator outcomes based upon the demographics of student populations deemed "At–Risk" by the state of North Carolina. In terms of their respective perspectives regarding the overall effectiveness of 9th Grade Academies, Centers, and Center Models on the three distinct Trichotomous Categorical Variables the academicians interviewed were clearly positive in their

	a_1	a_2	a_3
b_1	+0.69	–0.08	–0.76
b_2	–0.61	–0.09	+0.70
b_3	–1.60	–0.16	+1.76

Table 4.

Crosstabulation of Variables		Independent Variables Categorical Variable 1 = a1	Categorical Variable 2 = a2	Categorical Variable 3 = a3	Results: =
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 5. Goodman &Kruskal's Lambda (λ) Tri–SquaredTable

Lambda (λ) for Predicting		Standard Error	.95 Confidence Interval Limits Upper	Lower
a from b:	0	—	—	—
b from a:	0.0980	0.0985	0	0.2912

Table 6. Goodman &Kruskal's Lambda (λ) for the Tri–Squared TestResults: The Index of Predictive Tri–Squared Test VariableAssociation

without	0.8431
knowledge of	0.8431
knowledge of	0.3333
from	0.3987

Table 7. Estimated Probability of Correct Prediction when Predictingthe Tri–Squared TestResults by Trichotomous Input Categorical and Outcome Variables

respective comments (Yes for Categorical Variables: a1b1 = 48, a2b1 =43, and a3b1 = 38 with Grand Total = 129 for all positive items). The Categorical Variables were: a1= successful via: Impact, and Positive Testing [the summation of the outcomes of the assessment instrument item 1]; a2= Made a difference via: Participation, and Graduation Rate [the summation of the outcomes of the assessment instrument item 2]; and a3= Aided in Retention via: Drop Out Rate. The Tri–Squared statistical analysis rejected the null hypothesis via the Tri–Squared hypothesis test which yielded the following results: [The Tri–Squared Test critical value]=0.484 < 8.131 = [The Calculated Tri–Squared Test Value]. Thus, there was enough evidence to reject H0 atp > 0.975 is 0.484. These results in Table 5-7 illustrate that there is a significant difference in the perceptions of the research participants regarding the overall effectiveness of 9th Grade Academies, Centers, and Center Models as determined by the Tri–Squared Test instrument in terms of: (1.) Success according to: Overall Impact and Positive Testing; (2.) Made a difference according to: Student Participation and Assessment of Reported Graduation Rate; and (3.) Aided in Retention as reported by a lowering of the reported Drop Out Rate.

Conclusion

The purpose of this paper is to provide further support for the design of specific psychometric instruments in educational research (specifically the novel field of "Education Science") by examining how the Tri–Squared Test is triangulated. The Tri–Squared Test Algorithmic Model and associated Statistical Methodology were provided to illustrate and display how this method can be put to use both practically and rapidly. The Total Transformative Trichotomy–Squared Research Design Methodology is universally applicable in–depth investigative procedure that is an ideal way of examining the unique, diverse, and many times specialized procedures inherent to a variety of research models and investigative inquiry. Qualitative outcomes can be transformed into measurable quantitative outcomes to determine the outcome of research hypotheses. Both qualitative and quantitative methods are seamlessly incorporated into a unified data analysis methodology that delivers a reporting procedure that specifically aligns with the initial research objectives, hypothesis, and variables of the investigator.

The novel field of "Educational Science" with the associated Tri–Squared Test was provided as the ideal environment that supports and validates the use of "Trichotomous Psychometrics" as a means of producing event–specific trichotomous instrumentation. Further support was provided through a research study that used a trichotomous instrument to determine the impact of Ninth Grade Academies, Freshman Academies or similar models upon ninth grade minority student achievement. The study provided an ideal example of just how effective trichotomous psychometric instruments are and how they can be used as qualitative data gathering instruments in a research study. Ultimately, the example study determined that 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 Tri–Square analysis which yielded the following: A Critical Tri2 value of 0.484 < 8.131 the Calculated Tri2 value. Thus, the research null hypothesis was rejected and it can therefore 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 (Osler, 2013). This research methodology provides educators with an advanced approach to data analysis that is an ideal transformative mixed methods research design that allows the the in–depth comparison and transformation of qualitative outcomes into quantitative data. As more and more educators use these tools through professional development and educational enquiry they will mature into dynamic Education Scientists who positively impact the field of learning now and in the future.

References

[1]. Balfanz, R. &Legters, N. (2004). *Locating the dropout crisis: Which high schoolsproduce the nation's dropouts?* Baltimore: John Hopkins University Centerfor the Social Organization of Schools.

[2]. Cook, C., Fowler, H., and Harris T. (2008). *Ninth Grade Academies. Easing TheTransition To High School.* Retrieved fromhttp://www.ncpublicschools.org/intern-

research/reports

[3]. Darling, N.&FriedlaenderD. (2004). Creating Excellent and EquitableSchools, *Educational Leadership* (5) 14-21.

[4]. Dedmond, R.M. (2008). Launch students into their decade of transition. Techniques: *Connecting Education and Careers*, 83(4), 14-19. Retrieved June 22, 2010 from ERIC, Article No. EJ790422.

[5]. Donegan, Billie. (2008). The Linchpin Year. *Educational Leadership* 65 (8): 54-56.

[6]. Gough-Perkins, D. (2005). The Adolescent Learner: Fixing High Schools *Educational Leadership* 62 (7): 88-89.

[7]. Kelly, K. (2010). *Freshman Academies: A Study of Student Outcomes.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses.(AccessionOrder No. AAT3440881). North Carolina Department of Public Instruction [NCDPI] (2011) websites:

[8]. http://newschoolsproject.org/page.php?p=2.5

[9]. http://www.dpi.state.nc.us

[10]. http://www.ascd.org/publications/newsletters/infobrief/ winter07/num48/toc.aspxat http://www.ncpublicschools.org/research/dropout/reports

[11]. Osler, J. E. (2013). The Psychometrics of Educational Science: Designing Trichotomous Inventive Investigative Instruments for Qualitative and Quantitative for Inquiry. December 2012 – February 2013 *i-manager's Journal on Educational Psychology.* Vol. 8, No. 3.

[12]. Osler, J. E. (2013). The Psychological Efficacy of Education as a Science through Personal, Professional, and Contextual Inquiry of the Affective Learning Domain. February – April *i-manager's Journal on Educational Psychology*. Vol. 6, No. 4.

[13]. Osler, J. E. (2012). Trichotomy–Squared – A novel mixed methods test and research procedure designed to analyze, transform, and compare qualitative and quantitative data for education scientists who are administrators, practitioners, teachers, and technologists. July – September, *i-manager's Journal on Mathematics.* Vol. 1, No 3.

[14]. Osler, J. E. and Waden, C. (2012). Using innovative technical solutions as an intervention for at risk students: A meta–cognitive statistical analysis to determine the impact of ninth grade freshman academies, centers, and center models upon minority student retention and achievement. September – November *i-manager's Journal on School Educational Technology.* Vol. 7, No 3.

[15]. Partland, James M. (2012). *Talent Development High School Program* Center for Research on the Education of Students Placed At Risk. John HopkinsUniversity, Baltimore, Maryland http://www.csos.jhu.edu/talent/high.html

[16]. Rust, J. &Golombok, S. (1989). *Modern psychometrics: The science of psychological assessment* (2nd ed.). Florence, KY, US: Taylor & Frances/Routledge.

[17]. Quint, J. (2008). Reshaping High Schools: Lessons from Leading Models, *Educational Leadership*, 65(8), 64-68.

[18]. Snell, J. C. & Marsh M. (2003). Meta–cognitive analysis: an alternative to literature reviews and meta–analysis for the sciences and the arts. *Education*, Vol. 124.Winter, 2003.

[19]. Waden, Carl (2011). *"The Impact of Freshman Academies Upon Ninth Grade Minority Student Achievement"*.Southeastern Baptist Theological Seminary, Wake Forest, NC.

[20]. Wise, Bob. (2008). High Schools at the Tipping Point. *Educational Leadership* 65 (8): 8-13. Wise, Bob. (2008). High Schools at the Tipping Point .Educational Leadership 65 (8): 813.

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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.