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Factors Related to Student Persistence in a New Residential STEM High School: The Case of the Tennessee Governor's Academy for Mathematics and Science

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To the Graduate Council:

I am submitting herewith a dissertation written by Amy Cinci Sullins entitled "Factors Related to Student Persistence in a New Residential STEM High School: The Case of the Tennessee Governor's Academy for Mathematics and Science." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Educational Psychology and Research.

Gary J. Skolits, Major Professor

We have read this dissertation and recommend its acceptance:

Russell L. French, John W. Lounsbory, Jennifer A. Morrow

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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A Dissertation

Presented for the

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Degree

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Amy C. Sullins

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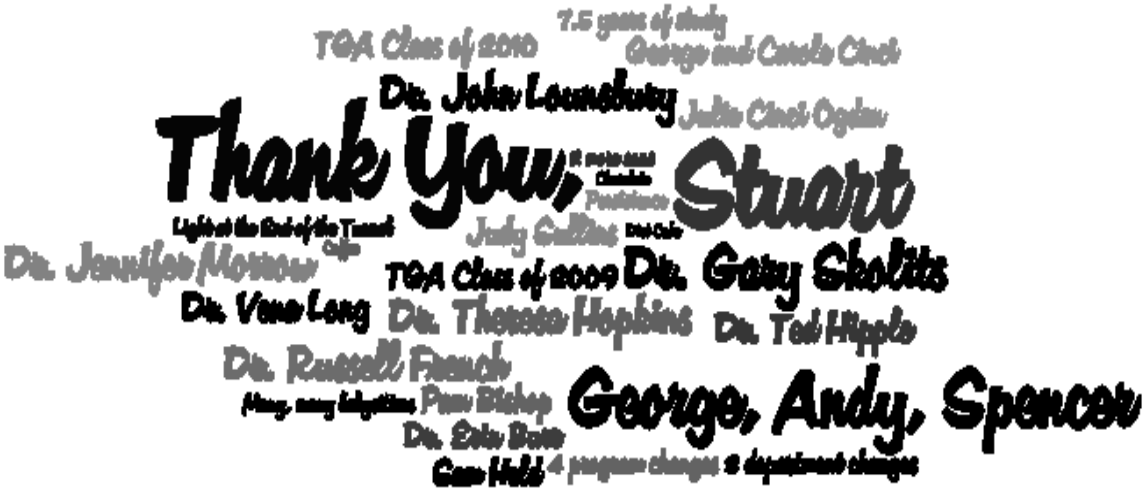

ABSTRACT

Public and private sectors are grappling with decreasing numbers of science, technology, engineering, and mathematics (STEM) professionals as the need for them rises. State-supported STEM residential high schools may be the premier conduit to educate and socialize students in order to prepare for STEM college majors and careers. Gaining understanding of how these schools can nurture students academically and affectively so that they successfully matriculate to university STEM settings is valuable; however, minimal research exists related to the affective domain in relationship to retention at state-supported STEM residential schools. This exploratory, mixed methods case study describes factors that contribute to student persistence in a residential school setting.

This study had four purposes: a) to describe students' meaning of belonging at a STEM residential school; b) to explore potential relationships between students' personality traits, expectations fulfillment, and belonging; c) to explore potential relationships between belonging and persistence, expectation fulfillment and persistence, and personality traits and persistence, and d) to describe characteristics of persistors and non-persistors. Participants in the study were the student population of the Tennessee Governor's Academy for Mathematics and Science (TGA) (n = 41). Following interviews of the population, qualitative analysis of the interviews included pattern coding and creation of an explanatory effects matrix; quantitative analysis of survey data utilized ANOVA, chi-square, and correlation. Results of analyses produced a student-generated, multidimensional definition of belonging and showed that students who perceived they belonged and expressed institutional commitment via ownership of TGA had the highest persistence rate (100%). Quantitative findings showed that students whose expectations

for TGA were met or exceeded had a higher sense of belonging, and belonging was associated with higher persistence. The personality traits agreeableness, conscientiousness, openness, and work drive were significantly related to belonging, suggesting that sense of belonging may function as a moderator between personality traits and expectation fulfillment.

For future study, a longitudinal design is recommended as well as incorporation of the variable educational practices in relation to the variables expectation fulfillment, personality, belonging, and persistence.

PREFACE

No one could better express than did [Plato] the fact that a society is stably organized when each individual is doing that for which he has aptitude by nature in such a way as to be useful to others (or to contribute to the whole to which he belongs); and that it is the business of education to discover these aptitudes and progressively to train them for social use (Dewey, 1916).

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CHAPTER 1: INTRODUCTION

Shortages in Science, Technology, Engineering, and Mathematics (STEM) Professionals

The number of United States students pursuing bachelor's degrees in science, technology, engineering or mathematics (STEM) fields is declining (*GAO-06-702T,* 2006), and the U.S. is ranked 29th out of 109 countries in the percentage of 24-year-olds with math or science degrees (National Science Foundation, 2006), despite billions of dollars spent by the federal government on STEM fields education programs (*GAO-06-702T,* 2006). Domestic jobs in mathematics and technology sectors continue rapid growth (*GAO-06-702T,* 2006), and those positions are increasingly held by foreign born mathematicians, scientists and engineers who attended college in the United States (National Science Foundation, 2006). Concerns have been raised at the federal level regarding the United States' ability to "maintain its global technological competitive advantage in the future" (*GAO-06-702T,* 2006, p. 1) due to lack of graduates in STEM fields.

Perceived STEM professional shortages have caused concern in the past and proved to be unfounded (Atkinson, Hugo, Lundgren, Shapiro, & Thomas, 2007). However, according to the National Consortium of Specialized Secondary Schools for Mathematics, Science, and Technology (NCSSSMST) (2007), the shortage of STEM professionals is real, and for the past 15-20 years the United States "made up for shortfall in American-born STEM graduates by expanding immigration of STEM talent" (p. 4). The United States' pool of foreign STEM talent is also diminishing as Saxenian's (2006) findings suggest that fewer foreign-born STEM degree-seeking university students are choosing United States colleges and universities to seek their STEM degrees (2006). In 2004, the proportion of physics bachelor's degrees awarded was two

times fewer in comparison to overall degrees awarded than the year before the launch of *Sputnik*, 1956 (COSEPUP, 2007); and papers published by U. S. researchers in the scholarly scientific journal *Physical Review* have plummeted, from 61% in 1983 to 29% in 2003 (Broad, 2004). Tapping America's Potential, a group comprised of 15 business organizations, predicts that by 2010, 90% of the world's engineers will be living in Asia (Business Roundtable, 2008).

While STEM graduates and United States STEM professionals are diminishing, United States school children are not scoring well on international STEM tests compared to students of other countries, as when U.S. high school 10th graders ranked 27th out of 39 international student groups in the 2003 administration of the Program for International Student Assessment, which measured student aptitude in application of mathematical concepts (COSEPUP, 2007).

Proposed Solutions for STEM Professional Shortages

Asked by the federal government to prioritize the top ten actions that policymakers could take to improve STEM professional prospects in the United States, the Committee on Science, Engineering, and Public Policy produced the research report *Rising Above the Gathering Storm: Energizing and Employing American for a Brighter Economic Future* in 2005. The first recommendation offered by the Committee was to vastly improve K-12 mathematics and science education, with a two-fold focus on recruiting teachers with content area STEM degrees and nurturing their teaching career with professional development; the second recommendation addressed increasing the number of U.S. students who enroll in Advanced Placement (AP) and/or International Baccalaureate (IB) level STEM courses and take the end-of-course AP and/or IB exams. The report also highlighted the 16 current STEM-specialty residential schools,

all members of NCSSSMST, commending their efforts at offering rigorous STEM coursework and leading the students toward authentic STEM research.

The development and sustainment of these specialty schools received further national attention from the report:

> Without a flourishing scientific and engineering community, young people are not motivated to dream of 'what can be' and they will have no motivation to become the next generation of scientists and engineers who can address persistent national problems (COSEPUP, p. 112).

In 2007, President Bush signed into law the *America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act* (America COMPETES Act, S. 761), a direct response by the federal government to the *Gathering Storm* report as well as the *Innovate America* report by the Council on Competitiveness (2005). Comprised of three critical areas, the Act's second critical area of focus, the strengthening of educational opportunities in science, technology, engineering, and mathematics in P-16, is particularly relevant to this study.

The America COMPETES Act allocated $150 million to state grants for the establishment or expansion of statewide specialty schools for mathematics and science, and also for partnerships between high school students and scientific mentors in national laboratories. The enactment of the law reflects that the STEM professional decline has been recognized politically and economically, in both public and private sectors (Business Roundtable, 2008). In "Tapping America's Potential (TAP): The Education for Innovation Initiative" the Business Roundtable set a goal to double the number of STEM college graduates in the United States by 2015. In its 2008 progress report, TAP echoed America COMPETES with a recommendation for federal

financial support to regional and state STEM magnet schools as well as funding for real-world scientific and engineering experiences for students (Business Roundtable, 2008).

In the NCSSSMST position paper *Addressing the STEM Challenge by Expanding Specialty Math and Science High Schools* (2007), findings show that students who attended NCSSSMST member high schools complete far more advanced and rigorous STEM coursework including STEM research projects than students at typical comprehensive high schools, and, most importantly, approximately 56% of graduates from mathematics and science high schools earn bachelor's degrees in mathematics or science-related fields. Of all students who earn undergraduate degrees, about 20% earn degrees in mathematics or science-related fields according to one report (Atkinson et al. 2007), while the National Center for Educational Statistics reports that in 2004, only 14% of all undergraduates were majoring in a STEM field (Chen, 2009).

The mission of NCSSSMST is to advance the cause of STEM education by proposing policy, informing practice, recruiting talented STEM students, and disseminating research on STEM teaching and learning (NCSSSMST, 2009). The consortium adheres to the belief that immersing students in advanced STEM coursework and challenging them with authentic research and inquiry opportunities in which they are partnered with scientists and mathematicians better prepares them for the rigors of advanced STEM study and for entrance and integration into the STEM professional community.

Currently, NCSSSMST member schools number over 125; 18 of these secondary schools are residential and statewide (Jones, 2009; Thomas & Williams, 2010), with the potential for further growth in the number of schools with the implementation and funding of the America

COMPETES Act. The NCSSSMST schools differ from the typical comprehensive high school in three main ways: first, the schools focus on STEM curricula; second, students engage in more advanced STEM curricula, and are expected to work at a college level as well as conduct authentic scientific research and investigation, and third, the schools support student learning through partnerships with college and universities, national laboratories, corporations, and alumni groups (Atkinson et al. 2007).

History of the STEM Specialty Residential School

Although the specialty school concept is not new, STEM specialty schools in the 20th century originated in the boroughs of New York City, with Stuyvesant High School, founded in 1904 to better prepare an industrialized male work force. The purpose of the school was practical in nature and reflected societal needs of the time (History of Stuyvesant School, 2009). Brooklyn Technical High School opened in 1922, followed by the Bronx High School of Science in 1938, sharing a central mission of providing advanced coursework in mathematics and science.

Owing to political agendas, economic forces, or international affairs, emphasis on and financial support of STEM schools vacillated through the 20th century. The 1980s saw a rise in STEM specialty school formation as a result of *A Nation at Risk*, the Cold War, and increasing research on nurturing a gifted and talented population of students (Cross & Cross, 2005). States increasingly formed regional STEM schools, but Stanley (1987) highlighted that rural and low-socioeconomic gifted students were not being served by such regional day programs and recommended that states with greater numbers of gifted and talented populations (as evidenced by the number of National Merit semifinalists within the state) should form residential, statewide programs to enhance educational STEM opportunities for all highly talented youth.

The first statewide, publicly funded residential STEM school, the North Carolina School for Science and Mathematics (NCSSM), was founded in 1980 and educates approximately 650 juniors and seniors in its live and learn community. Students equally represent the state's congressional districts, as mandated by the legislature which created the school. Nestled in the Research Triangle, students take coursework on their campus and experience internships at nearby Duke University, North Carolina State University, University of North Carolina Chapel Hill, and any number of laboratories and industries in the area (North Carolina School for Science and Mathematics: History and Mission, 2008). NCSSM has served as the premier model for the 18 similar publicly-funded statewide residential programs. According to the NCSSM website, 63% of its graduates pursue STEM fields; 80% attend University of North Carolina affiliated schools, and 75% are North Carolina tax payers. NCSSM meets its mission statement to provide "responsible leadership in the development and application of science, mathematics, and technology" to its constituents (North Carolina School for Science and Mathematics: History and Mission, 2008). The Illinois Mathematics and Science Academy, Oklahoma School for Science and Mathematics, and others followed suit in developing statewide, publicly funded residential schools. Many are situated in Southern states, such as Alabama, Arkansas, Louisiana, Mississippi, Missouri, South Carolina, and Texas.

Sustainability of the schools is a persistent concern, even when the school is part of the state's legislative agenda. Most of these schools operate within the oversight or jurisdiction of a college or university, enabling STEM high school students to enroll in advanced university level mathematics, science, engineering, and technology courses and utilize the costly laboratory equipment and other resources available at a research institution.

The Formation of a New Specialty STEM School in Tennessee

In 2006, Governor Phil Bredesen began planning for a statewide residential mathematics and science specialty school in Tennessee. By immersing students in a challenging, STEM-centered academic and residential setting, the specialty school can fulfill its education- and career-related purpose, as stated in its mission statement:

> The mission of the Tennessee Governor's Academy for Mathematics and Science is to provide challenging education opportunities for young men and women with interest in and potential for high achievement in mathematics and the sciences with the goal of increasing the number of Tennessee students who pursue careers and further study in science, mathematics, engineering and related fields.

A mathematics and science school situated on or near a college campus upholds the goals of P-20 "pipeline" initiative transpiring in the majority of the states (Tennessee Higher Education, 2007), in which greater alignment between public education and higher education is developed to increase post-secondary readiness among P-12 students. In Tennessee's plan for P-20 alignment, the *Statewide Master Plan for Tennessee Higher Education, 2000-2005* nine goals were identified, one of which specifically identifies the type of educational reform TGA upholds: "Offer relevant educational programs that address economic, intellectual, and social problems by partnering with business, government, and P-12 and other educational institutions" (THEC 1999). The STEM graduate and professional shortages were recognized economic and educational problems; establishing the school and recruiting partners was the response.

Situating the school in Knoxville, TN, provided for a unique partnership with both the University of Tennessee in Knoxville and Oak Ridge National Laboratory, the U.S. Department

of Energy's largest science and energy laboratory. Students "live and learn" in Knoxville and engage in advanced academic and research experiences. Following approximately ten months of planning which included meetings with representatives from the North Carolina School for Science and Mathematics, the Tennessee Governor's Academy for Mathematics and Science welcomed its inaugural class of 2009 in August, 2007.

Now in its third year of operation, the Tennessee Governor's Academy for Mathematics and Science (TGA) is a residential program for talented eleventh and twelfth graders, enrolling a maximum capacity of 48 students. Significant resources have been amassed to provide students with a rigorous academic curriculum for the students at TGA, University of Tennessee, and Oak Ridge National Laboratory, as well as to attend to the students' residential needs and experiences. The school is located at the Tennessee School for the Deaf (TSD) campus.

As with any innovative educational program, student retention is key to program success and continuance. Student outcomes and impacts, including STEM majors in college and subsequent entrance into the STEM professional community will be longitudinally evaluated. In the inaugural year of TGA, 172 high school sophomores applied, and 24 were accepted to form the class of 2009 following an abbreviated application rating and screening process. Nine members of the inaugural class of 24 voluntarily left or were asked to leave during or concluding the 2007-2008 academic year. While each case of non-persistence was unique, TGA faculty and administration concluded that in-person interviews conducted during a day-long visit to TGA would enhance the selection process for the class of 2010 and increase the likelihood of selecting applicants who would persist at TGA. Further, the application itself was revised to include more

essay questions and an applicant interest inventory, in order to learn more about each applicant's unique characteristics.

For the class of 2010, 122 applications were screened using a more rigorous process involving face-to-face interviews, observation of the applicants interacting in group settings, and pre-assessments. However, by October 2008, three of the 30 members of the class of 2010 had left the program, during what Tinto (1998) deems the separation and transition phases of transitioning from high school to college (in this study transitioning from the home high school to a residential magnet school). Even following improvements to the applicant screening process, attrition occurred early in the program that supercedes attrition rates at similar math and science residential specialty schools, according to Dr. Suzanne Donnolo, Admissions Director of the Oklahoma School for Science and Mathematics (personal communication, December 4, 2007).

Thus, like public secondary schools under *No Child Left Behind* (2001), in which schools are mandated with achieving a graduation rate of 90%, student retention at specialty STEM schools is paramount to continuation of TGA, as tax-paying stakeholders and state legislators expect a positive return on its substantial investment. Specialty STEM schools, like TGA, must select the most suitable student candidates who will persist in the live and learn community to graduation and subsequent matriculation into a college or university.

In previous decades, research on specialty STEM residential schools centered largely on rationale for developing and sustaining such schools (Eilber, 1987; Stanley, 1987; Stanley, 1991). Other past studies applicable to this research concentrated on residential schools for gifted adolescents, a similar population to the TGA student body, and their outcomes following graduation (Clark & Dixon, 1997; Dorsel & Wages, 1993).

Results of longitudinal studies on specialty STEM school graduates, their college majors, and employment have entered the literature (Achter, Lubinski, Benbow, & Eftekhari-Sanjani, 1999; Webb, Lubinski, & Benbow, 2002), and the NCSSSMST conducted its own longitudinal studies of member schools graduates encompassing over 1,000 graduates (Blaisdell & Tichenor, 2002; Thomas, 2000; Thomas & Love, 2002). Still, these studies were essentially descriptive and outcomes-based, not addressing the complexities of highly intelligent adolescent STEM students living and learning together. Academic preparation for the STEM field is equally as important as investigating the numerous social and emotional matters which emerge within residential adolescent populations.

More recent studies are beginning to examine the intricate systemic issues of the STEM residential school, including narrowing the performance gap between genders in specialty school settings (Levacic & Jenkins, 2005) and the psychological sense of well-being and satisfaction with school experienced by students enrolled in a specialty science school compared to a typical high school population (Jin & Moon, 2006).

As one of the newest specialty STEM residential schools, TGA is a living and learning community, and students' perceptions should be examined through a wider lens that accounts for both academic experiences and interactions as well as the social and emotional dynamic of residing on site with their peers. These variables reflect a model of belonging, the Student Integration Model, developed by Tinto (1975) in which academic integration and social integration are viewed as equally important in developing the students' sense of commitment to the institution, which in turn leads to greater persistence (Pascarella & Terenzini, 1980; Terenzini, Lorang & Pascarella, 1981).

Specialty STEM residential students transition from their home high school, at which they were academic leaders and often leaders in extracurricular activities, in the classrooms, and among their peers, to a new school environment far more competitive and challenging than the home high school. It is well-documented that assisting in that transition is critical to student persistence at the college level (Hoffman, Richmond, Morrow, & Salmone, 2002; Tinto, 1998). Goodenow (1991) and Eccles, Lord and Midgley (1991) found that middle school years, or the transition from childhood to early adolescence, is when fostering and sustaining a sense of belonging is most important. However, research needs to be conducted on student transitions in middle adolescence (ages 14-17), belonging, and retention within the specialty residential school context, especially since the STEM residential schools initiative is part of the current federal government agenda (Jaffe, 1997).

Further, broadening the range of student characteristics explored in relation to belonging and retention has merit. Incoming students bring with them expectations for the new educational environment, and these expectations are either met, exceeded, or the new educational environment is beneath or below their expectations. Drawing from Expectancy-Value Theory of Achievement Motivation (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000), in which students' perceptions of their own abilities and their expectations for success influence their classroom choices, efforts in the classroom, performance, and overall persistence, the fulfillment of these expectations becomes an important variable for faculty, counselors, and administrators to understand in relation to belonging and persistence.

Incoming students also bring with them distinct personality traits, of which the Big Five hierarchy has been well-researched for prediction, particularly of academic success or

achievement, since being validated by McCrae and Costa in 1987 (Bidjerano & Dai, 2007; Duff, Boyle, Dunleavy, & Ferguson, 2004; Lounsbury, Sundstrom, Loveland, & Gibson, 2003). The Big Five include Neuroticism (will be referred to as Emotional Stability in this study); Extraversion; Openness to Experience and/or Intellect (will be referred to as Openness in this study); Agreeableness, and Conscientiousness. Moreover, personality traits have been shown to remain stable over time, throughout adolescence (McCrae, Costa, Terraciano, Parker, Mills, DeFruyt, et al., 2002) and throughout life changes (Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004). Thus, research should be conducted that explores relationships between expectation fulfillment, personality traits and sense of belonging and retention, or persistence, at a specialty STEM residential school.

Problem

As public and private sectors grapple with decreasing numbers of educated STEM professionals as STEM jobs continue to rise (*GAO-06-702T*, 2006), specialty STEM residential high schools may prove to be the premier conduit for educating and socializing high school students for STEM college majors and STEM careers. Gaining understanding of how these schools can nurture the students academically and affectively in order to retain them through graduation and matriculation to university STEM settings is valuable, although little attention has been paid to the affective domain in relationship to retention at specialty STEM residential schools. An exploratory study describing the factors that contribute to student persistence in a residential school setting is necessary and justifiable.

Purpose Statement

This study was designed to explore and describe the phenomenon of student persistence and its relationship with the variables of sense of belonging developed at the school, the fulfillment of their expectations for the school, and personality traits the student bring with them to the school. Further, the researcher explored the relationship between personality traits and sense of belonging, and expectation fulfillment and sense of belonging. Also of importance to the researcher are the characteristics of both school persistors and non-persistors within the school.

There are four purposes of this study: a) to describe students' meaning of belonging at a specialty residential school; b) to explore potential relationships between students' personality traits, expectations fulfillment, and belonging; c) to explore potential relationships between belonging and persistence, expectation fulfillment and persistence, and personality traits and persistence, and d) to describe characteristics of students who persisted at the school as well as those who voluntarily or involuntarily did not persist.

Research Questions

1. From the perspective of students, what does it mean to belong at a newly formed specialty high school?
2. What are the relationships among the constructs of belonging, expectations fulfillment, and personality traits, and how do these constructs relate to student persistence?
3. What are characteristics of students who persist and those who do not persist with the high school program?

Overview of Study Design and Theoretical Framework

A brief discussion of the belongingness model employed in this research study is

appropriate, as students' sense of belonging is developed and formed at the school. Goodenow (1993), while developing and testing an adolescent measure of belonging called the *Psychological Sense of School Membership* (PSSM), proposed that "The need to belong and to have a legitimate and valued membership in a setting may take precedence over virtually all other concerns" (p. 88). Students may not be able to focus on academics or other school-related activities until they determine where they stand in their community.

Building upon Goodenow's research and the PSSM instrument, Nichols (2008) developed a 2 x 2 Model of Belonging based on students' perceptions of both their belongingness—they feel they belong or they do not feel that they belong--at their school as well as their perceptions of the school climate as being a positive or negative place to be. Based on their responses affirming or refuting their sense of belongingness, as well as their positive or negative perceptions of school climate, four quadrants can be formed categorizing students as Connected, Adaptive, Rejected or Isolated, or Resistant, as appears in Figure 1.

Research subjects were middle school students in a start-up, day, magnet school who had left their former middle schools to attend the new magnet, similar to the participants in this study. Nichols utilized a modified version of the *Psychological Sense of School Membership Scale* (Goodenow, 1993) in oral interviews with the students to gain their perception of belongingness at the magnet middle school. Nichols found that the students "attributed positive or negative belonging beliefs to the quality of their relationships with their teachers or other students" (p. 164) indicating that relationships with others in the school is the most significant contributor to sense of belonging to these middle school students. Further, Nichols found that students who both viewed switching from their previous school to the new magnet school as a

Do you feel you belong(ed)?	What do you think of this school and that school? (Climate)		
		Positive climate	Negative climate
	Yes	*Quadrant A*: Connected	*Quadrant B*: Adaptive
	No	*Quadrant C*: Rejected or Isolated	*Quadrant D*: Resistant

Figure 1. Nichols' 2 x 2 Model of Belongingness

positive change and held high expectations for the new school, felt a greater sense of belonging at the new school if they also felt their expectations were met.

Hence, an examination of the relationship between students' background characteristics, including their personality traits, expectation fulfillment, and sense of belonging developed at the school, as well as their persistence at the school will build upon the work of Nichols by incorporation of her model into a larger research design.

Significance of the Study

This study will contribute to research on the affective domain at specialty STEM residential schools and those residential schools preparing gifted populations. Selection of potential students, preparing for the incoming students academically and residentially, and planning institutional interventions with students at risk for leaving the school (Pantages & Creedon, 1978) are all persistent topics for concern among NCSSSMST member schools, and suggestions for future research with a larger specialty school population would be relevant and timely given the prominence placed upon increasing STEM professional membership in the United States.

Close study of the unique context of a mathematics and science specialty school can lead to the greater understanding of a concept that has legislative provision by the federal government but lacks contextual studies involving current student populations. Resources in the form of state finances from Governor Bredesen's discretionary funds ($2.2 million, two-year grant) and significant university, research institutions, and corporate partnerships have been amassed in order to bolster the success of Tennessee's new specialty STEM residential school, and retention of students as well as per pupil expenditure are critical to the sustainability of TGA and have

political implications. Otherwise, school administrators cannot feasibly demonstrate to the Tennessee Legislature and other decision-making bodies the success of the program without a pool of graduates who have matriculated to prestigious colleges and universities to major in STEM-related fields.

Limitations

The TGA student population studied was small (n = 43, December 2008), necessitating an exploratory, descriptive study design. Generalizability to other new specialty schools is limited and study replication encumbered due to the applicants, applicant selection process, and context of the school. Further, student participation in research and evaluation activities was voluntary, and non-participants can especially affect the study results of a small population. The self-selection bias of this particular group of students is inherent in who chose to apply for admission to TGA. Those who were admitted have more homogeneous characteristics. The Hawthorne Effect, or reactivity of program participants to experimental situation, can also be a limitation in this study.

The researcher works at the site of the proposed study as the internal program evaluator for TGA. The research and evaluation stance has been objective since the inception of employment in August 2007 and remained objective in stance throughout this study. The researcher was engaged in a number of other research and evaluation activities and took care to delineate between on-site projects and dissertation research.

Delimitations

This is a bounded case study, representing one residential STEM high school at one point in time.

Study Definitions

This study defines constructs as follows:

- *Sense of Belonging* is the psychological sense of being a part of the live and learn community of the residential school (Nichols, 2008).
- *Expectation fulfillment* happens when students look back at their expectations for the new school through a retrospective lens and determine whether the school was beneath their expectations, met their expectations, or exceeded their expectations.
- *Persistence* is students continuing to attend the new school by achieving the prescribed GPA of 2.75 and meeting other school requirements.
- *Voluntary Non-Persistors* are students who voluntarily choose to leave the school.
- *Involuntary Non-Persistors* are students who are asked to leave the school for academic reasons, disciplinary reasons, or other reasons.
- *Success* is two-fold; juniors at the new school are invited back to for their senior year; seniors graduate from TGA.

Study Outline

This study is organized into five chapters. Chapter I serves as an introduction to the study, and contains statement of the problem, purpose statement, research questions, overview of the research design, and the significance of the study. Chapter I also includes important definitions, limitations and delimitations of the study. Chapter 2 includes a review of literature, organized by study variables. First, school persistence in high school and freshman year of college is explored, including factors contributing to persistence, factors contributing to dropping out, STEM college persistence, and persistence at mathematics and science high schools. The

contributions of sense of belonging to persistence is considered, while the variables expectations for school and personality traits will be considered as contributing both to the development of sense of belonging and school persistence. The study's methodology is outlined in Chapter 3. This chapter includes an introduction, research design, information about the research site and context, and participants, followed by procedures, including instruments and data collection, and data analysis. Chapter 4 reports the findings of the study and is organized according to the research questions; Chapter 4 also includes the study's conclusions. The final chapter, Chapter V, presents the discussion and provides recommendations for future research.

CHAPTER 2: REVIEW OF LITERATURE

From a Facebook status and ensuing comments, dated January 2009:

TGA Junior Female: is going HOMEWORK HARDCORE this weekend!

TGA Junior Male: nerd…

TGA Junior Female: If you're not a nerd, why r u here?

A seemingly simple exchange between two TGA juniors on the social networking website, Facebook, is actually highly revealing of the burgeoning culture of this new mathematics and science residential high school. A middle adolescent, defined as between ages 14-17 (Jaffe, 1997), posted as her Facebook status that her dominant weekend plans were to pursue studying "HARDCORE." A fellow student attempted to admonish this studious status, to which the female status-poster in turn questioned his purpose for being at the residential math and science school and branded him as an outsider for not subscribing to the "nerd" mores.

Several questions arise for the social sciences researcher: Is being perceived as a "nerd" valued at this school? What are traits of a "nerd"? Was the female student a "nerd" prior to beginning her junior year at TGA, or did she adopt that persona to belong or fit in at the new school? Did both students expect to be working on "homework hardcore" all weekend when they arrived at TGA? Which student will ultimately be successful, as evidenced by persisting through to graduation from TGA—the name caller, or the studious one?

This chapter reviews pertinent literature associated with this study as well as with this January 2009 Facebook status. First, the study's dependent variable, persistence, is explored including factors contributing to persistence, factors contributing to dropping out, STEM college persistence, and persistence at mathematics and science high schools. The contributions of the first independent variable sense of belonging to persistence is considered, while the other

independent variables expectation fulfillment and personality traits will be considered as contributing both to the development of sense of belonging and school persistence.

Persistence

Persistence in this study is defined as TGA program continuity: students that remain enrolled in the live and learn program TGA for both their junior and senior years. Achievement-related outcomes from successfully persisting include graduation from TGA, greater opportunities for admission and scholarships to prestigious colleges and universities, advanced-level mathematics and science courses at the University of Tennessee, and two internships at Oak Ridge National Laboratory with scientist mentors. With such opportunity, why would TGA students not persist with the program? What factors contribute to persistence and lack of persistence in a residential setting for talented adolescents?

Persistence at the College Level: Theoretical Perspective

The lion's share of research on student persistence takes place at the college level, particularly among the undergraduate freshman population. State and federal agencies and other funding sources mandate a variety of institutional reports on student quantity (recruited, applied, admitted, retained, departed) among other students characteristics (Johnson, 2008), for dispersing of funds and other resources. Retaining students is of immense financial concern to private and public 4-year colleges and universities as well as two-year community colleges (Stuart, 2009).

Tinto's Student Integration Model (1975), stemming from interactionalist theory (Braxton, Sullivan, & Johnston, 1997) is considered seminal work on persistence. The model considers persistence in terms of students' background characteristics and past educational experiences, students' goal commitments (degree completion) upon arrival at their university,

and how these factors interact with and shape students' academic and social integration into the new college environment as well as the institutional commitment that the students develop while attending the college. Tinto's theory espouses that increased integration to the college environment relates to, and interacts positively with, commitment to the institution itself and to the goal of graduating from the college: "Other things being equal, the higher the degree of integration of the individual into the college systems, the greater will be his commitment to the specific institution and to the goal of college completion" (Tinto, 1975, p. 96).

Institutional and goal commitment were the most significant predictors of freshmen student persistence in studies by Pascarella and Terrenzini (1980) and Terrenzini, Lorang, and Pascarella (1981), in which the researchers piloted a five-factor measure of Tinto's social and academic integration theory. Later, Alkandari (2008) upheld these findings that degree aspiration functioned as an agent of student retention and persistence, while a group of researchers found that career-related goal commitment was significantly related to an increase in persistence decisions among college freshmen (Hull-Blanks, Robinson Kurpius, Befort, Sollenberger, Nicpon, & Huser, 2005). Zhang and RiCharde (1998), in a study of college persistence as framed by the cognitive, affective, and psychomotor domains of Bloom's Taxonomy, found that college dropouts had a lower goal commitment to obtaining a college degree than the college persistors. Goal commitment, either toward degree completion or toward a career orientation, is positively related to choosing to persist.

Other variables positively related to or shown to predict persistence at the college level include successful adjustment and integration to the new environment (Frydenberg, 2008; Pittman & Richmond, 2008;); positive attitude toward college (Janosz, Leblanc, Boulerice, &

Tremblay, 1997), social support and encouragement from peers and faculty (Alkandari, 2008; DeBerard, Spielman, & Julka, 2004; Hoffman et al., 2002; Pan, Guo, Alikonis & Bai, 2008), strong high school academic preparation (Johnson, 2008), and proximity of 60 miles or less to the campus (Johnson, 2008).

While high school GPAs and standardized test scores have been shown to be predictors of college GPA (DeBerard et al., 2004; Galicki & McEwen, 1989), empirical studies of the relationship of academic achievement to college persistence have been mixed, with some researchers finding no relationship between college GPA and persistence (Alkandari, 2008; Kiser & Price, 2007-2008) and others finding a rise in GPA when at-risk freshmen are part of an intervention program aimed at increasing persistence (Pan, Guo, Alikonis, & Bai, 2008) and another researcher finding that college GPA had the largest effect on persistence rates of in-state students at a public research university (Johnson, 2008).

TGA students, like many college freshmen, are faced with adjusting to a new living and learning environment, including interacting with new peers and faculty members. A difference, however, is that TGA students, who have diverse individual backgrounds, are all highly talented in STEM fields and have all chosen to depart from their homes and home high schools to attend TGA with the expectation they will graduate from TGA, major in a STEM field, and become STEM professionals in Tennessee. A brief examination of literature reviewing their actual likelihood of persisting with college STEM studies is of value here.

Persistence Among Undergraduate STEM Majors

Of import to this study is the persistence of science, technology, engineering, and mathematics (STEM) majors in college. As mentioned in the previous chapter, estimates of college freshmen intending to major in a STEM field ranges from a low of 20% (Atkinson, et al. 2007) to an estimated high of 30% (Scott, Tolson, & Huang 2009). Chen's research findings (2009) showed that in 2003-2004, 14% of all college undergraduates in the United States were actually enrolled in a STEM major, lower than the estimates of students who plan to major in a STEM field. These 14% of all undergraduates are more likely to be male, Asian/Pacific Islander, foreign or non-native speakers of English, from a higher socioeconomic background, and experienced stronger academic preparation in high school (Chen, 2009).

Of those who do choose a STEM field as their major, persistence to graduation with a bachelor's degree in a STEM field is also estimated to be low. In an analysis of several longitudinal datasets, the National Center for Educational Statistics (Chen, 2009) found the retention rate of STEM majors from all undergraduates 1995-2001 was 53% persistence. The 47% who did not persist with a STEM major either changed majors to a non-STEM field or they dropped out of college.

Framed from the attrition perspective, another examination of STEM degree completion from the House Subcommittee on Research, Committee on Science, March 2006 Hearing reported a 50% attrition rate for students pursuing a degree in biology or the physical sciences, while the attrition rate for students pursuing a degree in engineering is closer to 60% (Subcommittee on Research, 2006).

Several studies have reported factors that increase STEM persistence. In a study by Scott et al. (2009), the high school class rankings, math SAT scores, and verbal SAT scores of students who remained mathematics or science majors for three years of college were significantly higher than students who did not persist with their STEM studies due to low GPAs. The researchers could predict with 75.5% accuracy which students would persist with STEM studies and which students would change majors due to low GPA from the three variables of high school rank, math SAT score, and verbal SAT score. Further, The ACT composite score and high school class rank along with academic self-concept all functioned as predictors of college GPAs for science, engineering, and mathematics majors (House, 2000).

According to the ACT (2006), high school students who met the ACT Readiness Benchmark in Science and then majored in science in college had a higher persistence rate than those science majors who did not meet that ACT Readiness Benchmark in science (71% persistence in science major versus 60% persistence in science major); further findings from ACT on STEM persistence in college indicate that when high school students took rigorous mathematics and science classes and developed a STEM career interest, they also exhibited higher rates of persistence with their STEM college major. This aligns with Chen's (2009) findings that STEM college persistors came from strong academic backgrounds in high schools, as well as with Russell and Atwater's (2005) findings that minorities who completed more advanced math and science coursework at the high school level were more likely to persist with the scientific studies in college. Additional findings from Chen's research for the National Center for Educational Statistics (2009) show that STEM degree completers tend to be White or Asian/Pacific Islander and have an educated parent.

Beyond individual background characteristics, other STEM persistence research examines social and academic integration, specifically through the mentoring process. For example, a longitudinal study of Westinghouse Science Talent Search winners (Subotnik & Steiner, 1993) found that scientist mentors were the most powerful influence on mentees' pursuit of a research-based scientific career, particularly among females. Mentors aided in socialization to the scientific community and helped instill confidence in their mentees. A report from the National Science Foundation (NSF) issued two decades ago underscored the importance of mentored undergraduate research, stating "It is clear that the academic community regards the involvement of undergraduate student majors in meaningful scientific research…with faculty members as on one of the most powerful instructional tools" (NSF, 1989, p. 6). Several more recent reports specifically state that mentoring should be a priority for preparing the next generation of scientists in America (B.E.S.T., 2004; COESPUP, 2007; National Science Board, 2003).

Persistence of High School Students at Residential Mathematics and Science Programs

Research on persistence within the context of the residential mathematics and science high schools is both limited and protected (Jones, 2009). Unverified accounts of attrition range from 5% to 20% from several admissions officers at residential schools (Jones, 2009). This researcher's efforts to contact Admissions Departments in other residential math and science schools were also met with polite refusals to disclose attrition rates, particularly regarding the early years of the schools' operation (Letita Mason, personal communication, July 2009; Suzanne Donnolo, personal communication, December 2007). Sethna, Wickstrom, Boothe and Stanley (2001) reported that the persistence rate at the Advanced Academy of Georgia, a

residential early college entrance mathematics and science school, ranged from 82.4% to 89.7%. Gatton Academy, Kentucky's residential mathematics and science early entrance program which, like TGA, opened in 2007, graduated 55 of 60 from its inaugural class for a persistence and graduation rate of 91.7%.

Hence, it may be surmised that attrition, or rate of non-persistence, ranges from as low as 5% to as high as 20% at the residential mathematics and science schools. Some of the non-persistence can be attributed to failure to meet academic standards or for disciplinary infractions, as all of the residential mathematics and science schools do have academic and disciplinary standards outlined in their student handbooks (Jones, 2009).

However, not all of the non-persistors can be categorized as academic failures or rule-breakers. Why do some choose not to persist with their advanced STEM studies while other talented students do persist? The next section examines variables that influence gifted and talented students' choices not to persist with their advanced educational experiences.

Gifted and Talented Dropouts

College literature centers on student retention and persistence, while high school literature is dominated by research on raising the graduation rate and preventing *dropouts* (U. S. Department of Education, NCES, 2008). Hansen and Toso (2007), in a mixed methods study of a small sample of gifted dropouts, found that the main reason the dropouts left their high schools was due to a lack of sense of belonging. The dropouts complained of lack of academic challenges, few positive interactions with teachers and peers, and lack of "respect for values held in high esteem at school (e.g., popularity, conformity, and sports)" (p. 32). These dropouts also exhibited high empathy, much like the dropouts in Zhang and RiCharde's study of college

departers (1998). Hansen and Toso recommend that gifted students need "rigor and choice" or else parents should seek alternative educational settings for them (2007, p. 40).

Fimian (1988) examined factors accounting for stress and burnout among young gifted adolescents and found strong associations between "lowered self-esteem levels, externalized control loci, high state/trait anxiety levels, the impact of life change events upon the student, high levels of tedium, and low levels of school life quality" (pp. 399-400) and both classroom stress and burnout, factors often associated with reasons for dropping out of school. This gifted adolescent sample was comprised of typical comprehensive public high school students. When gifted students feel that they are not in control of their situations, experience extreme boredom, do not perceive that school is valuable or they are getting much out of school, and when they experience lower self-esteem they are much more likely to be both stressed and burned out by school.

Most closely related to the experiences of the inaugural year at TGA, Dorsel and Wages conducted a study of the initial year of the South Carolina Governor's School for Science and Mathematics (1993). The attitudes and beliefs of the inaugural class of 70 juniors and their parents became significantly more negative as the year progressed; further, the belief intensified that students would have been admitted to a more prestigious college or university had they remained at their home high schools. The researchers do point out that the students' and parents' attitudes did not become negative, scale-wise, rather that the attitudes were less positive. Negative attitudes can lead to students' increased desire to depart, particularly when their home high school is viewed from a distance in a more prestigious manner.

Sense of Belonging

Sense of belonging is defined by Goodenow (1993) as "The extent to which students feel personally accepted, respected, included, and supported by others in the school environment" (p. 80). Positive, reciprocal interpersonal relationships form the core of sense of belonging to a school, and "sense of belonging is critical to adolescents' adjustment because it meets their developmental need for relatedness" (Hamm & Faircloth, 2005, p. 61). In other words, adolescents naturally desire group affiliation.

Smerdon (2002) operationalized belonging as a multidimensional construct; sense of belonging, as defined above, also involves a commitment to academics as well as commitment to the school itself, echoing Tinto's Student Integration Model (1975). Viewing belonging through this lens, the construct can be an important factor in student persistence, as research studies applying Tinto's model have found institutional commitment, or the commitment to the school itself, a predictor of persistence (Pascarella & Terrenzini,1980; Terrenzini et al., 1981).

Other research findings have differentiated between belonging to a class (microcosm) and belonging to an institution (macrocosm). Freeman, Anderman, and Jensen (2007) examined associations between classroom belonging and academic motivation, and variables contributing to the development of belonging at the institution. The researchers found social acceptance, from peers and teachers, to be most strongly associated with institution-level sense of belonging. This echoes Tinto's (1997) work that social integration may need to occur first and be more important for new students.

Factors Associated with Higher Sense of Belonging

Student-level characteristics and school-level characteristics that have relationships with belonging have been well researched. In a study of a large sample of middle school students in 6th and 8th grades, Ma (2003) concluded that self-esteem, a student characteristic, was the largest predictor of sense of belonging, and hypothesized that self-esteem and belonging may have a "circular" relationship, "with each embracing the other" (p. 347). When a student has high self-esteem, s/he is more likely to belong at his or her school.

Another high predictor of students perceiving they belonged was overall good physical and mental health (Ma, 2003), which resonates with the Pretty, Conroy, Dugay, Fowler, and Williams (1996) study in which belonging correlated with self-evaluations of well-being.

Numerous school level characteristics are related to sense of belonging. Students attending smaller high schools experience a greater sense of belonging (Cawelti, 1995), and students attending Catholic high schools experienced a greater sense of belonging and community (Bryk, Lee, & Holland, 1993), perhaps due to a commonly shared or prevalent belief system.

A study by Brown and McIntire (1996) on belonging at the residential Maine School for Science and Mathematics (MSSM) compared student sense of belonging at MSSM with sense of belonging at a nearby magnet high school that serves a partial residential population that elected to attend that high school. Researchers utilized the *Psychological Sense of School Membership* (PSSM) to measure belonging and found that the residential MSSM students had a greater sense of belonging; for example, for the item *I feel like a real part of my school*, the *agree* and *strongly agree* mean percentages were 71.4% for MSSM and 37% for the partially residential magnet

high school which represented a significant difference. There were significant differences for 12 of the 18 items on the PSSM.

Finn (1989), whose research centers on dropouts, suggested that student participation in extracurricular activities can offer insight into student sense of belonging, perhaps reflecting institutional commitment.

In addition to school size, type (private; residential magnet), and extracurricular offerings, students' voice and choice are important components of belonging at school. In a study of perceptions of school membership, of which sense of belonging is a dimension of overall school membership, Smerdon (2002) found that students experienced a greater sense of school membership when they experienced more authority over their academic work and when they had a homeroom or advisory period during their school day. The homeroom or advisory period was thought to increase students' social interactions with other students and an adult (a teacher). This research included a sample of over 11,000 high school students from two waves of the National Educational Longitudinal Study, 1988 and 1990.

Belonging and academic outcomes. A sense of belonging or acceptance at school is correlated with the outcome of higher academic achievement in empirical studies by Battistich et al (1995) and Goodenow (1993), albeit a small correlation. Students who are academically unsuccessful are more likely to perceive a lower sense of belonging (Calabrese, 1987; Goodenow, 1993).

Teachers and belonging. As social interactions form the core of sense of belonging, findings of empirical studies on the relationships between peers and teachers, Ma (2003) found that when students felt as if the teachers and staff cared for them and their success at school,

students felt a greater sense of belonging in the school. According to Ma's results, a caring faculty was more important to students' sense of belonging than academic achievement. Similarly, Bryk and Driscoll (1988) suggest that teachers' commitment to student learning and time devoted to teaching tasks increases student perceptions of belonging at school. Research findings at the freshmen collegiate level identified specific teacher characteristics that contributed to a greater level of class belonging (Freeman, et al. 2007). The teacher characteristics included warmth and caring, as well as an instructional style that elicited student interactions.

Motivation and belonging. Sense of belonging can function to predict student motivation to succeed academically (Goodenow, 1992). In a large scale study of younger students, researchers identified a correlation between student belonging and intrinsic motivation (Battistich et al., 1995). As students perceived a sense of belonging at the school, their intrinsic motivation, or own desire to learn, increased. Classroom sense of belonging is associated with academic motivation at the college freshmen level also (Freeman et al., 2007).

Peers and Belonging. In Osterman's comprehensive literature review of belonging in middle and high schools (2000), peer acceptance serves to support students' sense of belonging. Hamm and Faircloth (2005) distinguish between peer acceptance and friendship; peer acceptance is classroom-based and group-oriented, whereas friendship is "dyadic and intimate in nature" and offers more help, emotional support, and counsel (p. 62). High achieving students often felt a lack of peer acceptance, and thus did not feel that they belonged since what they contributed to the school was not of value. Having close friends, however, acted as a "buffer and secure base"

to negotiate negative peer acceptance (p. 73). Conversely, lack of sense of community or belonging is correlated with adolescent loneliness (Pretty et al., 1996).

At the collegiate level, Hoffman et al. (2002) conducted focus groups with a sample of freshmen involved in on-campus learning communities to develop a belonging instrument. Their analysis of the focus groups concluded that most freshmen are initially overwhelmed by their academic loads; the peers in the learning communities offered academic support that was vital to successful adjustment. Subsequently, in pre-testing of the belonging instrument, learning-communities freshmen scored higher on the Sense of Belonging instrument developed by the researchers, indicating that they perceived that there would be "valued involvement" at the university (p. 251). Both classmates and friends aid in the adjustment to school and sense of belonging.

Encouragement and Support of Students in Residential High School Context

Students who choose to attend residential STEM high schools are an idiosyncratic group. These 16-year-olds are willfully moving from their homes to a college-like environment; literature on social and academic integration into the freshman year of college is vast, but several studies have examined the unique situation of the talented 16-year-old in the residential, college-like setting (Jin & Moon, 2006) and are reviewed in this chapter.

Social coping and adjustment in residential schools has been studied with a focus on the complexities of learning to navigate within a gifted residential setting; student coping by, surprisingly, denying their giftedness yet also recognizing their acceptance into a group of gifted peers were significant findings (Cross & Swiateck, 2009). Overall, however, the researchers suggest that gifted adolescents may "become more comfortable in terms of social interactions,

gaining a sense of acceptance never felt before in school" (p. 32) as a result of immersion in a residential school setting.

Ingersoll and Cornell (1995) studied the social adjustment of gifted female adolescents enrolled in an early college entrance program. Their findings suggested that early entrance females were engaged in more solitary activities and fewer social activities than typical female college freshmen who lived on campus, but overall, the two groups had very similar social adjustment, even considering the age difference between the early entrance females and the typical female college freshmen. In a more complex study on gifted coping and adjustment to a residential school setting, researchers studied coping in terms of physical health, psychological well-being, behavioral problems, academic performance, and overall adjustment (Dunn, Putallaz, Sheppard, & Lindstrom, 1987). Social support, particularly from the students' families, was related to successful adjustment at the residential school; perceptions of peer support were significant findings for male students and their adjustment to the school, and perceptions of social support were significant to both males and females in adjusting. The researchers hypothesized that familial support provided a "strong base" aiding with adjusting to new situations, while peer support and other supports in the new setting or situation aided in adolescent self-perception (p. 471).

Following adjustment to the new environment, gifted and highly talented students attending residential STEM schools report a significantly higher satisfaction with school life than talented students attending a typical comprehensive high school, especially in the domains of curriculum rigor, knowledgeable faculty, and peer and faculty relationships (Jin & Moon, 2006).

Implications are that the academic and socio-emotional needs of gifted and highly talented youth may be better met in a contained setting like the residential high school.

Other positive interaction afforded to highly talented math and science students beyond that of like-minded, gifted peers is the relationship with a mentor, a research scientist holding a graduate degree. Mentors are viewed as change agents in motivating underachieving gifted students (Lemley, 1994); encouragers of underrepresented populations in the STEM community, like females and rural, isolated adolescents, to pursue a scientific career (Mason & Mason, 1991; Subotnik & Steiner, 1993; Zanelli & Smith, 2000); and guides of scientifically talented students who also have learning disabilities in reading and writing (Cooper, Baum, & Neu, 2004).

This immersion into a supportive academic setting does result in the nurturing of a STEM college major and career. As reported earlier in this study, 56% of students who were graduates of a STEM day or residential magnet program graduated with STEM college degrees (Atkinson, et al., 2007), far greater than the general college undergraduate population, which is about 7% (Chen, 2009). In an exploratory causal-comparative study by Plucker, Cobb, and Quaglia (1996) students at the residential Maine School for Science and Mathematics reported higher aspirations for their lives and careers and a more favorable perception of their school climate than general ability students.

Unique as they may be, gifted students in a residential school setting have similar classroom and social navigations to college freshmen. Referring again to Tinto's Student Integration Model (1975), Tinto later grew critical of studies emerging from his persistence model that examined persistence as fixed rather than variant, and he proposed Stages of Passage in the College Student Career marking the challenges students face in transitioning from home to

college life (1988). Tinto provided the example that students' reasons for departure from college after six weeks are very different than students who have attended the college for two years.

The first of Tinto's stages, called Stage of Separation, is marked by "some form of parting from past habits and patterns of affiliation" (p. 443). Students must separate physically and emotionally from their hometown, home high school, family, etc. Next, in the Transition to College stage, students begin college life, in their classes, residence hall, etc., but are not yet integrated academically and socially into college. Finally, students experience Incorporation into College, in which students are integrated, academically and socially. These stages are fluid, rather than linear and fixed; Tinto stresses that future persistence studies should consider these various transitional stages. It can be surmised that 16-year-olds leaving their homes and orienting themselves to a completely new, highly challenging learning and living environment also experience these stages.

As nurturing as these residential settings may be, dropping out or failing to persist is a reality for gifted and talented students at typical comprehensive high schools as well as in the residential magnet setting.

Belonging and Persistence with School

Belonging is considered an understudied variable in persistence studies (Hausmann, Schofield, & Woods, 2007; Hurtado & Carter, 1997). As discussed earlier in the chapter, studies of high school persistence often focus on at-risk adolescent populations and are framed as dropout preventers. For example, in Goodenow's research on belonging, a lack of sense of belonging increased propensity to drop out of school (1993).

Midgely and Urdan (1992) and Wigfield and Eccels (1995) found that perceptions of belonging and support from the school can moderate the risk of failure during times of high stress, such as the transition from middle school to high school. This transition, typically transpiring between 8th and 9th grades and almost always involving changing schools, is considered a highly susceptible period for adolescents (Neild, 2009).

Students in three high schools participating in the Coalition for Essential Schools reform project were found to have better classroom behavior and a lower dropout rate when they felt a greater sense of community at their schools (Royal & Rossi, 1996). The researchers further suggested that a higher sense of community leads to feelings of greater commitment to the school, thus a desire to remain enrolled at the school. Osterman's comprehensive analysis of empirical research on student belonging during early and middle adolescence concluded that "students who experience acceptance are more highly motivated and engaged in learning and more committed to school" (2002, p. 359). Commitment seems to act as a mediator between belonging and persistence.

As TGA is residential and college-like in its environment, a glimpse at belonging as it relates to student persistence at the college level is valuable. In college studies, freshmen who experienced academic success and integration as well as peer integration reported the greatest sense of belonging (Hausmann et al. 2007; Pittman & Richmond, 2008). Belonging was found to be a "significant predictor" of institutional commitment as well as intentions to persist (Hausman et al.). Findings from both studies indicate that adjustment and successful integration into the academic and social realms of the institution, stemming from sense of belonging, are related to student persistence.

Expectation Fulfillment

The second independent variable in this study was expectation fulfillment, which will be defined, and the Expectancy-Value Theory of Achievement Motivation will be summarized. Empirical studies relating expectations to persistence and expectations to sense of belonging will be reviewed. Expectation fulfillment occurs when students look back at their expectations for the new school through a retrospective lens and determine if the school was beneath their expectations, met their expectations, or exceeded their expectations.

Expectations that students bring with them to the new setting do interact with the real experiences students have in those settings, shaping student performance and effort. The Expectancy-Value Theory of Achievement Motivation, a multifaceted interactive model, advances that students' perceptions of their own abilities and their expectations for success influence their classroom choices, effort in the classroom, performance, and overall persistence (Eccles & Wigfield, 2002; Wigfield & Eccles 2000). The researchers believed that expectations are students' beliefs regarding their individual success; their findings from longitudinal studies of early adolescent and middle adolescent populations concluded that a) when students perceive they have the ability and the expectations to perform well in mathematics, their resulting mathematics grades are higher, and b) when students perceive that mathematics is valuable and worthwhile, they persist in mathematics courses. Both of these findings were predictors; the first predicted mathematics grades while the second predicted mathematics coursework persistence.

Stein and Hussong (2007) utilized Expectancy-Value Theory as the framework for a longitudinal study of the transition from middle school to high school among a rural, at-risk population. Their findings determined that students' perceived positive experiences in middle

school predicted perceived positive experience in high school. The researchers did not explore if positive attitudes led to an increase in student persistence, but a study of college students significantly related a positive attitude toward college to student persistence (Janosz, et al. 1997).

Expectations and Student Persistence

An early study on college freshmen expectations found that those freshmen who expected that college would require a great amount of work and effort did experience greater academic success than other study participants who did not have high academic expectations, following a control for student background characteristics (Dispenzieri & Giniger, 1971). The researchers did not examine graduation rates, or persistence, of this sample.

Studies have been conducted at residential magnet high schools similar to TGA on expectations and student persistence. Coleman (1995) situated himself as researcher in a math, science, and humanities residential high school for gifted and talented 11^{th} and 12^{th} graders for over a year, and found that student expectations for homework in their new, more academically rigorous setting was a "shock" (p. 41). Using phenomenological questioning, he probed and found that students' ability to adjust to the increased homework and academic load required a great amount of adjustment, particularly since the amount of homework was greater than they anticipated. Further, the students had to alter their social and academic lives, as homework and academics became greater and more time-consuming than the social aspect. The most successful students in Coleman's study were "taking-it-in-stride," as the students were "experiencing the intensity, having occasional misgivings, and looking toward the future" (p. 49).

Coleman concluded that for this population of gifted and talented students who have chosen to attend a rigorous, residential magnet STEM school, adjusting to the "shock" "may be

instrumental in making a commitment…Choosing to stay at [the school] may be a sign of commitment" (p. 51). Thus, when students can successfully adjust their expectations to the reality of the new environment, they are demonstrating commitment to the school, which may lead to persistence at the school.

Keup (2007) conducted a qualitative inquiry of students' expectations for college prior to their freshman year and at the conclusion of their freshman year. Beyond Smith and Wertlieb's (2005) findings that expectations for college were categorized as academic and nonacademic or social, Keup identified four areas of expectations: academic, nonacademic/social, interpersonal relationships and individual development. Individual development was defined as students possessing a "sense of agency" and "personal ambition" (p. 16). This particular expectation "inspired students to action" during their freshman year, and Keup suggested that the individual development expectation transferred into personal goals, which enhanced student commitment at the college (p. 23).

Cole, Kennedy, and Ben-Avie (2009) proposed exploring relationships between students' background characteristics, high school engagement, expectations for college, and engagement in the first year of college to determine if any functioned as predictors for success during the freshman year. The researchers reviewed several campus studies on students' backgrounds, expectations, and engagement, and they posit that expectations function as "input" that students bring with them to college, and that those expectations "influence our perceptions and behaviors" in the new environment, linking the past experiences to the present and future (p. 59), leading to their development of a model of first-year engagement in college. Student expectations should

inform college personnel in designing and improving upon first-year acclimation programs, as well as increasing student persistence, according to the researchers.

Thus, the findings of these three studies of expectations at a residential mathematics and science magnet school involving two large samples of college freshmen uphold the Expectancy Value Theory; i.e., students' expectations interact with the reality of their new environment, influencing their academic performance, perceptions of their abilities, achievement outcomes, and sense of commitment to the institution. Commitment, as discussed earlier in the chapter, functions as a predictor of student persistence.

Expectations and Belonging

While no studies were found exploring the potential relationship or association between student expectations and sense of belonging, the results of a recent empirical study (Konings, Brand-Gruwel, van Merrienboer, & Broers, 2008) on expectations for a new learning environment and curriculum were very pertinent to this study and to the context of a residential mathematics and science high school. The researchers examined a large sample of middle adolescents as they experienced a new, nationwide curricular shift to what the study authors deem a "powerful learning environment," characterized by four major shifts from the teaching and learning protocols familiar to the study participants: a) shift in course development and sequencing, with a focus on integrating subjects; b) shift in pedagogy, with an emphasis on greater self-directed learning and increased student collaboration; c) shift to cognitive theory of learning, and d) shift to teacher-as-facilitator classroom role.

Expectations for the new learning environment, students' learning characteristics, and students' prospective dissatisfaction were collected longitudinally; researchers found that

students who held high expectations for the learning environment and who exhibited learner characteristics that were open to new curriculum developed higher positive perceptions of the learning environment upon experiencing it.

When the learning environment did not meet expectations coupled with students not adjusting their learner characteristics to the new curriculum, students experienced several negative educational outcomes, including dwindling intrinsic motivation, a decrease in deep processing, (a term from semantic network theory, when new knowledge becomes part of one's schema), and an increased fear of failure. Students felt anxious and unsure, and began to academically disengage from the new learning environment. These students' expectations for the new learning environment were very different from the reality of that learning environment; once they experienced the actual learning environment, they reacted negatively.

Disengagement from school constitutes loss, or decrease, in sense of belonging at the school; it can be surmised that when expectations are not met and students cannot successfully adjust their expectations to the reality of the actual environment, they disengage.

Personality Traits

The third and final independent variable, personality traits, is examined next. The Big Five, or Five Factor Model, of personality is introduced first, followed by a literature review of personality traits and sense of belonging, and personality traits and student persistence with school. Trait theorists approach personality as a measurable entity; each individual exhibits certain behaviors and attributes based on their personalities, forming a unique blueprint (Hergenhahn & Olson, 2007). While there are almost unlimited numbers of traits, trait theorists have used factor analysis to examine clusters of traits. Eysenck, for example, posits that there are

three dominant personality traits (1991). However, the dominant trait theory is the Big Five, also referred to as the Five Factor Model (FFM) of personality, considered the current "default model of personality structure" (McRae & Costa, 2008, p. 273). The Big Five consists of five broad traits: Agreeableness, Conscientiousness, Emotional Stability (also referred to in literature as Neuroticim), Extraversion, and Openness; its ubiquity was observed recently when the Big Five made its way into popular culture via an article in the monthly trade publication, *O: The Oprah Magazine*, extolling the merits of President Obama's high Conscientiousness rating (Dzubow, 2009, p. 113).

In the Big Five model, narrow traits are traits that reside at a lower level of the personality hierarchy than do the broad Big Five factors (O'Connor & Paunonen, 2007). Narrow traits can contribute incremental validity and criterion-related validity in the prediction of academic performance (Lounsbury et al., 2003). For example, Lounsbury et al. found that Work Drive, a narrow trait defined as "industriousness and willingness to expend extra time and effort to meet achievement-related work goals," (p. 69) does contribute significantly to the prediction of GPA of middle and high school adolescents. Lounsbury et al. recommend the use of composites of Big Five traits along with select narrow traits in future predictive studies.

The Big Five model has been studied extensively in relation to student success in college. Research on Big Five personality traits as predictors of academic success established that Conscientiousness functions as a robust predictor of both high school and college GPA and academic success (Abe, 2005; Komarraju, Karau, & Schmeck, 2009; Noftle & Robins, 2007; Trapmann, Hell, Hirn & Schuler, 2007), even controlling for student characteristics. Agreeableness and Openness have been found to be positively related to academic performance

(Bidjerano & Dai, 2007; Komarraju, Karau & Schmeck, 2009; Lounsbury, Sundstrom, Loveland, & Gibson, 2003).

Of interest to this study, researchers noted a positive association between Factor G on the *16 Personality Factor Questionnaire* and success in Calculus I, II, and III courses at the college level. Factor G, called "persistence and perseverance" by the researchers, corresponds with Conscientiousness in the Big Five model (Shaughnessy, Stockard, Moore, & Siegel, 1993, p. 6). In two other studies utilizing small samples of gifted science students and Advanced Placement mathematics students, both groups exhibited significantly higher traits of self-confidence, assertiveness, and independence, known as Factor E on the *16 Personality Factor Questionnaire.* (Ham & Shaughnessy, 1992; Odom & Shaughnessy, 1989).

An extensive meta-analysis of 23 recent empirical studies of personality traits as predictors of academic performance in college (O'Connor & Paunonen, 2007) has shown that while Conscientiousness is consistently positively correlated to academic performance, Openness and Extroversion correlations produced mixed results (r= .06, for Openness; r= -.05, for Extroversion) and Agreeableness and Emotional Stability demonstrate little to no relationship to college academic performance (r= .06, for Agreeableness and r= -.03, for Emotional Stability).

Another systemic meta-analysis of 58 empirical studies (Trapmann et al., 2007) upheld O'Connor and Paunonen's meta-analysis: Conscientiousness did have generalizable, substantial validity to predict college students' GPAs, an important academic outcome. In this meta-analysis, Agreeableness, Openness, Extraversion, and Emotional Stability did not predict college students' GPAs. Thus, the trait Conscientiousness is found to have predictive qualities regarding academic outcomes in college.

Personality Traits and Sense of Belonging

Next, potential associations between personality traits and sense of belonging and personality traits and student persistence are reviewed. Students attending smaller colleges, students who lived on campus, and students who were members of Greek organizations exhibited higher senses of community (Lounsbury & DeNui, 1996); sense of belonging is a dimension of sense of community. Further, sense of community was significantly related to Extroversion, the personality trait that most encompasses sense of community. From these findings, the researchers propose that sense of community, or belonging, is not only environmentally formed but *interactionist*; sense of community is a result of personality traits the students bring with them to the college interacting with the environment of the college. This finding is concurrent with the Student Integration Model of Tinto (1975).

Turning to a context more similar to the residential living and learning environment of TGA, researchers studied the psychological characteristics and personality traits of gifted adolescents in a residential setting (Dixon, Cross, & Adams, 2001) using cluster analysis. They attempted to portray a "type" of gifted adolescent who would choose to leave home and attend a residential math and science high school. Six clusters of student types were identified; within these clusters, there were few significant differences among the students with regard to their personality traits, which were measured using the Minnesota Multiphasic Personality Inventory for Adolescents (MMPI-A). One cluster differed significantly on Social Introversion (the converse of Extraversion in the Big Five model), while another cluster differed significantly on Scholastic Competence (most closely related to Conscientiousness in the Big Five model). These researchers found that the students were more heterogeneous than predicted and stressed that

gifted adolescents should not be stereotyped as all being the same, or homogeneous (Dixon et al., 2001).

Emotional stability, or neuroticism, was found to be negatively associated with students' satisfaction with college, in a meta-analysis of Big Five personality traits and academic success (Trapmann et al., 2007). Komarraju and Karau (2005) found that low achievement motivation, defined as students' drive to persist and compete, correlated with lower Emotional Stability. Belonging, therefore, may be related to higher Extraversion, while disengagement from the institution may be related to lower Emotional Stability.

Personality Traits and Student Persistence

Researched at a time when the nation's high school dropout rate was higher than the current rate, Satir and Cardon (1968-1969) sought to find if the propensity to drop out could be accurately predicted by means of personality traits, thereby leading to the development of a "school persistence equation" (p. 24) based on the scores of the *High School Personality Questionnaire*, a 14-factor personality inventory. Their sample consisted of "high ability dropouts" (p. 23) and a comparison group of well-matched persistors; both groups participated by taking the *High School Personality Questionnaire* (HSPQ). Employing an equation they derived from the statistical analyses of the personality inventory scores, the researchers correctly classified 62% of the dropouts and persistors. The mean scores of the traits Intelligence, Excitability, Enthusiasm, Sensitivity, and Withdrawal comprised the persistence equations the researchers developed. They suggested that school counselors or other educators would need little information on personality traits, as they could refer to the cutoff scores for the personality inventory to provide interventions to the potential dropouts.

Current studies of personality traits and persistence seek to shed light on the traits needed for persistence to graduation, particularly at the collegiate level. However, studies exploring the potential relationship or potential predictive validity have not found a connection. According to Trapmann et al., 2007) in their extensive meta-analysis of 58 empirical studies of the Big Five as predictors of academic achievement at the college level, with retention being one of three achievement criteria, not enough studies were identified to test the researchers' hypotheses that Conscientiousness would be positively related to retention. The researchers summarized personality traits in empirical studies on student persistence and retention: "Further research is needed concerning retention versus attrition as a criterion of success" (p. 146). Emotional stability, Openness, and Extraversion were not associated with persistence, according to their meta-analysis, while the correlation coefficients for Conscientiousness and Agreeableness could not be calculated due to lack of coefficients.

A study on the role of personality traits in students' intention to withdraw from college drew from research within organizational psychology on employee turnover (Lounsbury, Saudargas, & Gibson, 2004). The researchers reviewed models of retention by Tinto and others, and concluded that the pre-college individual characteristics the models all have in common could certainly be personality traits. When the researchers examined personality traits and intention to withdraw from college, all Big Five traits as well as two narrow traits, Sense of Identity and Work Drive, were found to be significantly related to intent to withdraw from college. For example, Conscientiousness was negatively correlated to intention to withdraw (r = -.25, $p < .01$). The researchers do not imply that personality inventories should replace cognitive, achievement-oriented measures, but they do suggest personality trait inventories be used in the

admissions process. Further, they recommend that future researchers studying persistence based on, for example, Tinto's Student Integration Model should control for personality traits, thus affecting the magnitude of institutional and environmental effects.

Summary

As reflected in this literature review, complex relationships exist among the variables of this study: persistence, belonging, expectation fulfillment, and personality traits. Empirical studies and other pertinent literature on persistence found that goal commitment (toward graduation or entrance to a career field) and institutional commitment produced a positive effect on student persistence. These commitments appear to influence sense of belonging and persistence, as suggested in the literature.

All Big Five personality traits were found to be significantly related to decisions to leave a learning institution. Further, the expectations students bring with them to a new learning environment and their subsequent adjustment to the reality of the learning environment can forge or flatten goal and/or institutional commitment, leading to decisions to persist or the initiation of departure decisions.

TGA provides a unique opportunity to study the potential relationships between sense of belonging, expectation fulfillment, and personality traits, and how these variables affect or influence student persistence. These constructs have not been studied in such a context before; therefore, TGA provides both a distinct population and opportunity to explore the relationships of these variables. Incoming students bring a set of expectations and their unique personality traits with them to TGA, while sense of belonging and expectation fulfillment are determined

while at TGA. The choice to persist results from the interaction of these three variables, along with many other variables not accounted for in this study.

Chapter 3 will describe the study participants and context, and provide a guide for the research design of this mixed methods case study, which is exploring persistence at Tennessee Governor's Academy for Mathematics and Science. Referring back to the Facebook exchange at the introduction of Chapter 2, what will become of the TGA "nerd"? Or the name caller? Did either of them bring expectations and personality traits more amenable to development of sense of belonging and propensity to persist with their rigorous math and science studies at TGA?

CHAPTER 3: METHOD

This chapter frames the study's design with rationale for the design. It describes its unique context and participants; explains data collection procedures and instrument selection, and provides details regarding quantitative and qualitative data analysis.

Research Questions

Three research questions guided this study, as follows:

1. What does it mean to belong at a newly formed specialty high school?
2. What are the relationships among the constructs personality traits, expectation fulfillment, and belonging, and how do those constructs relate to student persistence?
3. What are characteristics of students who persist and those who do not persist with the high school program?

To answer the research questions, this study employed mixed methods within an exploratory case study framework, which "investigates a contemporary phenomenon in its real life context" (Yin, 1993, p. 59). The four purposes of this study were a) to describe students' meaning of belonging at a specialty residential school; b) to explore potential relationships between students' personality traits, expectations for the school, and belonging; c) to explore potential relationships between belonging and persistence and personality traits and persistence, and d) to describe characteristics of students who persisted at the school as well as those who voluntarily or involuntarily did not persist.

Design of Study

This study is a mixed methods case study investigating the phenomenon of student sense of belonging and its relation to student persistence within the context of a new residential

mathematics and science high school experience. It is a within-site study concentrating on a particular residential school and it is intrinsic, as the case "presents an unusual or unique situation" (Creswell, 2007, p. 74) in which the researcher sought to provide "an in-depth understanding" (p. 74). As Greene (2005) stated, "cross-context patterns of regularity *and* within-site contextual complexity are *both* respected and engaged" (p. 21). The mixed methods design chosen for this study was *complementarity*, a term devised by Caracelli and Greene (1997), in that quantitative and qualitative results elucidate and augment eachother. This study is also descriptive as it includes a rich perspective, since schools do not exist in a vacuum and are best understood within their unique context.

Case study research can be generalized to the theory being tested, not to populations (Yin, 1993). Hence, this study can be used to "expand our understanding of theoretical propositions and hypotheses in situations where the context is important" (p. 39).

Case study was selected due to the small size of the new school and its status as a bound system. In this context, and examining this phenomenon, case study was the most appropriate methodology. Understanding of the phenomenon is sought rather than determination of causation. Experimental research and, in some situations, quasi-experimental research designs are not optimal designs in situations where the richness of the context needs to be captured. Such was the case of the newly formed Tennessee Governor's Academy for Mathematics and Science.

Context of Study

Schools Like Ours, the title of a forthcoming book from the National Consortium of Specialized Secondary Schools in Mathematics, Science, and Technology (NCSSSMST), highlights the importance of establishing, perpetuating, and sustaining STEM specialty schools

as conduits for future STEM professionals. Only 17 other schools like TGA exist in the United States, being residential, statewide, public, and free of charge. Most are line-items in the state budget, mandated by legislature, supported by tax dollars, and charged with representing the demographics of the state. TGA is funded by Governor Bredesen's discretionary funds.

Typically, these specialty schools, residential or day magnets, are planned for years, as is the case with Gatton Academy in Kentucky, affiliated with Western Kentucky University. A planning process of almost ten years that included decision-making in curriculum, housing, staffing, faculty, legislature, funding, and much more resulted in the opening of the Gatton Academy in August 2007 with 120 juniors and seniors.

Tennessee Governor's Academy for Mathematics and Science (TGA) is a specialty STEM residential program for talented 11th and 12th graders with diverse backgrounds from across the state. Governor Bredesen pledged $2.2 million toward the formation and development of TGA. In *Schools Like Ours*, the authors stress the importance of pre-planning prior to implementation, including responding to the question: "What do we want our graduates to look like?" Also key to the planning process are a mission statement, curriculum decisions, staffing decisions, and program sustainability. The TGA Planning Committee planned facilities, mission, staffing, and curriculum, with sustainability and program advocacy handled by The University of Tennessee, Knoxville (UT) and the Office of the Governor.

While planning for the Tennessee Governor's Academy for Mathematics and Science (TGA), the University of Tennessee examined other STEM specialty residential schools, particularly the North Carolina School for Science and Mathematics (NCSSM), the nation's oldest model, founded in 1980. The TGA planners devoted less than one year to the planning

process, from school conception to students arriving on campus in August 2007. The TGA planners met with NCSSM and received assistance and advice from the Missouri School for Mathematics, Science, and Technology and the Oklahoma School for Science and Mathematics (OSSM) in this rapid preparation for students' arrival in August 2007.

NCSSM Chancellor Gerald Boarman recommended that TGA house its students on the UT campus or another location where students could walk for groceries, amenities, and, possibly exercise and entertainment (personal communication, May 22, 2007 and March 14, 2009). TGA planners chose to situate the school on the Tennessee School for the Deaf campus, a gated, 100-acre campus with its own board and oversight, which TGA follows.

In March 2007, during the planning stages for TGA, this researcher began working for the school as an evaluation intern. Responsibilities included developing the evaluation scheme and assisting with application review and rating. Currently, the researcher serves as the program's internal evaluator, charged by the executive director to evaluate the program and engage the students, their parents, and other stakeholders in this process. The researcher does not evaluate the implementation of the program, nor is the researcher involved in evaluation of the TGA faculty or in the financial situation of the academy.

The University of Tennessee Institutional Review Board approved the researcher's evaluation design in July 2007, titled the Tennessee Governor's Academy for Mathematics and Science Comprehensive Evaluation Plan (TGA-CEP). In this IRB, the researcher functions as an observer of the students, interacting with them to conduct interviews, focus groups, or to administer surveys at prescribed data points. However, the researcher is considered a participant among the faculty and staff.

When students and their parents are accepted to TGA, they sign parental consent and student assent forms for the purposes of research and evaluation. The TGA students and their parents participate in surveys, interviews, and focus groups that are all scheduled components of the TGA-CEP. Much of the data for this study were obtained through regular evaluation activities and/or through the TGA application review process.

The inaugural class of 2009 arrived at TGA in August 2007, comprised of 24 students. By summer 2008, 15 of the original 24 planned to return for their senior year. The nine who left did so for a variety of documented reasons, including homesickness, and a desire to return to activities and/or athletics of home high school, among other reasons. Each student departure was handled on a case-by-case basis by the TGA Lead Teacher. Two of the cases were deemed involuntary departures, as those two students were asked to leave. One dismissal was for a disciplinary reason, while the other requested departure was based on a socialization reason. The other remaining six departing students chose to depart, but the TGA Lead Teacher confirmed that of those six voluntary non-persisters, two would not have been invited back for their senior year based on low academic performance.

Due in part to the lack of persistence, the TGA administration and faculty began developing ideas for academic standards and a discipline code to implement in fall 2008. During this challenging inception year the researcher formulated questions regarding applicant suitability for a demanding, academically rigorous residential program and what sense of institutional fit or belonging they developed while at TGA.

In fall 2008, 15 seniors returned, plus an additional new senior who was brought in from the 2007 waiting list. Thirty juniors joined the seniors for a total of 46 TGA students. The TGA

Student Handbook was published in summer 2008 containing an academic standard of maintaining a 2.75 GPA and a discipline code involving point accumulation for violations. Both standards were created by examining academic and discipline policies at other residential STEM schools.

Following the 2008-2009 academic year, 13 seniors successfully graduated, and 22 juniors planned to return; thus, 35 students persisted, while 11 did not persist at TGA.

Of the 11 2008-2009 non-persistors, two juniors left voluntarily at the beginning of the school year. One male was homesick, and the other was both homesick and felt that he could not compete with the academic rigors of TGA. Of the other nine non-persistors, all were involuntary, as they were asked to leave. Three seniors and three juniors departed due to academic reasons, and three juniors were asked to leave for disciplinary reasons. TGA administration and faculty planned further revision of the academic standards and discipline codes for 2009-2010.

The applicant screening policy evolved three times during the three-year application cycle of the school. In the third recruiting year, 2009, applicants completed a lengthy application which included essays, an interest inventory, recommendations, and demographic information, then progressed to a telephone interview followed by an on-site, two-day TGA Experience, at which applicants met students and faculty, toured facilities, observed a STEM class in session, completed placement examinations, and were interviewed by faculty. This procedure changed significantly from the inception year, when applicants completed a brief application and were interviewed on the telephone twice. Thus, the TGA applicant screening process, academic standards, and discipline code are continuing to evolve and change.

Participants

The participants in this study were the student body population of Tennessee Governor's Academy for Mathematics and Science. The student body was comprised of 43 juniors and seniors in December 2008 (three students, of the total 46, had departed prior to December).

Student persistence data were collected through June 2009. Between December 2008 and June 2009, three seniors and five juniors were asked to leave TGA due to failure to meet academic standards or disciplinary infractions. Four juniors decided not to return to TGA following the conclusion of their junior year.

Hence, participants in this study were comprised of three groups of TGA students or former students:

Current students (CS), juniors and seniors

Voluntary Non-Persistors (VNP), who chose to leave the program for a variety of reasons

Involuntary Non-Persistors (INP) who were asked to leave the program for academic or disciplinary reasons

Characteristics of TGA students from December 2008 are presented in Table 1.

Data Collection

Data collection in this study was continuous and integrated, as this researcher supports the position of Howe, here quoted in Miles and Huberman (1994), that quantitative and qualitative data are "inextricably intertwined" (p. 41). First, the study variables are introduced and the procedures for data collection are discussed, followed by thorough descriptions of the instruments used to collect the data.

Table 1. *Characteristics of the TGA Student Population, December 2008*

Student Characteristics	Seniors	Juniors
Number	16	27
Gender	8 females 8 males	14 females 13 males
Ethnicity	10 White 3 African-American 3 Asian/Pacific Islander	22 White 1 African-American 4 Asian/Pacific Islander
Standardized Test Scores	Seniors	Juniors
[a]PSAT Mean	182.5	176.2
[b]ACT Composite Mean	27.9	26
[c]PLAN Composite Mean	23.7	23.9

Note. Students took standardized tests as sophomores at their home high schools.

[a]PSAT: senior class, $n = 7$; junior class, $n = 13$.

[b]ACT: senior class, $n = 7$; junior class, $n = 7$.

[c]PLAN: senior class, $n = 7$; junior class, $n = 23$.

The second independent variable, *personality traits* is comprised of the Big Five Personality Traits: Agreeableness, Conscientiousness, Emotional Stability, Extroversion, and Openness, and the narrow traits Career Decidedness, Self-Directed Learning, and Work Drive.

Study Variables

This study examined four variables: sense of belonging, personality traits, expectation fulfillment, and persistence. The independent variable *sense of belonging* was determined by the students' position on the 2 x 2 Model of Belonging (Nichols, 2008). Students were categorized as Connected, Adaptive, Rejected/Isolated, or Resistant, as per the analysis of interview data. Sense of belonging was measured using both the *Psychological Sense of School Membership* inventory mean scores outlined in Chapter 1 and an interview protocol.

The second independent variable, *personality traits* is comprised of the Big Five Personality Traits: Agreeableness, Conscientiousness, Emotional Stability, Extroversion, and Openness. The Big Five hierarchy has been well-researched for prediction, particularly of academic success or achievement, since being validated by McCrae and Costa in 1987 (Bidjerano & Dai, 2007; Duffa et al., 2004; Lounsbury, Sundstrom, Loveland, & Gibson, 2003). The Big Five include Neuroticism (will be referred to as Emotional Stability in this study); Extroversion; Openness to Experience and/or Intellect (will be referred to as Openness in this study); Agreeableness, and Conscientiousness. Three "narrow traits" of personality also included in this study are Career Decidedness, Self-Directed Learning, and Work Drive. Costa & McRae's (1987) Big Five traits, also referred to as the Five Factor Model (FFM) were developed following decades of analysis in which the five traits clustered together in factor analysis; narrow personality traits are encompassed within the Big Five and can enhance incremental validity, as

demonstrated when Work Drive was found to add significantly in predicting course grades (Lounsbury, Saudargas, & Gibson, 2004).

The third independent variable, students' *expectation fulfillment*, was categorized as exceeded expectations, met expectations, or was below expectations (ordinal data). The second dependent variable, *persistence*, was explored in terms of persisting with the school and not persisting (departing) the school. Of school non-persistors, some students left voluntarily (VNP), and others were asked to leave (INP). Study variables are presented in Table 2.

Instrumentation

The researcher serves as the program evaluator for TGA, and under the IRB for the TGA comprehensive evaluation plan, was able to gather a wide array of participant data through a variety of methods. Instruments selected for this study included two carefully chosen, externally produced measures and an internally-produced interview protocol.

Transition to College. The first instrument, the *Transition to College* (TTC) inventory (also referred to as the *Adolescent Personal Style Inventory*) developed by University of Tennessee Psychology Professor, Dr. John W. Lounsbury, was administered to TGA students and incoming TGA students in spring 2008. This instrument provided data regarding the personality trait variables. It was also administered to the TGA senior class during their junior year, in 2008. The instrument is for adolescents beginning with age 12, spanning early, middle, and late adolescence, and consists of 118 items that measure the Big Five personality traits (openness, agreeableness, extraversion, conscientiousness, and emotional stability) and Narrow personality traits in relation to high school students transitioning to college. The inventory takes about 15 minutes to complete, and participants responded to the 127 items with one of five

Table 2. *Study Variables*

Independent variables	Measurement
Sense of Belonging	Position in the 2 x 2 Model of Belonging
	Connected
	Adaptive
	Rejected or Isolated
	Resistant
Expectations	Expectation fulfillment
	Exceeded expectations
	Met expectations
	Below expectations
Personality Traits	Big Five traits:
	Agreeableness, Conscientiousness, Emotional stability,
	Openness, Extraversion
	Narrow traits:
	Career decidedness, Self-directed
	Learning, Work drive
Dependent Variables	
Sense of Belonging	*Psychological Sense of School Membership* score means
Persistence	Persistors
	Non-persistors
	Voluntary non-persistors
	Involuntary non-persistors

options: *Strongly disagree*, *Disagree*, *In-between*, *Agree*, and *Strongly agree*. All together, the inventory examines 13 personality traits; in addition to the Big Five listed previously, the eight narrow traits of aggression, career decidedness, leadership, optimism, sense of identity, tough-tender mindedness, self-directed learning, and work drive are measured. Each of the 13 scales consists of approximately 10 statements. For example, sample items within the scale Work Drive include the following:

- I don't mind staying up late to finish a school assignment.
- Doing well in school is the most important thing in my life.
- Even if I won a million dollars, I would study hard to make good grades in school.

In a study of 290 10th graders, Lounsbury, Sundstrom, Loveland, and Gibson (2003) investigated narrow personality traits in addition to the Big Five traits in predicting students' academic success. In their sample, the Cronbach alphas measuring internal consistency reliability for the four of the Big Five traits examined in this study were agreeableness, 0.82; conscientiousness, 0.83; emotional stability, 0.82; extraversion, 0.86; and openness, 0.82. The narrow personality trait of work drive had a Cronbach alpha of 0.87. Further, the 7th grade sample (n = 220) in the same study all had Cronbach alphas greater than 0.79 (Lounsbury, Sundstrom, Loveland, & Gibson, 2003).

In another study by Lounsbury, Saudargas, Gibson, and Leong (2005), a sample of 552 college undergraduates were administered the *Transition to College* inventory in order to determine if personality traits related to the domains college satisfaction and general life satisfaction. Cronbach alphas for the seven personality traits which will be examined in this study, were as follows: openness, 0.75; agreeableness, 0.75; conscientiousness, 0.79; emotional

stability, 0.84; career decidedness, 0.91; self-directed learning, 0.74, and work drive, 0.84. It is to be noted that all Cronbach alphas were 0.74 or higher. Hence, these two studies provided evidence for a sufficient level of internal consistency reliability of the TTC with its intended adolescent population.

This study focused on four of the Big Five traits of openness, agreeableness, conscientiousness, and emotional stability, as well as the narrow traits of self-directed learning, career decidedness, and work drive. Throughout the first and second years of the school, TGA faculty has consistently noted the importance of Self-Directed Learning as a key trait for TGA students to possess. TGA students are also encouraged and nurtured to choose a STEM major and STEM profession, making Career Decidedness a pertinent variable in this study. As noted previously, Lounsbury, et al. (2003) found that Work Drive, a narrow trait, does contribute significantly to the prediction of GPA of middle and high school adolescents.

The TTC demonstrates criterion validity, as researchers found when studying a sample of over 3400 high school students. Utilizing institutional records such as GPA, attendance, and discipline records, as well as students' self-report of life satisfaction, the Work Drive scale was significantly positively correlated with GPA ($r = .40$; $p < .01$), while Emotional Stability was significantly positively correlated with life satisfaction ($r = .52$; $p < .01$) (Lounsbury, Saudargas, Gibson, & Leong, 2005; Lounsbury, Steel, Loveland, & Gibson, 2004; Lounsbury, Sundstrom, & Loveland, & Gibson, 2003).

Psychological Sense of School Membership. This instrument provided data for the variable of student belonging and was developed by Carol Goodenow (1993). The PSSM was chosen from numerous instruments to measure the TGA students' perceived sense of belonging,

as the PSSM was intended to measure belonging for diverse adolescent students. When the instrument was being developed, no "psychometrically sound measures" of belonging were available (Goodenow, 1993, p.81). Initial versions of the instrument were pilot tested with participants at three different middle schools in urban and suburban settings and with native English speakers as well as students who were English language learners. Further, the socioeconomic status of the participants varied. With each iteration of the instrument, the number of items were reduced from 42 original items to the current 18-item statements, of which participants choose among five selections ranging from *not at all true* (1) to *completely true* (5). The 18 items measure five belonging domains: students' sense of belonging at the school (e.g., "I feel like a real part of this school."); students' perceived teacher response (e.g., "Teachers here are not interested in people like me." [reversed]); students' perceived peer response (e.g., "Other students here like me the way I am."); respect (e.g., "People here notice when I am good at something."), and overall perceived liking or inclusion (e.g., "People at this school are friendly to me."). (See Appendix A.)

Goodenow tested the scale for internal consistency reliability among the diverse school populations. Suburban students had the highest Cronbach alpha at 0.875 for the first study and 0.884 when the survey was re-administered a year later. For urban students responding to the English version of the scale, the Cronbach alpha was 0.803, and for urban students responding to the Spanish language version, the Cronbach alpha was 0.771.

Construct validity was determined by employing contrasted groups validation procedures. Again, during testing of the instrument, several hypotheses were made regarding the results of the suburban students and the urban students. For example, due to the suburban students having

more educated families and hailing from a smaller community, Goodenow predicted that they would have a greater sense of belonging than the students at the urban school. This was indeed the case as the mean belonging at the suburban school was 3.86 and the combined urban schools was 3.10, significant at the $p < .001$ level. Another hypothesis was that girls would feel a greater sense of belonging than boys, and that hypothesis was found true in both urban and suburban settings.

The instrument, with high levels of reliability and validity, has been used widely in a variety of settings and with students who are not native speakers of English. The TGA student population is comprised of students from urban, suburban and rural areas and students whose native language is not English. Selecting an instrument that has success in measuring belonging among such variance was important. Following the administration of the PSSM, open-ended, structured interviews were conducted to gather student perceptions of belonging at both their home high schools and at TGA. The PSSM results and data from the first participant interview were analyzed for the purpose of orienting participants in the 2 x 2 Model of Belonging (Nichols, 2008) discussed further in the Data Analysis section.

Participant Interview. Stake (1995) views the interview as an instrumental data collection tool for highlighting "multiple realities." Student interviews occurred in December 2008 and addressed students' perceived sense of belonging at their home high schools and at TGA, their expectations of TGA prior to attending, and how their expectations met the reality of TGA. Interview questions were derived from those posed by Nichols (2008) to the middle school population she interviewed. The semi-structured interview protocol included the following questions:

What did you think of your home high school?

Looking back at your home high school, how do you feel about it now?

Do you feel you belonged, or fit in, at your home high school? Why or why not?

What do you think of TGA?

Do you feel you belonged, or fit in, at TGA? Why or why not?

The summer before your junior year, what did you imagine TGA would be like? What did you expect of TGA?

Has TGA met those expectations, surpassed those expectations, or is it below those expectations? Why?

During the first interview, a senior male spoke extensively of "getting used to TGA," or adjusting. Following the first interview, the question, "Your classmates have spoken to 'getting used to TGA.' What does that mean to you? Can you address that statement?" was added.

The questions "What did you think of your home high school?" and "What do you think of TGA?" were intentionally broad and open-ended to capture participants' first reactions to those environments, and to learn if those responses were triggered by social interactions, academics, or another factor.

Social and academic integration to the college environment is the centerpiece of Tinto's Student Integration Model (1975). Probing questions followed the participants' initial responses, and those follow-ups included questions like, "You've spoken to the academics at TGA. What are your thoughts on the residential life?" or "You were very involved in extracurricular activities at your home high school. How are you involved at TGA?"

The open-ended questions were designed to gather participants' perception of belonging; the orientation of the sense of belonging (academic, social, other); perceptions of TGA climate (positive, negative, neutral) for situating participants in the 2 x 2 Model of Belonging (Nichols, 2008), and students' expectations for TGA.

In December 2008, the student body of 43 was scheduled for interviews, which were part of routine evaluation activities. Forty-one of the students participated in the interview. The juniors (n=27) were still in their first semester of school, and, according to Pittman and Richmond (2007), who researched college freshmen, exhibit "increased levels of psychological symptoms" (p. 273) like school adjustment. Students in their second semester "have had the opportunity to become part of the university community and psychological symptoms related to the immediate transition to college have decreased" (p. 273). With the total number of students at 43 in December 2008, each student was an important contribution to the research.

Procedures

The procedures described are all components of the TGA *Comprehensive Evaluation Plan* (TGA-CEP) and are replicated with each new junior class. First, prospective TGA students are administered the *Transition to College* (TTC) inventory as part of the application process to TGA. When applicants reach the third tier of the selection process, they visit TGA to shadow current students and be interviewed. The finalists are also administered several placement assessments, and the TTC is among those instruments. The scores for the TTC guided the researcher in answering research question number two, *What are relationships among personality traits, expectation fulfillment, and belonging, and what relationship exists between belonging and student persistence?*

Once students are admitted to TGA, they and their parents sign assent/consent forms, approved by the University of Tennessee Institutional Review Board (IRB). Students and their parents do not have to participate in the research and evaluation activities, but student participation is close to 100% when surveys are administered, as students are vested in "voicing" their opinions and suggestions for school and program improvement. At the conclusion of fall semester, students are either individually interviewed or surveyed regarding their perceptions of their sense of belonging and their retrospective sense of expectations for the school, among other constructs not pertaining to this study. The *Psychological Sense of School Membership* (PSSM) was integrated into this interview. Scores from the PSSM were utilized in research question two, along with TTC scores; the interview transcriptions were analyzed for research questions one and three, *What does it mean to belong to a newly formed specialty high school?* and *What are characteristics of students who persist and those who do not persist with the program?*

Throughout the academic year, student attrition is recorded, and students are grouped by voluntary persistence or non-voluntary persistence. Data collection ceases for non-persistors at the point of their departure, but data collected to that point was considered in the study. Persistence data contributes to the third question, *What are characteristics of students who persist and those who do not persist with the program?*

Hence this study contained three independent variables, as follows: personality traits; sense of belonging, and student expectation for the program. The dependent variable of the study was student persistence. Figure 2 is a flow chart depicting the life cycle of data collection for this study.

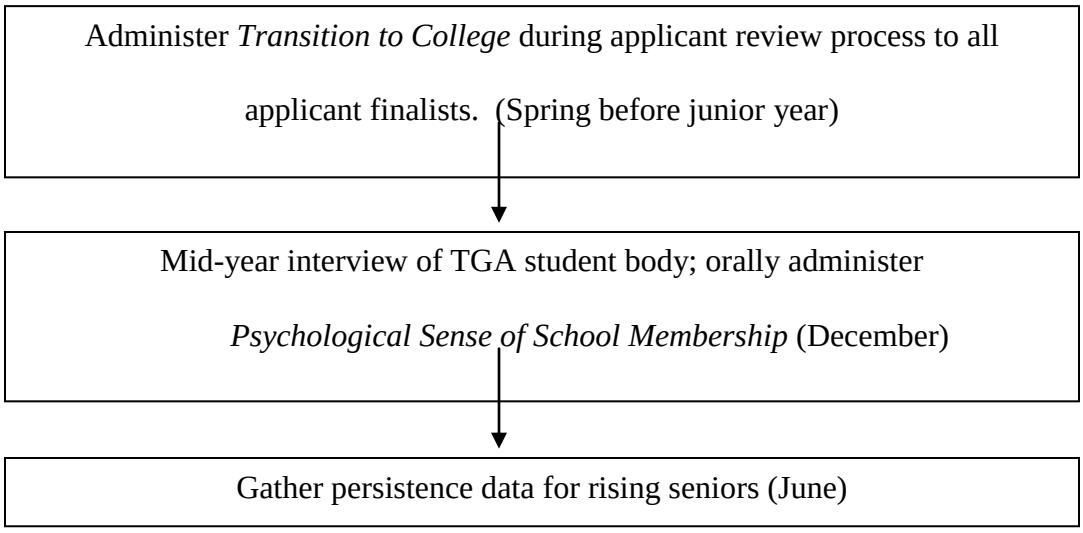

Figure 2. Flow Chart of Research Design and Task Completion

Analysis of Data

Data analysis was both quantitative and qualitative, building upon each analysis until the development of the explanatory effects matrix for preliminary explanations and future hypothesis-building. Analysis of data discussion is organized by each research question. Figure 3 provides a visual description of the mixed methods data analysis framework for this study.

Research Question One

To address the first research question, "What does it mean to belong at a newly formed specialty high school?" data from the student population interview, including the oral administration of the *Psychological Sense of School Membership* inventory of December 2008 were analyzed. Data are both closed and open-ended.

Data analysis of the student population interview transcriptions from December 2008 situated each participant in the 2 x 2 Model of Belonging. Transcriptions were initially coded descriptively (first-level codes) for interpretive purposes, and were replicating Nichols' (2008) codes developed in the Model of Belonging research. The pre-determined code master list categorized codes into student perception of school climate (positive, negative, neutral). The code master list also categorized for students' perception of belonging (yes, no, sort of, and the center of the belonging perception, as in interpersonal relationship with teachers, interpersonal relationships with peers, academic, etc.). However, due to the exploratory nature of the work, the researcher was aware of the potential for other emerging codes.

From the descriptive or first-level codes, transcripts were further studied and pattern coded (Miles & Huberman, 1994). Pattern coding allows the researcher to generate themes from

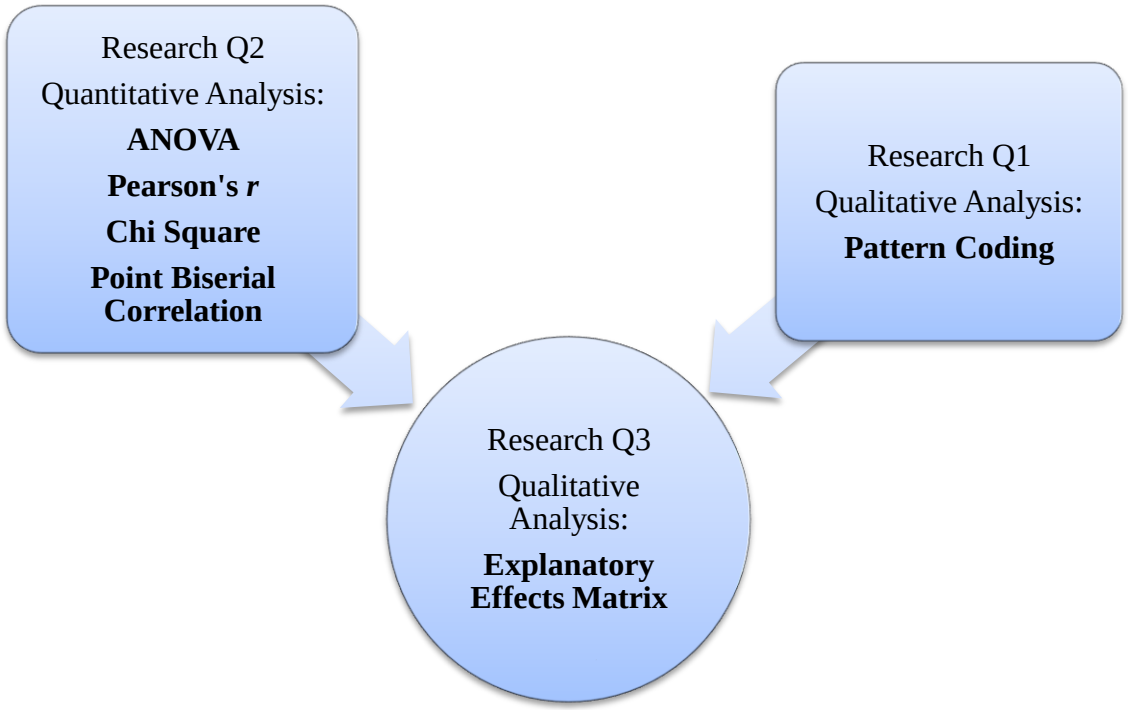

Figure 3. Illustration of the Integration of the Study's Quantitative and Qualitative Analyses

the transcripts, as the pattern codes fuse a large quantity of material into viable units of analysis. Pattern coding is used to study other qualitative data not transformed for the 2 x 2 Model of Belonging. This study was exploratory and descriptive, so efforts were not made for explanation or causation, but emergent themes and emergent constructs elucidated the quantitative analysis of this study.

Research Question Two:

What are the relationships among the constructs personality traits, expectation fulfillment, and belonging, and how does belonging and personality traits relate to student persistence?

Prior to performing quantitative analysis, data were entered in SPSS 17. *Transition to College* data were continuous and presented as stanine scores. *Psychological Sense of School Membership* (PSSM) mean scores were also continuous. Expectations data were ordinal, categorized as exceeding expectations, met expectations, or beneath expectations, and assigned corresponding numbers (3, 2, or 1).

ANOVA variables: Belonging and expectation fulfillment. An ANOVA was performed between students' expectations (coded as 1, 2, or 3) and students' sense of belonging, as indicated by the PSSM mean scores, to explore potential differences in the belonging means among the participants when grouped by expectations.

Pearson product-moment correlation variables: Belonging and personality traits. Pearson product moment correlation coefficients were calculated in order to explore relationships between students' sense of belonging, as indicated by the PSSM mean scores, and students' personality traits, as indicated by TTC stanine scores. Correlational studies should, at minimum, involve 30 participants according to Gay and Airasin (2003). Correlation cannot

determine causality but can determine relationships between these independent variables, useful for hypothesis building for future studies.

Chi-square tests for independence: Belonging and persistence. A Chi square test for independence was performed between the variables belonging and persistence, coded as 1 = persisted and 0 = did not persist. Due to lack of variance in PSSM means and low cell counts, belonging was converted to a nominal variable with the categories 1 = belong and 0 = did not belong.

A second chi square test of independence was performed between the variables expectation fulfillment and persistence to determine if the values of one variable was related to or dependent on the values of the second variable. Expectation fulfillment was categorized as 1 = below expectations; 2 = met expectations, and 3 = exceeded expectations. Persistence was categorized as 1 = persisted and 0 = did not persist.

Point-biserial correlation variables. The relationship between persistence and personality traits was studied employing point-biserial correlations, which measure the association between each continuous variable and a dichotomous, or binary, variable (Glass & Hopkins, 1995). Persistence is a naturally occurring dichotomous variable; students persist with the program or they do not (1 = persisted; 0 = did not persist). Personality traits are continuous. Point-biserial correlations were completed between personality traits and student persistence.

Research Question Three:

What are characteristics of students who persist and those who do not persist with the high school program?

The aim of the qualitative analysis for the third and final research questions was to enhance and expound the qualitative analysis for the first question and the quantitative analysis for the second questions, providing a richer description of TGA, its students, and its context, upholding the complimentary (Greene, 2005) nature of this study. Coding, used frequently by qualitative researchers, are labels designated to information that researchers gather. Codes integrate a large volume of material into units of analysis. Matrices, or graphic displays, are created by researchers to assist themselves and their readers in comprehending a large amount of material (Miles & Huberman, 1994).

An explanatory effects matrix, which examines the results of a process, was generated to respond to the third research question. In this study the researcher believed a relationship existed between the study variables beyond that revealed by quantitative analyses. By sifting the findings of the first and second research questions, further insights into characteristics of program persistors and non-persistors could be revealed within the matrix's visual display. The purpose of the explanatory effects matrix is to pose questions such as, "Why were these outcomes achieved? What caused them—either generally or specifically?" (Miles & Huberman, 1994, p. 148). Miles and Huberman consider this matrix the first step in studying causation, useful following this study for development of future research questions and hypothesis-building.

Following close study of the results of the qualitative analysis for research question one and the quantitative analyses for research question two, the data used to construct the explanatory effects matrix were those displayed in Table 3.

Table 3. *Data and Data Sources Included in Explanatory Effects Matrix*

Data	Level	Data Source
Participants' Position within 2 x 2 Model of Belonging ***Connected*** ***Adaptive*** ***Rejected/Isolated*** ***Resistant***	Nominal	Interview protocol
Perceptions of Home High School ***Positive*** ***Negative*** ***Neutral***	Ordinal	Interview protocol
Expectation Fulfillment ***Exceeded*** ***Met*** ***Below***	Ordinal	Interview protocol
Emergent Patterns from Research Question 1 ***Sacrifice*** ***Negotiations*** ***Hindrances/Blockers*** ***Ownership***	Nominal	Analysis of interview transcriptions
Persistence ***Persistor*** ***Non-Persistor***	Nominal	School records, June 2009

The researcher then examined the matrix for patterns, relations between the variables, comparisons among the variables, and, most importantly, teased out potential unforeseen intervening variables that correlation cannot determine. Due to the small size of TGA and its unique context, the explanatory effects matrix enhanced the descriptive nature of this exploratory case study as well as findings discovered via the quantitative analysis of the variables. In addition, these exploratory, descriptive study results can lead to hypothesis-building for a later causal study.

Figure 5 provides a comprehensive alignment of each study research question, data source, data source item, and the data analysis.

Summary

Multiple instruments, interviews, and both quantitative and qualitative analysis techniques were interwoven to create a resonant exploration of the phenomena of belonging and persistence at TGA. Quantitative analysis included ANOVA, chi square tests of independence, correlation, and point-biserial correlation to explore relationships between the study's independent variables and between the independent variables and dependent variable. Qualitative analysis included pattern coding and the development of an Explanatory Effects Matrix, aimed at graphically illustrating the phenomena to enhance and expound the quantitative and qualitative analyses for research questions one and two. Adherence to a complementarity approach, in which the quantitative and qualitative analyses elucidate and enhance the other, was maintained. In the next section, results of the mixed methods data analysis are discussed.

Research Question	Data Source	Data Source Item(s)	Data Analysis
1. What does it mean to belong at TGA, based on student perceptions?	• Interview protocol, December 2008	• What do you think of it here at TGA? • Do you feel you belong, or fit in, at TGA? Why or why not? • A classmate commented that you have "get used to" TGA. Can you speak to that?	• Descriptive coding followed by Pattern coding
2. What are the relationships between the constructs personality traits, expectations, and belonging, and how do belonging and personality traits relate to student persistence?	• *Psychological Sense of School Membership* • Expectation fulfillment • Interview protocol December 2008 • *Transition to College* • Persistence, June 2009	• Inventory score means • Before you arrived, what were your expectations for TGA? Has TGA met, surpassed, or is it below your initial expectations? • Inventory stanine scores • School records	Quantitative: • ANOVA • Pearson's *r* • Chi square • Point biserial Correlation
3. What are the characteristics or TGA persistors and non-persistors?	• Belonging: position in 2 x 2 Model • Expectation fulfillment • Persistence • Emergent patterns from qualitative analysis of research question one	• Interview transcriptions (items listed above) • School Records • Findings of Research Question 1	Qualitative: • Explanatory effects matrix

Figure 4. Alignment of Research Questions, Data Sources, Items, and Analysis

CHAPTER 4: RESULTS

Data Analysis

The purposes of this study were to describe students' meaning of belonging at a specialty residential school; to explore potential relationships between students' personality traits, expectation fulfillment, and belonging; to explore potential relationships between belonging and persistence, and to describe the characteristics of students who persisted at the school as well as those who voluntarily or involuntarily did not persist.

Chapter 4 presents the results of analyses of the qualitative and quantitative data collected from the student body through two externally produced instruments, one interview protocol, and school records. Tennessee Governor's Academy for Mathematics and Science (TGA) students provided the population for this study, which numbered 43 students in December 2008.

Research Questions

Three research questions guide this study, as follows:

- What does it mean to belong at a newly formed specialty high school?
- What are the relationships among the constructs personality traits, expectation fulfillment, and belonging, and how do those constructs relate to student persistence?
- What are characteristics of students who persist and those who do not persist with the high school program?

Instrumentation

The researcher serves as the program evaluator for TGA, and under the IRB for the TGA comprehensive evaluation plan, was able to gather a wide array of participant data through a

variety of methods. Instruments selected for this study included two carefully chosen, externally produced measures and a researcher-developed interview protocol.

The *Psychological Sense of School Membership* (PSSM) was selected from among several belonging measures, as it is intended to measure belonging for diverse adolescent students (e.g., rural, urban, suburban backgrounds). The 18-item scale is a 4-point Likert scale, and it was administered orally to the students prior to their structured interviews. Participants select from (1) not at all true of me; (2) somewhat true of me; (3) mostly true of me, or (4) completely true of me.

The *Transition to College* (TTC) inventory measured 13 personality traits, including the Big Five traits and eight additional narrow traits. The 127-item inventory is a 5-point Likert agreement scale. Means of the Big Five traits and three of the narrow traits were independent variables in this study. The TTC was administered to the TGA seniors (n = 16) in February, 2008 during their junior year at TGA, and to the TGA juniors (n = 27) during the final phase of the TGA application process in April 2008, prior to their admission to TGA.

As the student population at TGA was small (n = 43 at time of study), a structured interview protocol developed by the research was employed to gather students' expectations for TGA and to expand upon their sense of belonging at TGA. Questions were a combination of closed and open-ended.

Finally, in June 2009 student persistors and non-persistors were recorded from the TGA school records.

Participants

Selection Method

Participants in this study were the entire student body of TGA, which numbered 43 students in December 2008. Student participation in surveys, interviews, and other non-class related research was voluntary; students and their parents signed a research and evaluation consent/assent form prior to the students beginning their junior year. However, research and evaluation findings were utilized by TGA faculty and administrators for program improvement, so students were accustomed to participating and experiencing program changes resulting from their participation.

The students were also accustomed to interacting with the researcher for surveying, either in their classroom for a paper and pencil administration or via email for an electronic survey. Interviewing the student body involved more personal contact with the researcher, which for many of the juniors was their first participation in an interview. Appeals were also made to social validation, and consumable incentives in the form of snacks, soft drinks, and a small cash sum encouraged participation. Students signed up for 30-minute blocks of interview times scheduled during finals week of their fall semester. Refer to Table 4 for student characteristics.

Response Rate

High response rates are typical at TGA; the students are, for the most part, interested in sharing their perceptions with administration. As this study examined relationships between data from multiple instruments, and because the sample was previously established as small, missing data from the responses is accounted for and explained.

Table 4. *TGA Student Population Characteristics and Response Rate from Study Data Collection Methods*

Student Characteristics	Seniors	Juniors	Totals
Number	16	27	43
Gender	8 females 8 males	14 females 13 males	22 females 21 males
Ethnicity	10 White 3 African-American 3 Asian/Pacific Islander	22 White 1 African-American 4 Asian/Pacific Islander	32 White 4 African-American 7 Asian/Pacific Islander
Participants in data collection methods			
Psychological Sense of School Membership and Interview	15 7 females 8 males	26 14 females 12 males	41 21 females 20 males
Transition to College	14 7 females 7 males	24 13 females 11 males	38 20 females 18 males

Interview and Psychological Sense of School Membership

The PSSM and interview were conducted during fall semester finals week, December 2008. The entire student body (n = 43) scheduled times to participate. One senior was dismissed due to academic reasons prior to the scheduled interview, and that senior chose not to participate. The senior was dropped from the data set as determining the sense of belonging is a key independent variable. Another junior failed to participate after numerous attempts at rescheduling by the researcher, so that junior was also removed from the data set. Hence, the number of student participants was 41.

The 41 students who did participate provided data for quantitative analysis of the relationships between belonging, expectations, and persistence.

Transition to College.

The TTC personality inventory was administered to the seniors in February 2008 (while they were juniors) and to the juniors in April 2008. Due to a variety of conflicts, three students of the 41 study participants never took the TTC. The sample size for the TTC administration was n = 38.

Findings

Research Question One:

What does it mean to belong at TGA, based on student perceptions?

Because the belonging perceptions of TGA students comprise the data essential to respond to this research question, direct quotations were used extensively. Students are only identified as male or female, along with junior or senior, to protect their privacy. The quotations have been edited for digressions and fillers, such as “you know” and “like” unless they provide

information about students' emotions during the interview. Square brackets [ ] indicate the addition of a word or words to aid in contextualization or to conceal information that might diminish the anonymity of a participant. When the inclusion of the interviewer's question is necessary for comprehension, it is prefixed by Interviewer.

TGA students hailed from varied backgrounds and geographical locations, and their high schools, whether comprehensive, magnet, or private, also varied widely in size, course offerings, extracurricular offerings, and teacher quality, as described by the TGA students. Common to many TGA students were complaints of poor teacher quality or lack of adherence to the curriculum at their home high schools. All TGA students seemed to have one or two strong teachers, typically in mathematics or science, who encouraged them and, perhaps, assisted them with the TGA application process. Many TGA students addressed the lack of academic challenges for students like them at their home high schools; an example follows:

> I just thought it was really boring and it seemed like a lot of useless stuff to be going through just to get an education. But, I mean I liked it. I have a bunch of friends and we all have fun, but, you know, I knew that I needed better. I mean I shouldn't have to sit in the back of the classroom while the teacher like disciplines another student in front of the class (TGA student, personal communication, December 9, 2008).

Some students portrayed their home high schools as "poor," "country," "small," and "not well-equipped." Students from these smaller, often rural, high schools frequently noted the lack of academic encouragement from faculty and/or students. As one junior male stated:

> I just always see how they don't encourage the students enough. They were thinking that shooting to go to UT is pushing it. They stick you going to Tennessee Tech or Vol State

> Community College. I'm just seeing that now, and now here, UT is the 'Yeah, you apply to this you're going to get in' school (TGA student, personal communication, December 9, 2008).

However, a few students self-identified as coming from larger high schools, with numerous extracurricular activities, courses, and better teachers. Seven TGA students felt that their home high schools actually offered very similar academic challenges or, in fact, better academic challenges than TGA. All seven of these students attended large high schools; one attended a magnet school, one attended a private school, and five attended suburban schools with high statewide rankings.

Regardless of their perceptions of their home high schools, almost all TGA students felt positively or neutrally toward their home high schools, and almost all felt that they belonged at their home high schools. Students found groups of friends who were like-minded; for example, their classmates in advanced, honors, or AP classes. Many students were very active in time consuming extracurricular activities with high levels of commitment, like varsity sports, marching band, or choir. Those students stated that most of their friends were also involved in that extracurricular activity(ies).

A select few students felt as if they did not belong at their home high school; one male junior stated, "It was like I was really smart, and people usually didn't hang out with me. I liked to talk about what I learned and stuff, and they talked about what's on TV" (personal communication, December 10, 2008). In general most TGA students really liked their home high school "environment," as a female junior stated. "I really liked the school spirit, activities we

were involved in, clubs and stuff like that, my friends (personal communication, December 9, 2008).

Common to most TGA students, however, was their dominant reason for choosing to come to TGA: lack of academic challenges available at their home high school. One senior stated that, with the exception of English, he would be taking all of his courses at a nearby college once he began 11th grade; another junior commented that she often corrected her teachers in class, particularly her mathematics teachers.

Belonging at TGA, as envisioned by the faculty and administration, was about being surrounded by like-minded students who are predominantly focused on mathematics and science academics. A goal for TGA students, set by the inaugural faculty, was for TGA students to form a cohort. To develop a student-generated definition of belonging, the December 2008 interviews were analyzed qualitatively using pattern coding (Miles & Huberman, 1994).

Almost all TGA students perceived that they belonged at TGA and the origin of their belonging emerged in a limited number of patterns: some perceived they belonged for social reasons; some perceived they belonged for academic reasons, and some perceived they belonged as a merger or blending of the social and the academic. Most students cited that they had friends at TGA, where "being social," and "getting along with most people" were valued aspects of belonging (TGA students, personal communication, December 8, 2008). The social interaction aspect of belonging was made clear by this senior male, who expressed some dissatisfaction with the social element:

> I do feel like I belong here to a degree, but I suppose I could fit in more, because it is really diverse but with an element of closed-mindedness. Not all students are really open

> to being accepting of other students' opinions. I've seen people looked down upon for their views (personal communication, December 8, 2008).

A senior female, when asked if she belonged at TGA, said, "Yeah, I fit in. Teachers are fine. Students are really fine too. I get along with them" (personal communication, December 8, 2008). Getting along with students and teachers is important in the small, enclosed setting of TGA.

A smaller group of students felt that they belonged due to academics and fitting in academically, as this junior male stated when asked if he belonged at TGA, "Yes, definitely. It's a great school, great academics. It really does help you towards college" (personal communication, December 10, 2008). A senior male said, "I like it a lot. The academics are great…the opportunities from UT are great. The Oak Ridge internship, really great opportunity" (personal communication, December 8, 2008). These students, and others, immediately responded to the belonging query with academic rationale. Others with an academic focus to their sense of belonging contrasted TGA's educational atmosphere with their home high school as there were "more smart people" and they "don't have to wait for everyone to catch up" (personal communication, December 9, 2008).

The final group of students merged the social interactions with the academic fit. In their responses to the interview question, "Do you belong at TGA?" A junior male stated:

> I fit in here. I'm surrounded by people who are smarter than me. And I don't feel like an outcast. I can talk to them sometimes because we all have similar passions because it's a math and science high school (personal communication, December 10, 2008).

A senior female responded similarly, "Yes, I do, as I am making good grades and I have been friendly and everyone seems like they like me" (personal communication, December 9, 2008).

Merging the academic with the social in the nature and quality of TGA friendship. Prior to coming to TGA for their junior year, some TGA students expected a campus of "nerdy people," and the contrast to the actual student body of "normal people, just smarter" was a pleasant discovery. This senior male stated, "Probably the biggest surprise was the people here 'cause I had kinda envisioned the super nerd kind of students" (personal communication, December 8, 2008).

The growing friendships amongst the TGA student body, and the nature and quality of these friendships as an element of belonging, were the next patterns that developed from the interviews analyses. Due to the unique living and learning setting of TGA, most TGA students, particularly among the juniors, responded very favorably to the friendships they were forming, as this junior male stated:

> The bonds you form with people up here, they're a lot stronger than the bonds you formed at your home high school, you know. These are friendships that are gonna last past high school, past college. You know, you're gonna meet these guys the rest of your life (personal communication, December 9, 2008).

A junior female said, "I found maybe a few more people here that are more like me and my interests and stuff. So it's been great" (personal communication, December 9, 2008). Because the students live together and take classes together, they are immediately immersed in round-the-clock interactions. A junior female felt this has led to closer friendships grounded in an academic focus:

> Even my friends I've known since I was two, like back home, I feel like I've connected with these people better, just because they kind of understand me. Like up here people are more like me, and they understand if I go off on some crazy tangent thing they can follow me. But some people from back home, not really (personal communication, December 9, 2008).

A senior female had a similar sentiment, "I have close friends, but not close enough where I tell them my ambitions. The friends I made here are closer. My friends at home are shallow" (personal communication, December 10, 2008). And a junior female stated:

> I think my friends here are more like me, I guess. I mean, I had friends, but I think we kind of grew apart a little bit because they sought different things. And I think the reason here the people are closer is because we're all towards education. And I think my friends back there, they were not really into it as much (personal communication, December 8, 2008).

Another junior male with a similar sense of belonging resulting from the merging of academic challenges and immersion into a culture of like-minded peers said:

> I feel like TGA has helped me to be myself just a little more. I used to be quiet and shy all the time but since TGA, I am a lot more social. I feel like I have some good friends at school and that people there do support me and care about me. I like that there aren't really any cliques at the school and we all get along pretty well (personal communication, December 10, 2008).

TGA students, as a whole, were more connected to the friends they made at TGA, as they have shared visions for their futures and more closely matched interests. Further, the residential setting propelled the friendships along at a faster rate than at a day school setting.

Not all students agreed that the residential component and the school component being merged was positive. Some expressed that they were tired of some students or felt they had no escape from school life. These sentiments were typically expressed by seniors, as this senior female stated:

> I don't think that's very good for someone's mental health, because I've seen so many people break because of it. And at present time I'm at my breaking point, and so I don't think it's a good idea to live with the same exact people you go to school with all the time and have class in your dorm. I don't think it's a good idea at all (personal communication, December 8, 2008).

Some juniors also felt this way, but rather than being inhibitors to belonging at TGA, the blurred lines between residential component and school served to affect the way the students perceived the school climate. The majority of these students felt as if they belonged, but more perceived the school climate as negative or neutral/negative.

Students who stated that they were not building friendships or connecting with people more strongly at TGA than at their home high school did leave TGA. These departures were both voluntary and involuntary. Three junior males commented that their "true" friends were their home high school friends and/or church friends; all voluntarily left TGA following their 11th grade years.

Seniors and academics and juniors and social opportunities. The distinctiveness of the senior and junior students' personalities was also discussed repeatedly by the TGA students. The senior class view of belonging was more academic in focus, in which being viewed as smart or getting straight As was paramount to belonging. One senior female said:

> The pressure is on to be at the top of your class, to be with your class, who is already at the top. And it's daunting at times because it's hard. But I know I have people around me that I can go talk to that are my friends. And I think I'm a puzzle piece, but one of those puzzle pieces that has a broken side to it. So it fits, but it's missing the straight As part.

This senior female felt she belonged, but was fractured in a sense since she did not conform to the high grades that her classmates achieved (personal communication, December 9, 2008). This competition and individualism among the senior class was a prevalent view among both the seniors and the juniors. Juniors and seniors both described that class as a whole as "independent" with more "introverts." One senior female stated, "I'm not a conversational person" (personal communication, December 8, 2008). Several seniors, both males and females, commented that they preferred to work alone and learn alone, as opposed to group studying and group learning. A senior male stated, "People kind of go off and do their own thing, and as long as no one else bothers them, they don't care. There's not much 'together' at all" (personal communication, December 8, 2008). The administrative vision for the formation of a cohort among the classes was not as successful with the senior class. This may be due in part to the loss of 9 of the initial 24 students in the class, and also may be credited to the tumultuous housing situation of the seniors' first year, discussed in Chapter 1.

The juniors, on the other hand, viewed themselves as a "family," in which "we're all in this together" (personal communication, December 9, 2008). They referred to themselves as "brothers and sisters," and instead of being solely competitive, "for the most part we all help each other and get along pretty well. There's one or two that don't get along" (personal communication, December 9, 2008). They contrasted themselves with the senior class, as one female junior stated, "We juniors are pretty outgoing. We try to get together, you know. If we need help with something, we study together as study groups and we stick with each other actually" (personal communication, December 9, 2008).

Some juniors did express displeasure at the students who were not as serious in their academic pursuits. They referred to these students as "the ones who don't need to be here" (personal communication, December 9, 2008). A junior male summed up his perceptions of the junior class:

> We all seem to get along very well, and once you start getting into schoolwork, we can come together and help each other and stuff—so I think future students would see that we are sort of more like a team than a class (personal communication, December 9, 2008).

The cohort vision of the inaugural administration and faculty appeared to be more effective with the juniors, who were more team-oriented and helpful toward one another.

Hindrances and blockers to belonging. While the majority of TGA students reported that home high school faculty and administrators and home friends and family were supportive and excited for the students to attend TGA, some students expressed that select faculty, family members, or friends responded negatively. These students who received frequent negative

communication regarding their choice to attend TGA often experienced confusion and frustration, which potentially impaired their sense of belonging at TGA.

Coaches were a group of blockers to some TGA students. A senior male who played varsity basketball and tutored teammates said:

> My old basketball coach, he had asked me at the end of my sophomore year if I was coming back to (high school) at the end of my junior year, because he wanted me to come back and play. I would have been a starter in junior year, but I decided to come here. He was upset I was leaving, but he was glad I was coming to a good program like this (personal communication, December 8, 2008).

Some coaches as blockers were more persistent; a junior female received frequent calls, as did her parents, from a coach about when and if she would be returning to her home high school. She did voluntarily depart following her junior year at TGA.

Sponsors of extracurricular activities that involved competition, like Scholars' Bowl, also acted as blockers to fully connecting at TGA, as the sponsors would express regret that the student was leaving the home high school and the team to attend TGA.

Parents were another group of potential blockers. One junior female reported speaking to her mother every day, and that many times her mother cried and asked when she'd be returning home: "She's not a good support for me. She's on the phone crying, 'I miss you so much.' I'm like, 'Mom, I've got a test tomorrow!'" (personal communication, December 9, 2008).

Many TGA students reported that friends were often sad and cried prior to their departure, but most TGA students were very well-connected with those friends via Facebook or other social networking media, text messaging and cell phone conversations, and emails. Home

high school friends and boyfriends/girlfriends did not seem to function as hindrances or blockers to belonging at TGA.

Overall, the majority of TGA students adapted to TGA, and while many miss their families and friends and may experience homesickness, they feel they have become "used to" TGA. This adjusting to, or "getting used to" TGA emerged as another pattern that students must overcome in order to fully belong, or fit in, at TGA (personal communication, December 8, 2008).

Adjusting to living and learning at TGA. "Getting used to TGA" dominated the fist student interview with a TGA senior male, so the researcher incorporated the topic into the interview protocol following that initial interview. Adjusting successfully to TGA included learning to cope with life away from home; encountering new classmates, faculty, and house managers; learning new policies and procedures for residential life and classroom learning; negotiating a dorm room and bathroom with a new roommate; experiencing a new learning environment and instructional style, and completing "voluminous" amounts of "stress-inducing" homework, tests, and assignments. Some students were more successful at adjusting to life at TGA than others.

Being "enclosed" and "losing freedom" was new to many students, as TGA rules state no automobiles, and the students are compelled to be on the Tennessee School for the Deaf campus most of their time at TGA (personal communication, December 8, 2008). The seniors expressed more dissatisfaction with this arrangement than the juniors did.

Students who shared that they had been away from home for lengthy periods, such as summer camps, summer boarding school programs, or faith-based camps felt they adjusted very

easily. Further, students who shared rooms and/or had siblings seemed to be less unhappy with the residential aspect of the TGA program.

Students who stated they were from single family homes and/or were an only child felt it took longer to adjust, since they had not often negotiated their home space with another person before and missed the "privacy" of their home life.

Homesickness seemed to be across the board and was reported by students who lived close to TGA and those who came from several hundred miles away. However, knowing they had support helped homesick students adjust, as a junior female related:

> I was the first junior to get homesick. But I talked to (school counselor), and we figured everything out. And I had a lot of people here that talked to me and supported me and helped me out through that, and so I feel like I've really grown close to them, the people up here, teachers, students, everybody (personal communication, December 8, 2008).

A junior female felt that adjusting to TGA is about interacting with the people: "You have to learn to work with strong personalities. Everybody is smart, and everybody thinks they are right" (personal communication, December 9, 2008). Ultimately, "getting used to" TGA was a varied process that took some students as little as a week or two, while other students were still in the process of adjusting to TGA when the researcher interviewed them in December at the conclusion of their first semester. The adjustment, however, emerged as a critical component to belonging at TGA and committing oneself to the program.

Sacrifice. Just as TGA required a unique adjustment period, students also made "sacrifices" to take part in the living and learning program of TGA. Adjustment to the school

coupled with the willingness to sacrifice the home high school and family life led to a greater sense of belonging and commitment to TGA.

Almost all of the students who chose to accept the invitation to attend TGA had to "sacrifice," as a senior male put it: "We did have to make a few sacrifices, but I think they're worth it" (personal communication, December 8, 2008). Students cited the two year internship program at Oak Ridge National Laboratory, coursework at the University of Tennessee, Mandarin Chinese for foreign language, and the trips (such as caving and the senior trip to China) as opportunities unique to TGA.

Many students were very forward thinking; a junior female said that TGA would be "better for my future" (personal communication, December 9, 2008), while a senior female said:

> It is stressful, and you do a lot of work, but I think that will help me in the long run. And it's given me a love for learning. Even though I've always felt that way, it's even greater now (personal communication, December 8, 2008).

A junior male, who gave up varsity football, said:

> Football's something I can get over really quick because I wasn't going to get a scholarship in it. I wasn't that good, so no big deal for me. I was better at math and science anyway. I want to work in the science field, so a place that can give me a better education in science is gonna be an obvious choice (personal communication, December 10, 2008).

A junior female who was also a high school athlete commented, "I thought it would really help me academically. It was a big step up. And I thought that was more important and outweighed

the sports. It outweighed everything at my old high school" (personal communication, December 10, 2008).

While sacrifice was common to all or most TGA students, the sacrifice was met positively by most, begrudgingly by some, who could not get past the lack of sports, or extracurricular activities, or looser rules at home. As a junior female said:

> Socially, TGA helps to make new friends, but does not allow for things most teenagers look forward to doing. Things such as competitive sports teams, social events like dances and movies are not something we get to do at the school. I feel like TGA has helped me to improve in school and I know I have learned much more than I would have at my home high school, but at the same time I also feel that I am missing out on a lot of typical high school experiences (personal communication, December 10, 2008).

This junior female voluntarily departed following her 11th grade year at TGA. Adjusting to TGA and willingness to sacrifice home and home high school activities emerged as important facets of belonging at TGA.

Negotiating. Some students struggled with the decision to remain at TGA during the academic year or to return following the summer break; the opportunities of TGA had to be balanced with the benefits of leaving TGA and returning to their homes home high schools. A junior male was very active in his church and church bands; he felt positively toward TGA and felt as if he belonged, but struggled with missing participation in his church and bands. He ultimately voluntarily departed following his junior year.

Several seniors stated that there were no mathematics or science courses left for them to take at their home high schools, and that was their primary reason for returning to TGA, as well

as for a better chance at college admissions and scholarships. One senior female provided one reason for returning to TGA for her senior year that her mother had spent "a lot of money on room decorations" (personal communication, December 8, 2008).

When the TGA students had difficulty making the sacrifice to attend TGA, the process of negotiating began. For many students who considered leaving, the negotiation was often painful, as they weighed benefits and drawbacks to returning home. Of the group of 41 who were interviewed in December 2008, four chose to voluntarily depart following their junior years: three males and one female. Reasons for departure were family, friends, sports, and church-related activities. Three of these students considered themselves belonging to TGA while one did not. Their negotiations coupled with being at home for the summer were determinants in their voluntary departure from TGA.

Ownership of TGA. Although many TGA students recognized potential educational and career-oriented future opportunities from attending and persisting with the TGA program, some TGA students recognized profound changes within themselves resulting from the experience, while others developed a greater sense of altruism with respect to future TGA students and the mathematics and scientific communities. Another vision of TGA founding administration and faculty beyond forming student cohorts was for students to be more global, group-oriented, and interested in reaching out to potential TGA applicants. These students all exhibited facets of ownership of TGA.

Again, most students recognized the opportunities for their own educational advancement at TGA. Beyond educational and career-oriented opportunities, some students discussed personal changes. A junior male from a rural, predominantly Caucasian high school stated:

> I can already tell that I've changed as a person being up at TGA. It's—you know, gain a little bit more responsibility and respect for myself and others and even like other cultures as well 'cause you've been put in a place where it's—you know, like my home high school they're just mainly all white. And now it's like you get a better respect for other races up here and you become a lot more worldly (personal communication, December 9, 2008).

A junior female spoke of her personal changes in more general terms:

> Once you get used to it, I mean, you grow so much being away from home. My parents can see the difference and I can see the difference. And I really like what TGA has done for me so far (personal communication, December 8, 2008).

A senior female also addressed her personal changes in more general terms, "I'm really glad I came. I think it's been a good program for me. It's definitely changed me positively as a person, I think" (personal communication, December 9, 2008). The researcher opted not to follow up these responses with probing questions, as a structured interview protocol was in place, and not all interview participants discussed personal changes resulting from the experiences at TGA.

The final pattern that grew out of the interviews analyses was the notion of serving as a positive representative of TGA to the public and to future incoming students as well as actively shaping the program from within as TGA students. A junior female commented, "I'm kind of glad we're coming into it new because even though it is kind of experimental, I guess it's good to be a part of something, knowing that hopefully it'll affect the future generations" (personal communication, December 9, 2008).

Seniors commented on the "activism" of the students in affecting program changes at TGA and felt their suggestions were listened to by TGA decision-makers, as evidenced by this senior who commented on, "the resilience of the staff to address the needs to make it a better school and, you know, to address it quickly and with an answer—a solution that fits the problem (personal communication, December 8, 2008)." Some seniors felt a responsibility to instill within the juniors a "dynamic" relationship with faculty and staff, as one senior male said, "I try to make sure they understand they can't take things lying down" (personal communication, December 10, 2008). Select members of the senior class appreciated the opportunity to affect change within TGA and wanted to perpetuate this "environment of activism."

Several students mentioned recruiting at their home high schools or within their home communities so others can have the opportunity to attend TGA. A junior male from a small rural high school said, "Like when I go home for break I go there (to home high school) just maybe to talk to somebody. I doubt they'll listen, but it's like I want to make it better" (personal communication, December 9, 2008). A senior male from a large suburban Middle Tennessee high school conducted multiple recruiting sessions at his own high school and other area high schools, while a junior female conducted recruiting sessions in West Tennessee.

Other students spoke to creating traditions and a school culture for future students. A junior female contrasted the "family" feeling of the junior class to the more individualistic nature of the seniors when she said:

> We've wanted to involve everyone a lot more, get together for like study groups and stuff, and I think that would be really helpful for the upcoming classes, so that they don't

> leave anyone out and everyone feels like they're accepted (personal communication, December 10, 2008).

A senior female who was questioning whether she's return to TGA for the spring 2009 semester said:

> I'm on the fence whether or not I'm coming back next semester. And I feel responsible if they (the juniors) were having a great experience, but they just don't want to get to the point that I'm at. I want to help them (the juniors) be successful (personal communication, December 8, 2008).

Few members of the senior class expressed a commitment to TGA at this level, when retaining the new juniors was important enough to become part of their negotiating process to return to TGA or their home high school.

TGA students expressed both their personal belonging and their commitment to the institution of TGA by expressing dissatisfaction with students who were not as academic in their focus, as a junior male stated:

> I mean the governor's paying for the education and you just blew it off. They shouldn't deserve it, I guess. It's kind of harsh, but I mean if they're not putting forth the effort they shouldn't get anything out of it (personal communication, December 10, 2008).

The students had a strong sense of an academic standard or personal code for attending TGA, which included appreciation for the opportunity and a strong work ethic.

All of the students who expressed ownership through positive personal changes or growth, and/or who developed a greater sense of commitment to TGA as expressed by voluntarily recruiting for the school or by aiding with student retention, persisted at TGA to

graduation or returned for their senior years. Further, all of these students were situated in the connected quadrant of the 2 x 2 Model of Belonging.

The TGA students' definition of belonging. Thus, according to this analysis of qualitative interview data, the student definition of belonging at TGA is embodied by a passion for mathematics and science; a strong work ethic and academic focus; commitment to the goal of completing the program as well as commitment to the program itself; putting educational and career opportunities that TGA offers ahead of many extracurricular activities and home high school connections; a strong sense of community and working together, including with the teachers, and adaptability.

A senior male, who was connected, exhibited ownership and a May 2009 TGA graduate, stated his beliefs about the burgeoning culture of TGA and the type of applicant TGA should seek:

> *Student:* I hope we're creating a learning community where everyone has their unique needs met and are challenged in the way that they need. I hope that's what's happening.
>
> *Interviewer:* Any other comments you'd like to make about your perceptions of TGA?
>
> *Student:* I'm hoping that it continues to improve. It's a lot better this year…hopefully we'll get a larger applicant pool…so that we have the ability to select who really needs to be here, someone who is able to interact in a community of this size is a big thing because that's going back to the 'getting used to it' is very different. My high school had about 1,500 kids and coming down to 40 or 20 last year is a big change. But I think the real thing is a love for learning that a lot of teenagers don't have. I'm not really sure how to define that….But at the same time, we don't want people who aren't interested in the

community itself, not just learning by themselves in their room (personal communication, December 9, 2008).

Research Question Two

What are the relationships between belonging, expectation fulfillment, and personality traits, and how do those constructs relate to student persistence?

Generating the study variables. Research question one generated a definition of belonging from the perspective of TGA students. The second research question calls for quantitative analysis, and the variables for these analyses had to be generated from the study's two externally produced instruments, the *Psychological Sense of School Membership* (PSSM) and *Transition to College* (TTC) as well as from the interview transcriptions. Prior to presentation of results of the second research question, an inclusion of the process of constructing the study variables is warranted. Table 5 displays this list.

Situating participants in the Model of Belonging. A brief discussion of the belongingness model employed in this research study is appropriate, as students' sense of belonging is developed and formed at the school. Building upon Goodenow's research and the *Psychological Sense of School Membership* (PSSM) instrument she developed (1993), Nichols (2008) developed a 2 x 2 model of belonging based on students' perceptions of both their belongingness—they feel they belong or they do not feel that they belong—at their school as well as their perceptions of the school climate as being a positive or negative place to be. Based on their responses affirming or refuting their sense of their own belongingness, as well as their positive or negative perceptions of school climate, quadrants are formed categorizing students as *Connected, Adaptive, Rejected* or *Isolated,* or *Resistant,* as appears in Figure 5.

Table 5. *Generating Study Variables*

Variable	**Data Source**
Sense of belonging	Interview protocol and *Psychological Sense of School Membership* means
Student persistence	June 2009 student records
Expectation fulfillment	Interview protocol
Personality traits	*Transition To College* personality inventory means

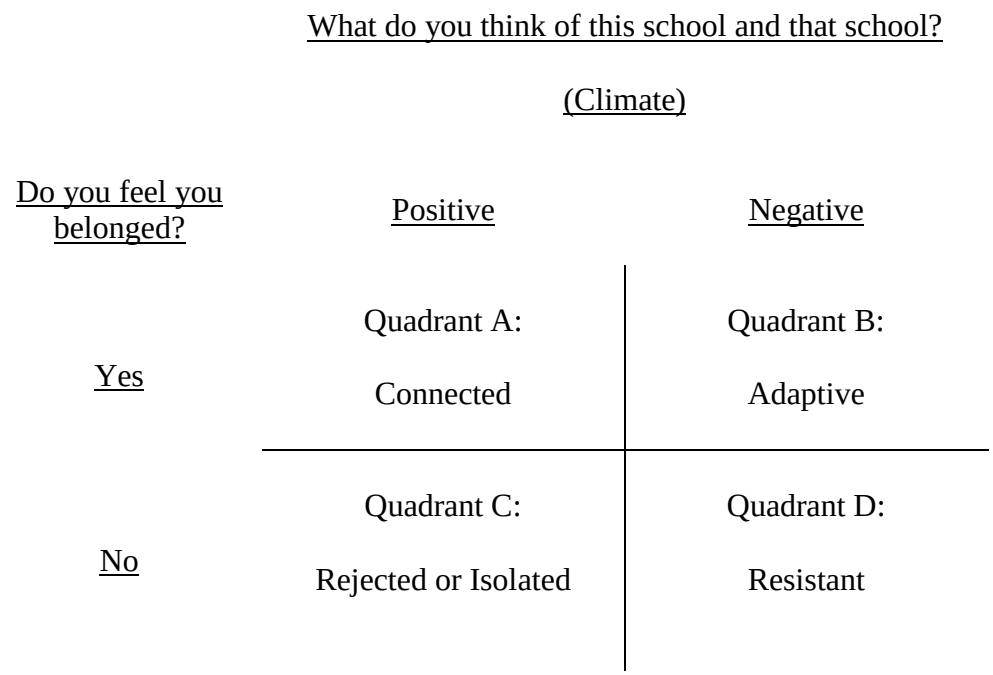

Figure 5. Nichols' 2 x 2 Model of Belongingness

To situate participants in a quadrant on the 2 x 2 Model of Belonging, interviews were analyzed to determine the following:

a) participants' perceptions of belonging at TGA (belonged at TGA or did not belong at TGA);

b) perceptions of school climate (positive, neutral, or negative), and

c) the sum and mean score of the *Psychological Sense of School Membership* (PSSM), which was administered orally at the onset of the interview.

Of the interview participants, 15 were TGA seniors and 26 were TGA juniors. Twenty-one were females, while 20 were male. The *Psychological Sense of School Membership* (PSSM) range was 52-72 (maximum possible score of 72) and the mean was 63.68.

Thirty-two participants, or 78.1%, perceived they belonged, or fit in, at TGA, while nine, or 21.9%, perceived they did not fit in or belong. Internal consistency was checked in that the TGA students were asked if they belonged during the oral administration of the PSSM and again during the interview protocol.

Twenty-eight participants, or 68.3%, felt that TGA was an overall positive climate, while 13, or 31.7%, viewed TGA as having an overall negative climate.

Determining persistence. Following the interviews in December, student persistence was recorded through June 2009. Of the 41 participants, eleven, or 26.8%, did not persist in the program. Thirty students either graduated or returned for their senior year, seven were asked to leave (INP) due to poor academic performance (five) or disciplinary infractions (two). The remaining four non-persistors voluntarily departed TGA following the conclusion of their junior year and returned to their home high school. Figure 6 features all interview participants' PSSM

sum scores, quadrant on the Model of Belonging, and persistence at TGA. Participants were situated in the 2 x 2 Model of Belonging, as displayed in Figure 6.

A listing of individual participants, their PSSM sum score, Model of Belonging quadrant, and resulting persistence or lack of persistence with the program is represented in Table 6.

The majority of TGA students, 24, or 58.5% were situated in the Connected quadrant as they identified themselves as belonging at TGA and they perceived the school climate favorably. The PSSM range of the Connected students was the highest, 59-72, and subsequently had the highest mean of 65.75. The Connected group also had the highest rate of student persistence, at 83.3% as 20 students persisted to graduation or returned for their senior years. A statement by a Connected junior male displays both positive perceptions of climate and positive sense of belonging:

> I'm involved with a lot of the extracurriculars up here. I need those and I really like the students. Everyone up here, you know, they're set on going to a really good college and they're really dedicated towards that and they work really hard. I get a positive feeling most of the times. Everyone here—they can learn and they enjoy learning for the most part (personal communication, December 9, 2008).

Again, this junior is an example of Connected as he showed sense of belonging by joining clubs and becoming more academically focused; he has bought into the culture of the school. He believes the school to be more positive than negative.

Of the four Connected students who did not persist, two were asked to depart because they did not meet the academic requirements of a 2.7 GPA. The remaining two Connected students were both junior males who decided to return to their home high school following the

What do you think of your home high school? (Climate)

Do you feel you belong?	Positive climate	Negative climate

BELONG	Quadrant A: Connected (n = 24)
	• Seniors (6)
	• Juniors (18)
	• Males (14)
	• Females (10)
	• Persistors (20, 83.3%)
	• Non-persistors (4, 16.7%)
	  • 2 INP, 2 VNP
	• PSSM range (59-72)
	• PSSM mean (65.75)
		Quadrant B: Adaptive (n = 8)
		• Seniors (5)
		• Juniors (3)
		• Males (4)
		• Females (4)
		• Persistors (6, 75.0%)
		• Non-persistors (2, 25.0%)
		  • 2 INP
		• PSSM range (56-67)
		• PSSM mean (62.13)

DID NOT BELONG	Quadrant C: Rejected or isolated (n = 4)
	• Seniors (0)
	• Juniors (4)
	• Males (2)
	• Females (2)
	• Persistors (1, 25.0%)
	• Non-persistors (3, 75.0%)
	  • 2 INP, 1 VNP
	• PSSM range (54-69)
	• PSSM mean (62.25)
		Quadrant D: Resistant (n = 5)
		• Seniors (3)
		• Juniors (2)
		• Males (0)
		• Females (5)
		• Persistors (3, 60.0%)
		• Non-persistors (2, 40.0%)
		  • 1 INP, 1 VNP
		• PSSM range (52-62)
		• PSSM mean (57.4)

Figure 6. Interview Participants Arrayed in 2 x 2 Model of Belonging

Table 6. *All Interview Participants' PSSM Scores, Model of Belonging Quadrant, and Persistence*

PSSM Sum	Class	Gender	2 x 2 Model of Belonging Quadrant	Persistence
65	Senior	Male	Adaptive	INP
66	Senior	Female	Adaptive	Graduated
56	Senior	Male	Adaptive	Graduated
62	Senior	Female	Resistant	Graduated
56	Senior	Male	Connected	Graduated
61	Senior	Male	Connected	Graduated
61	Senior	Female	Resistant	Graduated
59	Senior	Male	Adaptive	Graduated
68	Junior	Female	Connected	Senior
63	Senior	Female	Adaptive	Graduated
69	Junior	Female	Connected	Senior
67	Junior	Female	Adaptive	INP
58	Junior	Female	Isolated/rejected	Senior
70	Junior	Female	Connected	Senior
65	Junior	Female	Connected	Senior
69	Junior	Male	Connected	Senior
62	Junior	Male	Adaptive	Senior
71	Junior	Male	Connected	Senior
68	Junior	Male	Connected	VNP
54	Junior	Male	Isolated/rejected	INP
62	Junior	Female	Connected	Senior
52	Senior	Female	Resistant	INP

Table 6. continued

PSSM Sum	Class	Gender	2 x 2 Model of Belonging Quadrant	Persistence
69	Senior	Male	Connected	Graduated
69	Junior	Female	Connected	INP
59	Senior	Female	Connected	Graduated
69	Junior	Female	Adaptive	Senior
59	Senior	Male	Connected	Graduated
61	Junior	Male	Connected	Senior
68	Junior	Female	Connected	INP
68	Junior	Male	Adaptive	VNP
69	Junior	Male	Connected	Senior
65	Junior	Female	Isolated/rejected	INP
61	Junior	Female	Connected	Senior
60	Junior	Male	Connected	VNP
59	Senior	Male	Connected	Graduated
67	Junior	Male	Connected	Senior
72	Junior	Female	Connected	Senior
71	Junior	Male	Connected	Senior
55	Junior	Female	Connected	Senior
57	Junior	Female	Resistant	VNP
	Junior	Female	Resistant	Senior
Range (52-72)	Seniors = 15	Females = 21	Connected = 24 Adaptive = 8	Persistors = 30
M = 63.68	Juniors = 26	Males - 20	Isolated/rejected = 4 Resistant = 5	Non-persistors = 11

conclusion of the TGA academic year. In the interviews, although both males clearly expressed how much they "love" TGA and that TGA was superior academically to their home high schools, both junior males referred extensively to strong connections at their homes. One male discussed his participation in two faith-based musical groups; this male lived close enough to spend one or two days of his weekends performing with these bands, leaving TGA on most non-going home weekends due to his close proximity. This male's church and bands were of utmost importance to him: "I can't stress that enough" (TGA student, personal communication, December 9, 2008).

The other Connected junior male who voluntarily departed TGA following his junior year discussed the prominence of his family in his daily life and decision-making. Further, he commented that he chose not to make many friends at either his home high school or at TGA:

> Outside of (home high) school I had a lot of friends, but not really in school. I try not to get attached to people at school too much….Here at TGA it's still kind of the same situation and I really don't try to get myself too close to people (TGA student, personal communication, December 9, 2008).

This junior male was a three-hour distance from his hometown.

Eight TGA students, or 19.5%, believed the climate at TGA was negative, but they did feel as if they fit in or belonged at TGA. These five seniors and three juniors comprised the Adaptive group. Four were males and four were females. The score range on the PSSM for the Adaptive group was 56-67, lower than the range for the Connected group, with a PSSM mean of 62.13. An example of an Adaptive student is this junior female:

> I think I get along well with everybody. I think I fit in. They have conflicts every day because you think drama was bad in high school, try making them live together 24/7, you know, there's always something every day, someone's crying, someone's fighting. I'm a bystander—bystander's good…. There's that Nickelodeon show, *Zoey 101*. I thought [TGA] would be kind of like that….It's kind of like animals have to adapt to their surroundings. I feel like a polar bear in an elevator (personal communication, Decvember 9, 2008).

This junior female feels that she belongs; she has friends and is performing well academically, as she said earlier in the interview, "I think I'm keeping up academically well. It's very fast-paced." However, her perception of the climate is more negative than positive. In December, she was still adjusting to the "drama" and "conflicts" of residential life and seemed to not be settled or adjusted (personal communication, December 9, 2008).

Another Adaptive student, this senior male, made a choice for the inconveniences of communal living to be "doable for two years":

> There aren't as many students here, so there aren't as many friends. But I guess also the live-in with the students thing hurts the friend thing too because it's just when you're living with people they start to become like siblings to you. Stupid things get annoying, and it's a relationship that shouldn't be in school. But it is doable for two years.
>
> I think that I'm sort of the student that they were looking for for TGA because I think I'm pretty well rounded in math and science. And my school didn't have a whole lot of opportunities, so TGA has excelled in academics for me (personal communication, December 8, 2008).

This senior felt he belonged, and he even described himself as the "student that they were looking for" as he excelled academically but was from a school with fewer mathematics and science opportunities. However, he expressed frustration with the small student body of TGA and the problems that can become disproportionally large, showing that he viewed the climate negatively. He chose to overcome the negative climate and focus on the academic aspect of TGA.

Six Adaptive students, or 75%, persisted at TGA, while two did not persist (25%). Both students who did not persist were asked to depart. One senior male was asked to depart for academic reasons, while a female junior was dismissed for disciplinary reasons.

The quadrant with which the fewest TGA students were positioned was the Isolated/Rejected quadrant. Four TGA students, or 9.8%, identified the climate of TGA as being positive but believed they did not fit in or belong at TGA. All four of these students were juniors; two were males and two were females. The Isolated/Rejected students' PSSM range was 54-69, while their PSSM mean was 62.25, higher than the PSSM mean for the Adapted students.

Of the four Isolated/Rejected students, three students did not persist with TGA (75%), while one student persisted to the senior year (25%). Two of the three non-persistors were asked to leave; one male was asked to leave for failing to meet academic standards, while a female was asked to leave for disciplinary infractions. One other male departed voluntarily. The Isolated/Rejected group maintained the highest non-persistence rate and the lowest persistence rate of the four groups. An Isolated/Rejected junior male who voluntarily departed TGA in June 2009 said the following about his sense of belonging at TGA, including his interactions with classmates:

> It's really hard to have a good friend here for me because I feel like I'm only here for one reason and that's to challenge myself academically, and so I have made friends but I don't think they're very close to me like my friends back home. It doesn't make me feel different from other TGA students because I have enough support from home that I'm fine with that (personal communication, December 10, 2008).

This junior male felt that he belonged from an academic perspective, but that the friendships he was making were not nearly as close. Further, he does not seem interested in acquiring new friends: "I feel like I'm only here for one reason and that's to challenge myself academically" (personal communication, December 9, 2008).

Another Isolated/Rejected student, a junior female, said the following about TGA:

> I like it here. It's very hard. I wish I got more sleep. It's very rigorous, and I think I'm good here. I know that I belong here, but sometimes it's like I don't quite understand what the students are thinking. And so sometimes I feel all disconnected in that part. They're all wanting to sit around and hang out, but I've never been one to just sit around and hang out unless my work's done. It kind of interferes with me mingling with everybody. I've never had to share a room before, so that was quite difficult. And I feel like I'm being watched all the time, and that makes me more nervous than if I was just on my own (personal communication, December 9, 2008).

Again, this female junior believed she belonged at TGA, again from an academic perspective, but was still struggling to fit in socially with her peers. She did not relate to their study habits, and she had challenges adjusting to a roommate. Further, she felt like the faculty and staff were "watching" her "all the time" giving her a sense of uneasiness.

The final quadrant, Resistant, comprised five students or 12.2% of the TGA students who participated in the interview. Three of the students were seniors and two were juniors; all five were females. The Resistant students perceived the climate at TGA as being negative and also felt they did not fit in at TGA. Subsequently the Resistant group had the lowest PSSM mean of 57.4, and the PSSM range was 52-62. The following is an example of a Resistant student: "I thought [TGA] would be a lot more difficult and I hoped it would be drastically different from my home high school. The changes weren't quite as drastic as I hoped and I wish we were treated our age" (personal communication, December 10, 2008). Another Resistant student expressed dissatisfaction with the social aspect of TGA: "I feel like I'm getting a good education but I also feel like we're all being socially stifled and all of us are going to end up as complete social retards" (personal communication, December 10, 2008). In the final example, a Resistant student begrudgingly agreed to belonging at TGA, "I guess I belong. I don't plan on going home anytime soon so I suppose I feel like I belong if I'm not running home right away" (personal communication, December 10, 2008). This junior female had negative comments regarding the climate of the school, and she felt that the TGA program is beneath her expectations for it. Although she verbally stated that she belongs or fit in, the belongingness was framed negatively.

Another Resistant student was this senior female, who said the following about her perceptions of the climate and fitting in at TGA:

> I kind of feel like I belong with the other students, but I don't really—I don't really feel like this is a good place for me, just because of the social structure…everything is done as a group...there's very little privacy….. Some things don't sound like a big deal, but when you live through them it's just those little things get to be a pain….I came back to

> TGA partially because I'm stubborn. When I start something I want to finish it unless something like really drastic…partially because college applications, if I come to a school like this and then go back to my home high school, what that looks like is that it was too hard and I just quit. And partially because there was a limit to what I could get at my home school with the way classes are here (personal communication, December 8, 2008).

This Resistant senior's perception of climate is negative, particularly the lack of freedoms and being around other TGA students almost all of the time. The students were not up to her expectations academically, and it seemed from her statements that she returned to complete the program only, not because of friends, faculty, love of the program, etc. Instead, she wanted to maintain consistency on her college applications.

Three students in the Resistant group, of 60%, persisted at TGA and either graduated or returned for their senior year. Two students were non-persisitors; a senior female was dismissed for failure to meet academic standards, while a junior female departed voluntarily following her junior year.

Determining expectation fulfillment. Following the analysis of student interviews and PSSM scores to categorize students in the 2 x 2 Model of Belonging, student interviews were again analyzed to assign students into one of three expectations categories: the TGA program was below their expectations; the TGA program met their expectations, or the TGA program exceeded their expectations.

Portions of the interviews focusing on student expectations were extracted, including lead-in and probing questions, and the researcher and a second reader independently categorized

student responses. There was 78% agreement following this initial, independent analysis (reviewers agreed upon 32 of 41 categorizations). Disparities arose when students replied that TGA was "different" than their expectations, or when their responses were mixed. The researcher, second reader, and a third reader who analyzed only the nine uncategorized interview segments met and reread the interviews and successfully categorized the remaining nine. An example of the TGA program being beneath expectations is as follows:

> I thought that the academics would be far superior to anything that I've ever experienced….I expected a little more flexibility…seeming as if I actually meant something in terms of being an individual, not just a guinea pig in a program. It's below my expectations, but that doesn't mean it's far from at least—well, being at least decent for what I signed up for the program for (personal communication, December 9, 2008).

Another student who felt TGA was below expectations said, "I expected much harder classes. And I was actually expecting the students to be different as well….the other students weren't nearly as studious as I would've expected. So it's beneath" (personal communication, December 8, 2008).

Examples of the TGA program meeting student expectations are as follows:

> Overall I would say it met my expectations because there are some things it definitely excelled in and some things that went below my expectations….The academics, especially math and science, excelled. I wasn't really expecting to be taking UT Calculus I first semester of my junior year. I wasn't expecting to take differential equations my senior year. And I was really glad I got to take chemistry on campus at UT. That was

> definitely more than I expected (Male TGA student, personal communication, December 8, 2008).
>
> I figured TGA would be pretty much like it is now—wake up, go to class and then have homework the rest of the day. I didn't figure this much homework, but it's pretty much what I had in mind….TGA has definitely met my expectations. I wouldn't say surpassed, though, because of ORNL because I knew we were gonna go to it. I didn't figure we were gonna actually work there before junior year would end, so that's exciting. I like a lot of biology so, genetics, just working with stuff like loving organisms I find interesting (Male TGA student, personal communication, December 10, 2008).

Finally, the first example of the TGA program exceeding student expectations is as follows:

> *Student:* I thought I wouldn't have any social life. It'd just be boring up here all the time.
>
> *Interviewer:* What would make you want to come then?
>
> *Student*: I just—I know it's a better place for me and there was always a hope that it would be something different and it was. I don't know if it's just me that's changed or maybe I was wrong and I like it now….It's definitely passed my expectations. It's a lot more exciting, you know. It just gets better and I can't wait for my senior year to see how that turns out (personal communication, December 9, 2008).

The second example of TGA exceeding expectations is as follows:

> I thought because I was social that I was not going to fit in here. I thought the people here would be completely different from me, but they're all very much like me, which made me feel a lot more comfortable because I was like, oh dear, what if I'm not as smart as

> they are. Or what if they know everything there is to know…TGA has surpassed my expectations….Academically I thought I was going to be just awful. I thought I was going to flunk out. But really they explain it on a level that you can understand it. It's not like so high up the students can't understand it. And they help you to where you need to be academically. And the environment that you learn in also helps you to learn at a faster pace (TGA student, personal communication, December 10, 2008).

The expectations variables were coded (1 = *beneath expectations*; 2 = *met expectations*; 3 = *exceeded expectations*) and entered into SPSS 17.

Entering Transition to College scores. The researcher maintained a database with all TGA students' results of the *Transition to College* personality inventory. Individual mean scores for the seven personality traits that were independent variables in this study (Agreeableness, Conscientiousness, Emotional Stability, Extraversion, Openness, Career Decidedness, Self-Directed Learning, and Work Drive) for the 38 participants who took the TTC were entered in SPSS 17.

Statistical tests. Statistical tests were conducted between the independent variables, and also between the independent variables and the dependent variable. An outline of these tests is provided in Table 7.

Belonging and expectation fulfillment. The independent variables sense of belonging, as measured by the *Psychological Sense of School Membership* (PSSM) and reported in mean scores, and expectation fulfillment were explored using a one way ANOVA. Expectation

Table 7. *Statistical Tests Among the Study Variables*

Study Variables		Statistical Test
DV: Belonging (*PSSM means*)	IV: Expectation Fulfillment (*Below, Met, or Exceeded*)	ANOVA
IV: Belonging (*PSSM means*)	IV: Personality Traits (*Means*)	Pearson's *r*
IV: Belonging (*Belong, Doesn't Belong*)	DV: Persistence (*Persist, No Persist*)	Chi square
IV: Expectation Fulfillment (*Below, Met, Exceeded*)	DV: Persistence (*Persist, No Persist*)	Chi square
IV: Personality Traits (*Means*)	DV: Persistence (*Persist, No Persist*)	Point biserial Correlation

fulfillment for the new learning and living environment was categorized as (1) below expectations; (2) met expectations, and (3) exceeded expectations. PSSM items had a 4-point Likert scale of agreement, with (1) not at all true of me; (2) somewhat true of me; (3) mostly true of me, and (4) completely true of me.

The seven students who reported that TGA was beneath their expectations had a PSSM mean of 3.23; students who reported that TGA met their expectations (n = 24) had a PSSM mean of 3.59, and students who reported that TGA exceeded their expectations (n = 10) had a PSSM mean of 3.62.

A one-way analysis of variance on belonging (i.e., PSSM) showed a significant difference between groups effect, $F(2, 38) = 5.45$; $p < .01$. A Tukey post hoc test revealed that students who reported that TGA met their expectations ($M = 3.59$, $SD = 0.29$) or exceeded their expectations ($M = 3.62$, $SD = 0.26$) had a significantly higher sense of school membership than students who reported that TGA was beneath their expectations ($M = 3.23$, $SD = 0.18$). Refer to Table 8. The Tukey post hoc test showed that PSSM means of students with low expectations were significantly lower than those whose expectations were met (-.36, $p < .01$) or exceeded (-.38, $p < .05$).

The mean PSSM scores for students whose expectations had been met and whose expectations had been exceeded were 3.59 and 3.62, respectively. These scores are closer to the overall PSSM mean of 3.54. Students whose expectations had not been met at TGA had lower

Table 8. *One-Way Analysis of Variance Summary for Expectation Fulfillment*

Source	*df*	SS	MS	*F*	*Partial* η^2
Between groups	2	0.79	0.40	5.45**	.22
Within groups	38	2.77	0.07		
Total	40	3.56			

* $p < .01$.

PSSM means, indicating a lower sense of belonging at TGA, while students whose expectations had been met or exceeded had both higher, and very similar, PSSM means.

Belonging and personality traits. The potential relationship between the independent variables sense of belonging and personality traits was analyzed with Pearson's *r* correlation. The seven personality traits of Agreeableness, Conscientiousness, Emotional Stability, Openness, Career Decidedness, Self-Directed Learning, and Work Drive were entered as variables along with sense of belonging. Correlations are displayed in Table 9.

The relationship between Openness and belonging was significant ($r = .50$, $p < .001$ level). The relationships between Agreeableness, Conscientiousness, and Work Drive were also all significantly positively associated with belonging; Agreeableness ($r = .38$, $p < .05$), Conscientiousness ($r = .32$, $p < .05$) and Work Drive ($r = .33$, $p < .05$).

Two other relationships approached significance at the $p < .05$ level. The relationships between Emotional Stability and Self-Directed Learning with belonging were positive: Emotional Stability ($r = .32$, $p = .054$) and Self-Directed Learning ($r = .31$, $p = .055$).

Belonging and persistence. The independent variables sense of belonging and student persistence were analyzed using chi square test of independence. First, the data were entered as 2 x 2 Model of Belonging (1 = Connected; 2 = Adaptive; 3 = Rejected/Isolated; 4 = Resistant) in the rows, while Persistors and Non-Persistors were entered as columns. Five cells, or 62.5%, had an expected count less than five. There was low variance among the students when positioned in the 2 x 2 Model of Belonging, as there were 24 Connected, 8 Adaptive, 4 Rejected/Isolated, and 5 Resistant.

Table 9. *Intercorrelations, Means, and Standard Deviations for Scores on Psychological Sense of School Membership and Eight Personality Traits*

Measure	1	2	3	4	5	6	7	8	9	*M*	*SD*
1. PSSM	--									3.54	.30
2. Agreement	.38*	--								4.03	.61
3. Conscientious-ness	.32*	.35*	--							3.88	.48
4. Emotional Stability	.32	.41**	.43**	--						3.61	.74
5. Extraversion	.09	.18	.07	.52**	--					3.81	.72
6. Openness	.50**	.50**	.32*	.17	.10	--				4.40	.47
7. Career Decidedness	-.03	-.33*	.06	.18	.22	-.24	--			3.35	1.16
8. Self-Directed Learning	.31	.51**	.32*	.19	.09	.70**	-.34	--		4.12	.51
9. Work Drive	.33*	.55**	.42**	.23	.22	.52**	-.07	.72**	--	4.00	.57

*$p < .05$. **$p < .01$.

Due to this low variance, the researcher parsed the Model of Belonging and determined that 32 students perceived they belonged (24 Connected plus 8 Adaptive), while 9 students perceived they did not belong (4 Rejected/Isolated and 5 Resistant) thus amplifying the power of this small sample. The transformed data were analyzed with chi square test of independence, to increase power and to produce an exact *p*-value. Refer to Table 10.

When students who belonged were compared to students who did not belong, the former were found more likely to persist, $\chi 2(1, 41) = 4.85$, $p < .05$. Overall persistence, also called retention, of students at TGA from December 2008 through June 2009 was 73.2%; however, 81.3% of those students who perceived they belonged persisted, while 44.4% of those who felt they did not belong (or "fit") persisted.

From studying the results of the chi square test, perceptions of belonging, or fit, at TGA are found to be an indicator of student persistence.

Expectation fulfillment and persistence. The independent variable expectation fulfillment and the dependent variable persistence were analyzed using chi square. This analysis of expectations (1 = below expectations; 2 = met expectations; 3 = exceeded expectations) and student persistence yielded no significant difference, as shown in Table 11.

The chi square statistic with Fisher's Exact Test (as 2 cells contained counts less than 5) was .40, $df = 2$, and not significant, suggesting no significant association between student expectations and persistence.

Personality traits and persistence. The independent variable personality traits and the dependent variable persistence were analyzed with an independent sample t-test. The results of the t-test

Table 10. *Persistence Among Students Who Felt They Belong and Did Not Belong*

Sense of school membership	Persisted	Did not persist	$\chi^2(1)$
Belonged	26 (81.3%)	6 (18.8%)	4.85
Did not belong	4 (44.4%)	5 (55.6%)	
Total	30 (73.2%)	11 (26.8%)	

Table 11. *Persistence Among Students Who Felt TGA Was Below, Met, or Exceeded Their Expectations*

Expectation Fulfillment	Persisted (n = 30)	Did not persist (n = 11)	Fisher's Exact Test(1)
Below expectations	5 (71.4%)	2 (28.6%)	.40
Met expectations	17 (70.8%)	7 (29.2%)	
Exceeded expectations	8 (80.0%)	2 (20.0%)	

confirmed there is no significance ($p < .05$) between the seven personality traits and persistence or non-persistence among these TGA students: Agreeableness = .60;Conscientiousness = .14; Emotional Stability = .22; Openness = .98; Career Decidedness = .70; Self-Directed Learning = .73, and Work Drive = .57. Conscientiousness was the personality trait which was closest to approaching significance. Point-biserial correlations were also calculated to study potential relationships between personality traits and student persistence, as displayed in Table 12.

Conclusions for Research Question Two. TGA students whose program expectations were met or exceeded are more likely to feel a sense of belonging, and students who have a higher sense of belonging are more likely to persist with the program (81.3% retention rate of those who belong versus 44.4% retention rate of those who do not belong). Students who have higher levels of Agreeableness, Conscientiousness, Openness, and a stronger Work Drive are more likely to feel they belong at TGA.

Research Question Three

To respond to the final research question: *What are characteristics of students who persist and those who do not persist with the program?* the researcher developed a matrix for analysis of students characteristics, combining results from the findings of research questions one and two. Drawing from the work of Miles and Huberman's Explanatory Effects Matrix (1994), which is a matrix constructed to respond to the question: "Why were these outcomes achieved?" (p. 148). The Explanatory Effects Matrix "helps clarify a domain in *conceptual* terms; it is a useful first-cut exploration, beginning to trace back—and forward—the emerging threads of causality" (p. 148). Tables 13-16 present the characteristics of TGA persistors and non-persistors in matrix format. Table 13 presents Connected students, Table 14 presents

Table 12. *Intercorrelations, Means, and Standard Deviations for Scores on Persistence and Eight Personality Traits*

Measure	1	2	3	4	5	6	7	8	9	*M*	*SD*
1. Persistence	--									.26	.44
2. Agreement	.11	--								4.03	.61
3. Conscientious-ness	-.19	.35*	--							3.88	.48
4. Emotional Stability	.08	.41**	.43**	--						3.61	.74
5. Extraversion	.13	.18	.07	.52**	--					3.81	.72
6. Openness	-.10	.50**	.32*	.17	.10	--				4.40	.47
7. Career Decidedness	.09	-.33	.06	.18	.22	-.24	--			3.35	1.16
8. Self-Directed Learning	.08	.51**	.32*	.19	.09	.70**	-.34	--		4.12	.51
9. Work Drive	-.11	.55**	.42**	.23	.22	.52**	-.07	.72**	--	4.00	.57

*$p < .05$. **$p < .01$.

Table 13. *Explanatory Effects Matrix: Characteristics of Connected Students Who Persist and Do Not Persist with the Program*

Connected	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
1	+	Met	+				P
2	+/N	Exc		+			P
3	+	Exc	+				P
4	+	Met	-				P
5	+	Met	-				P
6	+	Met		+		A	P
7	N	Met	+				P
8	+	Exc	+			A	P
9	+	Exc	+		Y		VNP
10	+	Exc				A	P

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

(*Table 13 continues*)

(*Table 13 continued*)

Connected	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
11	+	Met				A	P
12	+	Met					INP
13	+	Met	+				P
14	+	Met	+			A	P
15	N	Met	+			A	P
16	+	Met					INP
17	N	Met					P
18	+/N	Met				A	P
19	+/N	Met	+				VNP
20	+	Exc				A	P
21	N/-	Exc				A	P

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

(*Table 13 continues)*

(*Table 13 continued)*

Connected	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
22	+	Met	+	+			P
23	N	Met	+				P
24	+	Exc	+				P

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

Adaptive students, Table 15 presents Rejected/Isolated students, and Table 16 presents Resistant students, as per the 2 x 2 Model of Belonging (Nichols, 2008).

The first column organized the 41 students who participated in the research study according to their 2 x 2 Model of Belonging quadrants (Nichols, 2008). Connected students were those who viewed the climate positively and perceived that they belonged at TGA (n = 24). Adaptive students viewed the climate negatively and perceived that they belonged at TGA (n = 8). Rejected/isolated students viewed the climate positively and perceived that they did not belong at TGA (n = 4). Finally, resistant students view the climate negatively and perceived that they did not belong at TGA (n = 5). Research procedures for situating students in the Model of Belonging were discussed earlier in this chapter.

The second characteristic is each student's perception of his or her home high school, which was a structured interview question. Students described home high schools as being positive, neutral, or negative. A + indicates positive; +/N indicates a positive to neutral perception; N indicates a neutral perception; N indicates a Neutral perception; N/- indicates a neutral to negative perception, and a – indicates a negative perception. All students are situated.

The third characteristic of the matrix is students' expectation fulfillment at TGA. *Low* indicates that TGA was below student expectations; *Met* indicates that TGA met student expectations, and *Exc* indicates that TGA exceeded student expectations. Procedures for determining student expectations were discussed earlier in this chapter.

Columns four through seven represent emergent patterns from the qualitative findings of research question two. Characteristic four is student sense of *sacrifice* to attend TGA. A +

Table 14. *Explanatory Effects Matrix: Characteristics of Adaptive Students Who Persist and Do Not Persist with the Program*

Adaptive	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
1	+/N	Met	-				INP
2	+/N	Met	-	+			P
3	+	Met	+	+	Y		P
4	+	Low	-	-	Y		P
5	+	Low	-	-	Y		P
6	+/N	Met	-				INP
7	N	Exc	+				P
8	+	Met	-	-			P

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

Table 15. *Explanatory Effects Matrix: Characteristics of Rejected/Isolated Students Who Persist and Do Not Persist with the Program*

Rej/Isolated	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
1	N	Low	-				P
2	N/-	Low					INP
3	+	Met					VNP
4	+	Exc		+	Y		INP

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

Table 16. *Explanatory Effects Matrix: Characteristics of Resistant Students Who Persist and Do Not Persist with the Program*

Resistant	HHS	EXP	SAC	NEG	HIN/BLO	OWN	PER/NP
1	N	Met	-	-			P
2	+	Low	-	-			P
3	N	Met	-	-			INP
4	+	Low	-	-	Y		VNP
5	N	Low	-				P

Note. HHS = Perception of Home High School; EXP = Expectation Fulfillment; SAC = Sacrifice; NEG = Negotiation; HIN/BLO = Hindrances or Blockers; OWN = Institutional Commitment; PER/NP = Persistence.

indicates a positive description of sacrifice; a – indicates a negative description of sacrifice, and a blank cell indicates that the student made no comment on his or her sacrifice.

Characteristic five is the student's discussion of his or her negotiating behaviors on whether or not to remain a student at TGA. As in the sacrifice column, not all students voluntarily brought forth this topic during their interviews. A + in the column represents that the student negotiated and felt positively about his or her negotiations to return to or remain at TGA. A – in the column indicates that the student negotiated and feels negatively about his or her decision to return to or remain at TGA. A blank cell indicates that the student did not discuss or mention a negotiating process.

Characteristic six indicates whether the student discussed any people functioning as hinderers or blockers in the student's adjustment or acclimation to TGA. A Y in the cell represents that the student did discuss the presence of a hinderer/blocker. A blank cell indicates that the student did not discuss whether or not she or he had experiences with a hinderer/blocker.

Characteristic seven represents whether the student offered insight into experiencing ownership of TGA. An A in the cell shows that the student displayed a sense of ownership, altruism, or desire to give back to TGA. A blank cell indicates that the student did not discuss topics related to this orientation.

As stated previously the responses presented in columns four through seven represent students' spontaneous responses to structured interview questions ("What do you think of it here at TGA?", "What does it mean 'getting used to TGA'?" and "What sort of atmosphere or environment do you think you are creating here at TGA?"), which led to discussions of sense of personal sacrifice to attend TGA; negotiating whether to return to or remain a student at TGA;

the existence of hinderers to their acclimation and adjustment to TGA, and to their feelings of ownership and commitment to TGA as an institution.

Finally, the last column contains TGA students' persistence from December 2008 through June 2009. A P in the cells indicates that the student was successful and persisted with TGA. Seniors graduated, and juniors achieved a GPA that earned them an invitation to return for their senior years. A VNP indicates that the student chose to depart TGA (also referred to in this study as dropouts). An INP indicates that the student was asked to leave TGA, either for academic or disciplinary reasons.

Students who were part of the connected quadrant (which is also the largest) overall felt positively toward their home high school, adjusted well to TGA, did not feel that what they left behind at their homes and home high school was a negative sacrifice, and were the most persistent group with the highest overall retention rate.

Moreover, within the members of the connected quadrant, TGA students who expressed ownership of TGA, which encompassed the desire to give back to TGA through recruiting for TGA, wanting to help new students acclimate to TGA, feeling responsible for the happiness and success of other students, showed institutional commitment to TGA. This subgroup, which represented 37.5% of the connected group (9 of 24 members) and 22% of the overall TGA population (9 of 41 students) had a 100% retention rate.

Within the adaptive students, all of them felt positively toward their home high schools. However, far more adaptive students viewed the sacrifices they made to attend TGA negatively; they did not, overall, feel that they sacrifices they made to be students a TGA were worth what they left behind at their homes and home high school. Also hindering their adjustment and

acclimation to TGA were people from home acting as blockers. No adaptive students expressed ownership of TGA. None of the adaptive students voluntarily left TGA; two were dismissed from TGA, but none chose to leave.

The rejected/isolated student group was the smallest sample (n = 5) and the most divergent of the quadrants. Expectation fulfillment varied. No rejected/isolated students expressed ownership of TGA. Three of these students did not persist; two were asked to leave and one chose to leave TGA.

The final quadrant, resistant, was overall very negative in their perceptions. This group had the lowest expectation fulfillment, and most group members viewed their sacrifice to attend TGA negatively. Further, group members were involved in negatively-framed negotiations to stay at TGA or to return home. No students in this group demonstrated ownership of TGA. Persistence was mixed with two departing.

Conclusions

Research Question One

The first research question sought to develop a student-generated definition of belonging at Tennessee Governor's Academy for Mathematics and Science. Through the oral administration of the *Psychological Sense of School Membership* as well as a structured interview protocol, interview participants stated their personal belonging beliefs as well as their perceptions of belonging at TGA. Interview lengths ranged from 12 minutes to 25 minutes.

Descriptive coding revealed that most students felt favorably toward the environment, or climate, of their home high schools, although they did not feel as favorably toward the academics, which is to be expected since the participants chose to leave their home high schools

for the academic opportunities at TGA. Most student felt they belonging at TGA and that the climate or environment at TGA was a positive one.

Several patterns emerged from pattern coding (Miles & Huberman, 1994). First, students commented on the nature and quality of their TGA friendships; for many, this was the first time academic (or classroom) peers merged with social friends. Their new friends at TGA have similar interests and goals and are equally committed to education. Second, Seniors identified themselves as being more academically oriented, focusing on individual pursuits of studying and college applications, while Juniors identified themselves as being more family- and team-oriented.

A third pattern is that of *hindrances* or *blockers* to belonging or fully integrating into the living and learning environment at TGA. Coaches and parents served as blockers to some students and impeded the transition from home and home high school to TGA. This transition to TGA became the fourth identified pattern, *adjusting* to TGA. The first interview participants voluntarily spoke so much about adjusting to TGA that the researcher added that query to the interview protocol. Adjusting varied among the students, with homesickness, stress of rigorous academic work, and other factors contributing to the differing times on adjusting.

The fifth pattern was that of *Sacrifice*. Many students commented that they sacrificed to attend TGA, giving up cars, friends, extracurricular activities, etc. to attend the new math and science school. The sixth pattern was *Negotiation*, as many students struggled with negotiating to return home during a semester break or whether to remain enrolled at TGA.

The final pattern was that of *Ownership* of TGA, or feelings of commitment to TGA that transferred to the desire to give back to TGA through recruiting, aiding in retaining younger students, etc.

According to the analysis of qualitative interview data, the student definition of belonging at TGA is embodied by a passion for mathematics and science; a strong work ethic and academic focus; a strong sense of community and working together, including with the teachers, commitment to the goal of completing the program as well as commitment to the program itself; putting educational and career opportunities that TGA offers ahead of many extracurricular activities and home high school connections, and adaptability.

Research Question Two

The second research question was answered by means of quantitative analysis.The potential relationships analyzed were: a) between the independent variable, belonging, and personality traits using Pearson's Product Moment Correlations, and, b) between belonging and expectations using Analysis of Variance (ANOVA). The potential relationships between the dependent variable, persistence, and the independent variables, belonging, expectations, and personality traits, were analyzed using chi-square tests of independence.

Sense of belonging and expectation fulfillment were analyzed with ANOVA. The Tukey post hoc test showed that PSSM means of students with low expectation fulfillment were significantly different than PSSM means of students whose expectations were met or exceeded. Students whose expectations for TGA were met or exceeded had significantly higher senses of belonging.

The Tukey post hoc showed a lack of difference between students whose expectations had been met and students whose expectations had been surpassed and their PSSM means. The PSSM mean for students whose expectations had been met and for students whose expectations had been exceeded were similar, 3.51 and 3.61 respectively. These scores are close to the overall PSSM mean of 3.54. Students whose expectations had not been met at TGA had lower PSSM means, indicating a lower sense of belonging at TGA, while students whose expectations had been met or exceeded had both higher and very similar PSSM means.

Next, the potential relationships between sense of belonging and personality traits were studied with Pearson's *r.* A positive relationship between Openness and belonging was observed. Agreeableness, conscientiousness, and work drive were also all significantly and positively related with belonging.

Analyses of the dependent variable, persistence, to each independent variable, belonging, personality traits, and expectation fulfillment were conducted. An analysis of belonging (positive belonging $n = 32$; lack of belonging $n = 9$) and non-persistence using a Chi Square Test of Independence yielded a significant difference in that students who expressed a sense of belonging at TGA had a significantly higher persistence rate. Overall persistence, also called retention, of students at TGA from December 2008 through June 2009 was 73.2%; however, 81.3% of those students who perceived they belonged persisted, while 44.4% of those who felt they did not belong (or "fit") persisted.

A Chi Square Test of Independence was also conducted between expectations and persistence. The chi square statistic suggested no significant association between student expectations and persistence.

Finally, point biserial correlation revealed no relationships of significance between personality traits and student persistence at TGA.

Several personality traits—openness, agreeableness, conscientiousness, and work drive—were significantly positively related to student sense of belonging at TGA. Further, students who believe their expectations have been met or surpassed have a higher sense of belonging at TGA. However, neither personality traits nor expectations are associated or related to student persistence. Belonging, however, is associated with student persistence.

Sense of belonging may function as a mediator between personality traits and expectations, which are both individual background characteristics students bring with them to TGA, while sense of belonging is developed at TGA.

Research Question Three

The final research question explored characteristics of students who persisted and those who did not persist with the TGA program, via the generation of an Explanatory Effects Matrix (Miles & Huberman, 1994). Students' position on the 2 x 2 Model of Belonging (Nichols, 2008), along with climate perceptions of their home high school, their expectation fulfillment, and their perceptions within the emergent patterns of sacrifice, negotiations, hindrances/blockers, and ownership of TGA were entered into the matrix, along with the outcome persistence.

Connected students, who viewed TGA's climate positively and felt they belonged at TGA, also felt positively toward their home high school and reacted positively regarding personal sacrifice and negotiations. Within the connected group, a subset of students also expressed feelings and offered personal examples of ownership (institutional commitment

coupled with the desire to give back to TGA). Students who exhibited ownership had a 100% persistence rate.

Adaptive students persisted at TGA, with the exception of two who were dismissed from TGA. Adaptive students feel that they belong, but they perceive the climate of the school negatively. This group had many students who expressed their sacrifices to attend TGA negatively, yet they did stick with TGA.

Students who were situated in the rejected/isolated and resistant quadrants had more negative perceptions of their home high schools and reacted more negatively to sacrifice, negotiations, and hindrances/blockers. None of those students expressed or volunteered feeling ownership toward TGA. Further, these groups had more students who felt their expectations for TGA had not been met. These groups also had the highest non-persistors.

CHAPTER 5: DISCUSSION

Conclusions were provided in Chapter 4; the purpose of Chapter 5 is to address the discussion for each research question; implications for practice; implications for future research; limitations of the results, and the epilogue.

Discussion

Research Question One:

From the perspective of students, what does it mean to belong at a newly formed specialty high school?

TGA seniors were overall more negative toward TGA; initially, the researcher surmised this was due to the numerous changes in policies and rules, mostly pertaining to their residential experience at TGA. However, a study of the inaugural class at South Carolina Governor's School for Science and Mathematics found that students and their parents became more negative in their perceptions of the new school as the year progressed (Dorsel & Wages, 1993). Another study examined students' social coping at the Indiana School for Science, Mathematics, and Humanities and found that students "became slightly more humble about their academic ability when in the company of highly able classmates" (Cross & Swiatek, 2009, p. 31). Perhaps TGA seniors, in particular, became more negative toward belonging and the environment at TGA due to academic struggles as well as the many kinks that had to be worked through during the inaugural year.

TGA juniors commented frequently on social aspects of their adjustment to TGA; creating a family environment and forming study groups or new student clubs were common topics to numerous juniors participants. The social aspect of TGA seemed paramount to juniors,

which included like-minded classmates and friends, and study groups, while seniors were more focused on college admissions and personal academic achievement, or the "academic." This aligned with Tinto's (1997) study of learning communities on college campuses; social interactions were initially more important than academics to college freshmen; as students progressed in their studies, the academics grew in importance in their lives. Similar to the TGA juniors, Hoffman et al. (2002) found that positive social interactions growing from a supportive academic environment increased students' feelings of comfort at college and merged the academic realm with the social. Thus, TGA students in their live and learn environment behave closely like college freshmen at a residential campus.

Hamm and Faircloth (2005) examined peer acceptance (classroom-based) and friendships (intimate dyads) with belonging. Differing from this study, TGA students do not have classmates they see only an hour or so each day in a group setting, as in a typical comprehensive high school; they learn, eat, travel, study, and socialize with their classmates and cottage mates. TGA students reported a high sense of belonging; perhaps they feel a peer acceptance that was missing from their home high schools. However, when students did not report having close friends or developing friendships greater than those friends at home, they did leave TGA. Peer acceptance—being immersed in a community of like-minded individuals—is important in establishing a strong initial connection with TGA, but developing close friendships that are more intimate also appears to be vital to persisting. Further research on the types of friendships—peer or intimate—established at residential high schools is required before this researcher can draw conclusions regarding friendships and persistence.

Braxton, Sullivan, and Johnson (1997) appraised Tinto's model of integration to college, deriving 15 propositions to test with numerous empirical studies from the literature. Interestingly, several TGA seniors demonstrated Propositions 14 and 15, as follows:

> 14. A high level of the goal of graduation from college compensates for a low level of commitment to the institution, and vice versa, in influencing student persistence in college.
>
> 15. A high level of academic integration compensates for a low level of social integration, and vice versa, in influencing student persistence in college.

Braxton et al. (1997) analyses of empirical studies supporting or refuting Tinto's model of college student departure offers "vigorous" support of both propositions 14 and 15 in single institution, residential university settings. For proposition 14, multi-institutional settings offered modest support. Thus, these findings may offer further explanation to why some of the seniors, who were more negative toward TGA during their interviews, developed a strategy to "stick it out" for their senior year.

While this study did not center on TGA students' perceptions of being gifted, most TGA students (considered a gifted/talented population of students) reported fitting in and belonging at their home high schools, having friends, and being involved in numerous extracurricular activities, but feeling much smarter than the majority of the students. They did not feel their academic needs were being served at their home high schools. Most TGA students did not perceive their talents as negative, or they did not express this in the interviews. This differed from a study of students at the Indiana Academy for Science, Mathematics and Humanities with a similarly sized sample (n = 51) in which students reported that being gifted was socially

stigmatizing, negative, at their home high schools although half the sample reported a sense of belonging to their home high school communities (Manor-Bullock, Look, & Dixon, 1995). More research into TGA students' perceptions of themselves at their home high schools would be required before conclusions drawn, however.

Hinderers/blockers, particularly when family-based or from an adult with whom the student had a close relationship, like a teacher or coach, served negative functions in students' adjustment and acclimation to TGA. As Dunn, Putallaz, Sheppard, and Lindstrom (1987) found, family support is significant to overall school adjustment in a residential setting; perhaps the converse is also possible, that when family members do not support but instead oppose the residential school, adjustment becomes slowed or impaired.

Research Question Two:

What are the relationships among the constructs belonging, expectations fulfillment, and personality traits, and how do these constructs relate to student persistence?

The oneway ANOVA of student expectation fulfillment and PSSM mean (belonging) showed that when expectations for TGA have been met or exceeded, sense of belonging at TGA is also greater. As Kelly, Kendrick, Newgent, and Lucas (2007) recommended, perhaps transitional activities should commence in the summer prior to moving to the new residential school so incoming students do not develop inflated or unrealistic expectations.

The findings of this study had some commonalities to Konings, Brand-Gruwel, van Merrienboer, and Broers' (2008) longitudinal study of student expectations for a new learning environment. The researchers examined student expectations for the new learning environment (curriculum, pedagogy, teacher stance) and found a positive relationship between expectations

prior to the program and the reality once students had experience the program. Further, students with negative expectations and negative perception of the new learning environment experienced negative educational outcomes, including decreased intrinsic motivation, decreased deep processing, and increased fear of failure. TGA students whose expectations were met or who believed their expectations were not met were more likely to voluntarily discuss negative program effects. One senior male shared how he studied more at his home high school, as the socialization and extracurriculars functioned as motivators. A senior female mentioned how TGA was "unhealthy" for her. Beyond these voluntary admissions, more investigation should be conducted on student expectations for the new learning environment, and, in the case of TGA, expectations for the new living environment as well.

This idiosyncratic group of self-selected students, who are both highly intelligent and willing to leave home two years early, have more in common with one another from a personality perspective than differences. Agreeableness, Conscientiousness, Openness, and Work Drive had a significant relationship with sense of belonging; the researcher had observed this informally in multiple situations, such as when middle children (in birth order) have a higher persistence rate, or when students self-report that they have shared rooms with siblings. Perhaps being a middle child and/or being accustomed to negotiating shared space and resources relates longevity in a stressful, new environment. And Conscientious students, who are achievement-oriented, persistent, and patient, will certainly adapt more readily to academic rigors of a math and science residential program.

While personality and expectations were not significantly related or associated with persistence, Kelly, Kendrick, Newgent and Lucas (2007) assert that personality traits are

important in persistence studies, as personality traits govern students' coping choices, which in turn impact students' adjustment to the new college environment. Further, knowledge of students' personality traits and other background characteristics can aid counselors or administrators in proactive intervention strategies that transpire prior to students beginning the new program of study.

Categorization in the 2 x 2 Model of Belonging (Nichols, 2008) may be a better overall determinant of student persistence, but further research with more student populations is required.

Research Question Three:

What are characteristics of students who persist and those who do not persist with the high school program?

Pittman and Richmond's 2007 study of second semester college freshmen findings conclude that freshmen who reported a higher sense of belonging in high school also perceived a higher sense of belonging in college, and that higher belonging was associated with higher academic achievement. Janosz, Leblanc, Boulerice, and Tremblay (1997) found in a longitudinal study of dropout predictors that the best screening variable for identifying potential dropouts was a "positive attitude toward school." These studies correspond with this exploratory study's finding, that almost all of the students who had positive views of both their home high schools and of TGA persisted.

The TGA Connected students reported, as a whole, more positive comments about their home high school and that they belonged at TGA. Their GPAs, while not considered a variable in this study, were higher than the Rejected/Isolated student and the Resistant students.

Following the interviews, five students were dismissed from TGA for academic reasons. Three students were in the Rejected/Isolated and Resistant quadrants, while two were in the Connected quadrant. Adding GPA or some other cognitive, achievement outcome could enhance the 2 x 2 Model of Belonging to include academic integration. Social integration alone could deem a student Connected, but students must be academically integrated by maintaining a criterion-based GPA in order to remain at TGA and other schools, like college.

Thus, persistence at TGA is most related to a multidimensional approach to school membership, adhered to by Smerdon (2002): students perceive a sense of belonging; they are committed academically, and they are committed to the institution itself. Students must feel all three of these in order to obtain "full membership" (p. 288). Academic commitment is defined as "a psychological investment in learning or mastery of the skills and knowledge that the academic work is intended to promote" (p. 289) while institutional commitment is defined twofold: "first is a commitment to the culturally defined goals, purposes, and interests held out as legitimate objectives….second element is a commitment to the structures or norms that define, regulate, and/or control the acceptable means of striving for these goals" (p. 289). Students at TGA, and at other rigorous academic residential programs, must be committed *psychologically* to the academics; they should crave learning for the sake of learning, not just to acquire an "A" or a certain GPA. TGA students alluded to this in interviews when they mentioned "student who don't belong here." Further, they must be passionate about learning, in this context, mathematics and science, and become a part of that devoted culture.

The Characteristics of TGA Students Who Persist and Do Not Persist with the Program tables highlighted students who persisted after June 2009 and those who departed. Non-

persistors are not wasted resources; much can be learned from the groups of departers as to their reasons for departing. In summer 2009, this researcher conducted an electronic survey of the TGA departers, both voluntary and involuntary, to gather their reflective perceptions on their sense of belonging at TGA, reasons for leaving TGA and their current judgment on if they had made the best choice to depart (if their departure was voluntary). Twenty program departers were invited to participate (from a population of 24 departers from August 2007 through June 2009; some email addresses were incorrect or not available). Ten of the 20 responded fully or partially to the survey, and results were very mixed. Some departers were noticeably angry and fostered ill will toward TGA, rendering their responses virtually unusable. However, from the departers who did respond without emotional profanity, several commented that their main reason for departure was the "enclosed" campus of TGA and strict rules. Departers commented that TGA seemed like a "prison" from which there was no escape. The environment was too limited and more rules-oriented than their parents' homes. Some wished they had "stuck it out" and persisted with the program, while others were happy they left.

Interestingly, no members of the Adaptive, Rejected/Isolated, or Resistant quadrants voluntarily spoke of institutional commitment, or sense of democratic ownership of TGA, as about half of the Connected students did. An early advocate for democratic principles applied in educational settings, John Dewey said education in a democracy must "[give] individuals a personal interest in social relationships and control, and the habits of mind which secure social changes without introducing disorder" (1916). Students must experience both voice and choice and feel vested members of the institution in order to obtain the highest level of membership in the school.

Implications for Practice

In the summer of 2009, as TGA administrators, faculty, and staff prepared for the arrival of the class of 2011, in part by reviewing some preliminary results of this study, proactive intervention strategies were pilot tested. First, many incoming students, current students, and some TGA faculty and staff "friended" one another on Facebook, the social networking site. Parents and incoming students were invited to visit the TGA block and to post comments. Incoming students communicated via cell phones as well.

Besides these electronic communications, the Incoming Junior Survey included items on students' expectations on specific domains, both academic and residential, regarding their lives at TGA (Kelly, Kendrick, Newgent, & Lucas, 2007; Konings, Brand-Gruwel, van Merrienboer, & Broers, 2008). For example, one item asked students to estimate their weekly homework load, by number of hours. Another item asked incoming students to rate how quickly they expect to adjust to TGA. These data were studied to "flag" any potential outliers and provide proactive interventions by faculty or the school counselor. Further, homesickness and adjustment data were gathered longitudinally from both the TGA students and their parents throughout the first semester at TGA. Again, outliers were "flagged" for proactive interventions, from the school counselor, faculty, or TGA seniors.

As of March, 2010, the class of 2011 has lost only one student, and that student was almost an immediate loss due to homesickness. Conversely, at this time in the junior year of class of 2009, six students (of 24) had departed or been asked to depart, and of the class of 2010, eight students (of 29) had departed or been asked to depart. Clearly, proactive interventions as espoused by Kelly, et al. (2007) coupled with an adaptation of Konings, et al. (2008) research

study on student expectations for a new learning environment had a part in the success in retaining a greater percentage of the class of 2011.

Other states and school systems are exploring residential mathematics and science magnet models as well as day magnet models, particularly as federal Race for the Top grant monies become available. Colorado is currently forming its own residential mathematics and science school, with the proposed name of COSMIC: Colorado Science, Math, and Innovation Center, and visited TGA. Results of this study along with other evaluation and research reports were provided for their state's decision-making process.

The National Consortium for Specialized Secondary Schools in Mathematics, Science, and Technology (NCSSSMST) which serves residential as well as day STEM schools could seek to organize its retention efforts, much like efforts in higher education to study and evaluate institutional retention practices (Supiano, 2009).

Implications for Future Research

For further research and to extend the current study, a longitudinal study of TGA program persistors to learn of their college experiences, degree(s) conferred, and career trajectories would be valuable for stakeholders at the state and institutional levels. Further, a longitudinal tracking of male and female choices of college major and careers will enhance the discussion of men and women in the STEM fields; men are found to be more likely to choose "working with things" and women "working with people" (Webb, Lubinski, & Benbow, 2002, p. 791).

This study was cross sectional, examining belonging beliefs at one point in time, which was the conclusion of the fall semester at a residential mathematics and science high school.

Applying Nichols' 2 x 2 Model of Belonging (2008) longitudinally to a larger middle or late adolescent population, either in a residential magnet school or in a college or university, would allow future researchers to also integrate the Model of Belonging with Tinto's Stages of Student Departure (1988) if the study transpired over one or more academic years.

Transitions to middle school, during early adolescence, and to college, during late adolescence, are well-researched areas, as discussed in Chapter 2; transitions during middle adolescence have received less attention they are less frequent occurrences. While these transitions do not occur as frequently as early and late adolescence transitions, this is a hole that should be addressed, particularly as more flexible educational opportunities are on the rise in the form of magnet programs, online opportunities, etc.

At the institutional and statewide level, a comparison of belonging as it facilitates institutional commitment of highly talented students in a typical comprehensive high school and a residential STEM high school would be of value. Most students in comprehensive high schools attend the school closest to them or to which they are designated to attend; school choice and vouchers are often not a possibility for rural, isolated students or students whose families are not aware of or supportive of choosing alternative educational environments.

This research study focused on individual background traits of the students, sense of belonging developed at the institution, and persistence. Another series of variables regarding belonging are the educational practices of TGA, including relationships with faculty, curriculum, and pedagogy; as Tinto (1997) recommend, "choices of curriculum structure and pedagogy invariably shape both learning and persistence on campus" (p. 622). The choice for students to attend TGA was an academically-based decision, as evidenced in this study as most participants

felt positively toward the climate, peers, and extracurricular opportunities of their home high schools, but not toward the academic opportunities. Hence, another study adding the variable educational practices is of value, as the pedagogy, curriculum, and rigors of homework and assignments were perceived differently by the TGA students.

Further, a study on why and how some students achieve belonging, academic integration, and institutional commitment at an institution is of high value, especially since those students persisted with the academic program (and all are either graduates or seniors, as of March 2010). Examining the generation, or creation, of this multidimensional belonging, nurturing it, and sustaining it have wide applications in middle schools, high schools, and college campuses. Going further still, a closer examination of students who develop institutional commitment, as in Smerdon's (2002) multidimensional definition, are worth of more in-depth study, perhaps through qualitative methods, in order to highlight traits, characteristics, or other variables that influence or affect that development.

Personality traits that students bring with them to an educational setting and how they affect, or influence, the students' development (or lack thereof) of sense of belonging is another topic for additional study. For example, if an institution admits a student with low Agreeableness, how can the counselors or staff at that institution target belonging activities or interventions to enhance that student's perceptions of being "part of" the institution?

A fascinating, but potentially time-and personnel-intensive field is utilizing social network analysis (SNA), based on network theory, to analyze student interaction patterns at an institution, which in turn affect academic integration and persistence. SNA research studies were proposed by Tinto (1997). SNA has the potential to graphically display relationships between

and among the "nodes," or participants in the network (students, faculty, residence life staff, etc.) examining the centrality of a node or nodes [degrees (number of connections to other nodes in the network); the betweenness, and the closeness of the nodes] to determine patterns of relationships. For example, if a node has sparse networks, that is, lacking adequate social connections, intervention steps can be taken to assist in social integration. Another example is if the SNA findings highlight a clustering coefficient, which suggests "cliques" or factions forming. An analysis of the burgeoning social network would be best in the fall semester when the incoming juniors have arrived to the campus and are adjusting to their new living and learning environment. This is transferable for many educational settings, such as when 8th graders transition to the high school setting in 9th grade.

Limitations of Results

Studying a population of students to a new school can produce limited results due to significant program changes that may be instituted during the year or following the conclusion of the year; further, adding a second population of incoming students can, as Ingersoll and Cornell stated in their study conclusions, there are numerous "possible confounds, including difficulty interpreting results when students from different years in the program are combined, in a cross-sectional study of adjustment" (1995, p. 59). This was echoed by Dorsel and Wages (1993) who studied the inaugural class of the South Carolina Governor's School for Math and Science and cautioned against a "full-scale" study of the inaugural class of a new school, due to the lack of precedence, level of expectations compared to the reality of the new school, and to the policies and procedures that would require changes and adjustments. This researcher not only studied the

inaugural class, but employed a cross-sectional study on the inaugural class and the second class to enter the new school

This study relied on two self-report instruments, the *Psychological Sense of School Membership* and the *Transition to College.* Self-reports measures, according to Trapmann, Hell, Hirn, and Schuler (2007) are "amenable to impression management, that is, coachable and fakable" (p. 147). TGA seniors in this study were administered the *Transition to College* in February of their junior year, while TGA juniors were administered the inventory as part of the admissions process to TGA. While the TTC demonstrates reliability and validity, the seniors were, at the time, at TGA for four solid weeks and may have been more study-weary and homesick than at another point in their junior year. The TGA juniors were final round applicants with high expectations of gaining admission to TGA, so they may have been seeking to impress with their personality test responses. Failure to administer the TTC in a similar context may have produced an effect on the TTC scores, although the researcher is unsure of the effect.

Study results are certainly not generalizable, as this research concentrated on a small, gifted population at a new mathematics and science residential school. Colorado is currently forming its own residential mathematics and science school, with the proposed name of COSMIC: Colorado Science, Math, and Innovation Center, and visited TGA. Results of this study along with other evaluation and research reports were provided for their state's decision-making process.

Epilogue

From a Facebook status and ensuing comments, February 23, 2009:

Senior Female #1: College students go crazy, but could never surpass the extent of insanity that TGA students experience.

Departed TGA Male #1: (likes this status)

Departed TGA Male #2: Amen. lol

Senior Female #2: Seriously...

Entering a new educational setting, the incoming students bring a host of characteristics with them that all factor in to whether the student will experience integration at the setting and, ultimately, persist with their education at that institution. This study found that student expectations for the new educational setting and personality traits functioned as mediator to the development of sense of belonging in students. Further, some students who felt they belonged also developed a greater commitment to the institution and perceived they were part of the democratic educational process at that institution. Those students had a 100% persistence rate, beyond that of students who felt they belonged at the academic and social levels.

Recall the Facebook exchange featured at the onset of Chapter 2. The student who called that other student a "nerd" did voluntarily depart TGA. That student failed to make deep friendships with other TGA students, although he did report belonging and peer acceptance. He also did not develop a commitment to the institution. He is the Departed TGA Male #2 in the Facebook exchange above.

The two senior females in the above exchange are connected and have persisted; they now exhibit institutional commitment that they did not as juniors, as both are instrumental in leading student and parent efforts to Save TGA. On January 13, 2010, TGA faculty, staff, and

students were notified that the residential program of TGA would close in 2011, when the class of 2011 graduates.

REFERENCES

ACT, Inc. (2006). *Developing the STEM education pipeline*. Iowa City, IA: ACT, Inc.

Abe, J. A. (2005). The predictive validity of the Five-Factor Model of personality with preschool age children: A nine year follow-up study. *Journal of Research in Personality, 39*, 423-442.

Achter, J. A., Lubinski, D., Benbow, C., & Eftekhari-Sanjani, H. (1999). Assessing vocational preferences among gifted adolescents adds incremental validity to abilities: A discriminant analysis of educational outcomes over a 10-year interval. *Journal of Educational Psychology*, *91*(4), 777.

Alkandari, N. (2008). Factors affecting students' retention at Kuwait University. *College Student Journal, 42*(2), 483-492.

America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science: America COMPETES Act of 2007. 110th Congress, 1(2007).

Atkinson, R. D., Hugo, J., Lundgren, D., Shapiro, M. J., & Thomas, J. (2007). *Addressing the STEM Challenge by expanding specialty math and science high schools.* The Information Technology and Innovation Foundation. Retrieved May 10, 2009 from http://ncsssmst.org/CMFiles/Docs/STEM%20Final_03_20_07.pdf.

Battistich, V., Solomon, D., Kim, D., Watson, M., & Schaps, E. (1995). Schools as communities, poverty levels of student populations, and students' attitudes, motives, and performance: A multilevel analysis. *American Educational Research Journal, 32*(3), 627-658.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497-529.

B.E.S.T. (Building Engineering and Science Talent). (2004). *The talent imperative: Diversifying America's science and engineering workforce.* Retrieved March 26, 2009 from http://www.bestworkforce.org/PDFdocs/BESTTalentImperativeFINAL.pdf.

Bidijerano, T., & Dai, D. Y. (2007). The relationship between the big-five model of personality and self-regulated learning strategies. *Learning and Individual Differences, 17,* 69-81.

Blaisdell, S., & Tichenor, K. R. (2002). Where are the students going? NCSSSMST gender and ethnicity differences for major and institution choices. *NCSSSMST Journal, 7*(2), 14-16.

Braxton, J. M., Sullivan, A. V. S., & Johnson, R. M., Jr. (1997). Appraising Tinto's theory of college student departure. . In J. C. Smart (Ed.), *Higher Education: Handbook of Theory and Research, Volume, XII* (pp. 107-164). Bronx, NY: Agathon Press.

Broad, W. J. (2004, May 3). U.S. losing its dominance in the sciences. *New York Times* Retrieved January 8, 2009 from http://www.nytimes.com/2004/05/03/us/us-is-losing-its-dominance-in-the-sciences.html?scp=282&sq=&st=nyt.

Brown, D. W., & McIntire, W.G. (1996). Sense of belonging in rural community high school and boarding magnet high school students. Paper presented at the Annual Meeting of the National Rural Education Association, October, 1996, San Antonio, TX.

Bryk, A. S., Lee, V. E., Holland, P. B. (1993). *Catholic school and the common good.* Cambridge, MA: Harvard University Press.

Business Roundtable. (2008). *Tapping America's potential: The Education for Innovation Initiative: Gaining momentum, losing ground, progress report 2008.* Retrieved January 8, 2009 from http://tap2015.org/news/tap_2008_progress.pdf

Calabrese, R. L. (1987). Adolescence: A growth period conducive to alienation. *Adolescence, 22,* 929-938.

Caraceilli, V. J., & Greene, J. C. (1993). Data analysis for mixed-method evaluation design. *Educational Evaluation and Policy Analysis, 15*(2), 195-207.

Caracelli, V. J., & Greene, J. C. (1997). Crafting mixed-methods evaluation designs. *New Directions for Evaluation, 74,* 19-32.

Cawelti, G. (1995). The missing focus of high school restructuring. *School Administrator, 52*(11), 12-16.

Chen, X. (2009, July). *Stats in Brief Series: Students who study STEM in postsecondary education.* National Center for Educational Statistics. U. S. Department of Education NCES 2009-161.

Clark, J. J. & Dixon, D. N. (1997). The impact of social skills, training on self-concept of gifted high schools students. *Journal of Secondary Gifted Education, 8*(4), 179-188.

Cole, J. S., Kennedy, M., & Ben-Avie, M. (2009). The role of precollege data in assessing and understanding student engagement in college. *New Directions for Institutional Research, 141*, 55-69.

Committee on Science, Engineering, and Public Policy (COSEPUP). (2007). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future.* Washington, DC: National Academies Press.

Cooper, C. R., Baum, S. M., & Neu, T. W. (2004). Developing scientific talent in students with special needs: An alternative model for identification, curriculum, and assessment. *The Journal of Secondary Gifted Education, 15*(4), 162-169.

Council on Competitiveness. (2005). Innovate America: Thriving in a world of challenge and change. Retrieved on March 11, 2009 from http://www.compete.org/publications/detail/202/innovate-america/

Creswell, J. (1998). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches.* Thousand Oaks, CA: Sage.

Cross, J. R., & Cross, T. L. (2005). Social dominance, moral politics and gifted education. *The Roeper Review, 28*(1), 21-29.

Cross, T. L., & Swiatek, M. A. (2009). Social coping among academically gifted adolescents in a residential setting: A longitudinal study. *Gifted Child Quarterly, 53*(1), 25-33.

DeBerard, M. S., Spielmans, G. I., & Julka, D. L. (2004). Predictors of academic achievement and retention among college freshmen: A longitudinal study. *College Student Journal, 38*(1), 66-87.

Dewey, J. (1916). *Democracy and Education*. Institute for Learning Technologies Digital Classics: 1994. Retrieved February 24, 2010 from http://www.ilt.columbia.edu/Publications/dewey.html.

Dixon, F. A., Cross, T. L., & Adams, C. M. (2001). Psychological characteristics of academically gifted students in a residential setting: A cluster analysis. *Psychology in the Schools, 38*(5), 433-445.

Dorsel, T. N., & Wages, C. (1993). Gifted, residential education: Outcomes are largely favorable, but there are some cautions. *The Roeper Review, 15*(4), 239-242.

Duff, A., Boyle, E., Dunleavy, K., & Ferguson, J. (2004). The relationship between personality, approach to learning, and academic performance. *Personality and Individual Differences, 36*, 1907-1920.

Dunn, S. E., Putallaz, M., Sheppard, B. H., & Lindstrom, R. (1987). Social support and adjustment in gifted adolescents. *Journal of Educational Psychology, 79*(4), 467-473.

Dzubow, L. (2009, April). Boring: The new cool. *O: The Oprah Magazine*, 113-114.

Eccles, J. S, Lord, S., & Midgley, C. (1991). What are we doing to early adolescents? The impact of educational contexts on early adolescents. *American Journal of Education, 99*(4), 521-542.

Eccles, J. S. & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109-132.

Eilber, C. R. (1987). The North Carolina school of science and mathematics. *Phi Delta Kappan, 68*(10), 773-777.

Eysenck, H. (1991). Dimensions of personality: 16, 5 or 3? Criteria for a taxonomic paradigm. *Personality and Individual Differences, 12*(8), 773–790.

Fimian, M. J. (1988). Predictors of classroom stress and burnout experienced by gifted and talented students. *Psychology in the Schools, 25*, 392-405.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*(2), 117-142.

Freeman, T. M., Anderman, L. H., & Jensen, J. M. (2007). Sense of belonging in college freshmen at the classroom and campus levels. *The Journal of Experimental Education, 75*(3), 203-220.

Frydenberg, E. (2008). *Adolescent coping: Advances in theory, research, and practice.* London: Routledge. From series *Adolescence and Society,* Ed. John C. Coleman.

Galicki, S. J., & McEwen, M. K. (1989). The relationship of residence to retention of black and white undergraduate students at a predominantly white university. *Journal of College Student Development, 30,* 389-394.

GAO-06-702T: Higher education: Science, technology, engineering, and mathematics trends and the role of federal programs: Hearings before the Committee on Education and the Workforce, of the U. S. House of Representatives, 109th Cong., (2006). (Testimony of Cornelia M. Ashby, Director, Education, Workforce, and Income Security Issues).

Gay, L. R., & Airasian, P. (2003). *Educational research: Competencies for analysis and applications*. 7th ed. Upper Saddle River, NJ: Merrill Prentice Hall.

Glass, G.V., & Hopkins, K.D. (1995). *Statistical Methods in Education and Psychology.* 3rd edition. Allyn & Bacon.

Goodenow, C. (1991, April). *The sense of belonging and its relationship to academic motivation among pre- and early adolescent students*. Paper presented at the annual conference of American Educational Research Association, Chicago, IL.

Goodenow, C. (1992, April). *School motivation, engagement, and sense of belonging among urban adolescent students.* Paper presented at the annual conference of American Educational Research Association, San Francisco, CA.

Goodenow, C. (1993). The psychological sense of school membership among adolescents: Scale development and educational correlates. *Psychology in the Schools, 30*(1), 79-90.

Greene, J. (2005). The generative potential of mixed methods inquiry. *International Journal of Research and Method in Education, 28*(2), 207-211.

Ham, S., & Shaughnessy, M.F. (1992). Personality and scientific promise. *Psychological Reports, 70*(3), 971-975.

Hamm, J. V., & Faircloth, B. S. (2005). The role of friendships in adolescents' sense of school belonging. *New Directions for Child and Adolescent Development, 107*, 61-78.

Hansen, J. B., & Toso, S. J. (2007). Gifted dropouts: Personality, family, social and school factors. *Gifted Child Today, 30*(4), 30-41.

Hausmann, L. R. M., Schofield, J. W., & Woods, R. L. (2007). Sense of belonging as a predictor of intentions to persist among African American and white first-year college students. *Research in Higher Education, 48*(7), 803-839.

Hergenhahn, B. R., & Olson, M. H. (2007). *An Introduction to Theories of Personality.* Upper Saddle River, NJ: Pearson Prentice Hall.

History of Stuyvesant High School. (2005). Retrieved March 13, 2009 from http://www.stuy.edu/about/history.php

Hoffman, M., Richmond, J., Morrow, J., & Salomone, K. (2002). Investigating "sense of belonging" in first-year college students. *Journal of College Student Retention, 4*(3), 227-256.

House, J. D. (2000). Academic background and self-beliefs as predictors of student grade performance in science, engineering and mathematics. *International Journal of Instructional Media, 27*(2), 207-220.

Hull-Blanks, E., Robinson Kurpius, S. E., Befort, C., Sollenberger, S., Nicpon, M. F., & Huser, L. (2005). Career goals and job-related factors among college freshmen. *Journal of Career Development, 32*(1), 16-30.

Hurtado, S., & Carter, D. F. (1997). Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging. *Sociology of Education, 70*(4), 324-345.

Ingersoll, K. S., & Cornell, D. G. (1995). Social adjustment of the female early college entrants in a residential program. *Journal for the Education of the Gifted, 19*(1), 45-62.

Jackson, L., Pancer, S., Pratt, M., & Hunsberger, B. (2000). Great expectations: The relations between expectancies and adjustment during the transition to university. *Journal of Applied Psychology, 30*(10), 2100-2125.

Jaffe, M. L. (1997). *Adolescence.* Hoboken, NJ: John Wiley & Sons, Inc.

Janosz, M., Leblanc, M., Boulerice, B., & Tremblay, R. E. (1997). Disengaging the weight of school dropout predictors: A test of two longitudinal samples. *Journal of Youth and Adolescence, 26*, 733-762.

Jin, S. & Moon, S.M. (2006). A study of well-being and school satisfaction among academically talented students attending a science high school in Korea. *Gifted Child Quarterly, 50*(2), 169-184.

Johnson, I. (2008). Enrollment persistence and graduation of in-state students at a public research university: Does high school matter? *Research in Higher Education, 49*(8), 776-793.

Jones, B. M. (2009). Profiles of state-supported residential math and science schools. *Journal of Advanced Academics, 20*(3), 472-501.

Kelly, J. T., Kendrick, M. M., Newgent, R. A., & Lucas, C. J. (2007). Strategies for student transition to college: A proactive approach. *College Student Journal, 41*(4), 1021-1035.

Keup, J. R. (2007). Great expectations and the ultimate reality check: Voices of students during the transition from high school to college. *NASPA Journal, 44*(1), 3-31.

Kiser, A. I. T., & Price, L. (2007-2008). The persistence of college students from their freshman to sophomore years. *Journal of College Student Retention, 9*(4), 421-436.

Kolloff, P. B. (2003). State-supported residential high schools. In N. Colangelo and G. A. Davis (Eds.) *Handbook of Gifted Education.* (3rd ed., pp. 238-246). Boston: Allyn & Bacon.

Komarraju, M., & Jarau, S. J. (2005). The relationship between the Big Five personality traits and academic motivation. *Personality and Individual Differences, 39,* 557-567.

Komarraju, M., Karau, S. J., & Schmeck, R. R. (2009). Role of the Big Five personality traits in predicting college students' academic motivation and achievement. *Learning and Individual Difference, 19,* 47-52.

Konings, K. D., Brand-Gruwel, S., van Merrienboer, J. J. G., & Broers, N. J. (2008). Does a new learning environment come up to students' expectations? A longitudinal study. *Journal of Educational Psychology, 100*(3), 535-548.

Lemley D. (1994). Motivating underachieving gifted secondary students. *Gifted Child Today, 17*(4), 40-41.

Levacic, R., & Jenkins, A. (2005). Evaluating the effectiveness of specialist schools in England. *School Effectiveness and School Improvement, 17*(3), 229-254.

Lounsbury, J. W., & DeNui, D. (1996). Psychological sense of community on campus. *College Student Journal, 29*(3), 270-277.

Lounsbury, J. W., Gibson, L. W., Sundstrom, E. Wilburn, D., & Loveland, J. (2004). An empirical investigation of the proposition that "School is Work." A comparison of personality-performance correlations in school and work settings. *Journal of Education and Work, 17,* 119-131.

Lounsbury, J. W., Hutchens, T., & Loveland, J. M. (2005). An investigation of Big Five personality traits and career decidedness among early and middle adolescents. *Journal of Career Assessment, 13*(1), 25-39.

Lounsbury, J. W., Saudargas, R. A., & Gibson, L. W. (2004). An investigation of personality traits in relation to intention to withdraw from college. *Journal of College Student Development, 45*(5), 517-534.

Lounsbury, J. W., Saudargas, R.A., Gibson, L.W., & Leong, F.T. (2005). An investigation of broad and narrow personality traits in relation to general and domain-specific life satisfaction of college students. *Research in Higher Education, 46*(6), 707-729.

Lounsbury, J. W., Sundstrom, E., Loveland, J. L., & Gibson, L. W. (2003). Broad versus narrow personality traits in predicting academic performance of adolescents. *Learning and Individual Differences, 14,* 67-77.

Ma, X. (2003). Sense of belonging to school: can schools make a difference? *The Journal of Educational Research, 96*(6), 340-349.

Manor-Bullock, R., Look, C., & Dixon, D. N. (1995). Is giftedness socially stigmatizing? The impact of high achievement on social interactions. *Journal for the Education of the Gifted, 18*(3), 319-338.

Mason, M. M., & Mason, W. B. (1991). Project S. C. A. M. P. (science, computer, and mathematics professions): A young scholars program for academically talented rural youth. In *Reaching Our Potential: Rural Education in the 90s.* Conference Proceedings of the Rural Education Symposium, Nashville, TN. pp. 2-11.

McCrae, R. R. & Costa, P. T., Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*(1), 81-90.

McCrae, R. R., & Costa, P. T. (2008). Empirical and theoretical status of the five-factor model of personality traits. In Boyle, G. J., Matthews, G., & Saklofske, D. H. (Eds.) *The SAGE Handbook of Personality Theory and Assessment, Volume 1: Personality Theories and Models.* Pp. 273-294. Thousand Oaks, CA: Sage Publications, Inc.

McCrae, R. R., Costa, P. T., Terraciano, A., Parker, W. D., Mills, C. J., De Fruyt, F., & Mervielde, I. (2002). Personality trait development from age 12 to age 18: Longitudinal, cross-sectional, and cross-cultural analyses. *Journal of Personality and Social Psychology, 83*(6), 1456-1468.

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of Community Psychology, 14*, 6-23.

Midgley, C., & Urdan, T. C. (1992). The transition to middle level schools: Making it a good experience for all students. *Middle School Journal, 24*(2), 5-14.

National Consortium of Specialized Secondary Schools of Mathematics, Science, and Technology: Overview. (2009). Retrieved on March 11, 2009 from http://www.ncsssmst.org/overview.aspx

National Science Board. (2003). *The Science and Engineering Workforce. Realizing America's Potential.* Washington, DC: National Science Foundation.

National Science Foundation. (1989). *Report on the national Science foundation disciplinary workshops on undergraduate education.* Washington, DC: National Science Foundation.

National Science Foundation. (2006). *Global higher education act in science and engineering.* Retrieved October 12, 2007 from www.nsf.gov/statistics/seind06/c2/c2s4.htm

Nichols, S. (2008). An exploration of students' belongingness beliefs in one middle school. *The Journal of Experimental Education, 76*(2), 145-169.

Neild, R. C. (2009). Falling off track during the transition to high school: What we know and what can be done. *Future of Children, 19*(1), 53-76.

Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: Big Five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology, 93*(1), 116-130.

North Carolina School for Science and Mathematics: History and Mission. (2008). Retrieved March 12, 2009 from http://www.ncssm.edu/about-ncssm/history.php.

Odom, J., & Shaughnessy, M. F. (1989). Personality and mathematical achievement. *Psychological Reports, 65*(3), 1195-1201.

Osterman, K. F. (2000). Students' need for belonging in the school community. *Review of Educational Research, 70*(3), 323-367.

Pan, W., Guo, S., Alikonis, C., & Bai, H. (2008). Do intervention programs assist students to succeed in college?: A multilevel longitudinal study. *College Student Journal, 42*(1), 90-98.

Pantages, T. J., & Creedon, C. F. (1978). Studies of college attrition: 1950-1975. *Review of Educational Research, 48*, 49-101.

Pascarelli, E. T., & Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *The Journal of Higher Education, 51*(1), 60-75.

Pittman, L. D. & Richmond, A. (2007). Academic and psychological functioning in late adolescence: the importance of school belonging. *The Journal of Experimental Education, 75*(4), 270-290.

Plucker, J., Cobb, C., & Quaglia, R. (1996). Aspirations of students attending a science and mathematics residential magnet school. Paper presented at the Annual Meeting of the National Rural Education Association, October, 1996, San Antonio, TX.

Pretty, G. M. H., Conroy, C., Dugay, J., Fowler, K., & Williams, D. (1996). Sense of community and its relevance to adolescents of all ages. *Journal of Community Psychology, 24*(4), 365-379.

Royal, M. A., & Rossi, R. J. (1996). Individual-level correlates of sense of community: Findings from workplace and school. *Journal of Community Psychology, 24*(4), 395-416.

Saxenian, A. (2006). *The new Argonauts: Regional advantage in a global economy.* Cambridge, MA: Harvard University Press.

Scott, T. P., Tolson, H., & Huang, T. (2009). Predicted retention of mathematics and science majors at a Research I institution and suggested advising tools. *Journal of College Admissions, 204*, Summer, 19-24.

Sethna, B. N., Wickstrom, C. D., Boothe, D., & Stanley, J. C. (2001). The advanced academy of Georgia: Four years as a residential early-college-entrance program. *Journal of Secondary Gifted Education, 13*(1), 11-22.

Shaughnessy, M. F., Stockard, J., Moore, J., & Siegel, C. (1992). Scores on the 16 Personality Factor test and success in college calculus I.

Smerdon, B. A. (2002). Students' perceptions of membership in their high schools. *Sociology of Education, 75*(4), 287-305.

Smith, J. S., & Wertlieb, E. C. (2005). Do first-year college students' expectations align with their first year experiences? *NASPA Journal, 42*(2), 153-174.

Stake, R. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

Stanley, J. C. (1987). State residential high school for mathematically talented youth. *Phi Delta Kappan. 68*(10), 770-773.

Stanley, J. C. (1991). An academic model for educating the mathematically talented. *Gifted Child Quarterly, 35*, 36-42.

Stein, G. L., & Hussong, A. (2007). Social and academic expectations about high school for at-risk rural youth. *American Secondary Education, 36*(1), 59-79.

Stuart, R. (2009). Reinventing remedial education. *Diverse Issues in Higher Education, 26*(18), 14-17.

Subcommittee on Research, Committee on Science, U. S. House of Representatives Hearing. *Undergraduate science, math, and engineering education: What's working?* 109th Cong 2 (2006).

Subotnik, R. F., & Steiner, C. L. (1993). Adult manifestations of adolescent talent in science. *Roeper Review, 15*(3), 164-169.

Suldo, S. M., Shaunessy, E., & Hardesty, R. (2008). Relationships among stress, coping, and mental health among high achieving high school students. *Psychology in the Schools, 45*(4), 273-290.

Supiano, B. (2009). Colleges move to organize their retention efforts. *Chronicle of Higher Education, 56*(11), A23.

Tapping America's Potential. (2008). *Tapping America's potential: The Education forInnovation Initiative: Gaining momentun, Losing ground, progress report 2008.* Retrieved May 7, 2009 from http://tap2015.org/news/tap_2008_progress.pdf

Tennessee Higher Education Commission. (1999). *Statewide master plan for Tennessee higher education, 2000-2005*. Nashville, TN: Tennessee Higher EducationCommission.

Terenzini, P. T., Lorang, W. G., & Pacarella, E. T. (1981). Predicting freshman persistence and voluntary dropout decisions: A replication. *Research in Higher Education, 15*(2), 109-127.

Thomas, J.A. (2000). First year findings: NCSSSMST longitudinal study of gifted students. *NCSSSMST Journal, 5*(2), 4-6.

Thomas, J.A., & Love, B. L. (2002). An analysis of post-graduation experiences among gifted secondary students. *NCSSSMST Journal, 6*(1), 3-8.

Thomas, J.A., & Williams, C.A. (2010). The history of specialized STEM schools and the formation and role of the NCSSSMST. *Roeper Review, 32*(1), 17-24.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*, 89-125.

Tinto, V. (1988). Stages of student departure: Reflections on the longitudinal character of student leaving. *The Journal of Higher Education, 59*(4), 438-455.

Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student persistence. *The Journal of Higher Education, 68*(4), 599-623.

Tinto, V. (1998). Colleges as communities: Taking research on student persistence seriously. *Review of Higher Education, 21*(2), 167-177.

Trapmann, S., Hell, B., Hirn, J. O., & Schuler, H. (2007). Meta-analysis of the relationship between the Big Five and academic success at university. *Journal of Psychology, 215*(2), 132-151.

U.S. Department of Education, National Center for Educational Statistics. (2008). *Dropout and completion rates in the United States: 2006* (NCES 2008-053). Retrieved January 28, 2009 from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008053

Van Hecke, M., & Tracy, R. J. (1987). The influence of adult encouragement on children's persistence. *Child Study Journal, 17*(4), 251-268.

Webb, R. M., Lubinski, D., & Benbow, C. P. (2002). Mathematically facile adolescents with math-science aspirations: New perspectives on their educational and vocational development. *Journal of Educational Psychology*, *94*(4), 785-794.

Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology, 89*(3), 411-419.

Wigfield, A., & Eccles, J. S. (1995). Middle grade schooling and early adolescent development: Part II interventions, practices, beliefs, and contexts. *The Journal of Early Adolescence, 15*(5), 5-8.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*(1), 68-81.

Yin, R. K. (2003). *Applications of case study research*. 2nd ed. Thousand Oaks, CA: Sage.

Zanelli, K. A., & Smith, K. (2000). GIRLS: Gifted, intelligent, real-life scientists. *The Science Teacher, 67*(5), 46-47.

Zhang, Z., & RiCharde, R. S. (1998, May). Predictors and analysis of freshman retention. Paper presented at the Annual Forum of the Association for Institutional Research, Minneapolis, MN.

APPENDICES

Appendix A. *Psychological Sense of School Membership* and Interview Protocol

Sense of Belonging Interview Protocol

Prior to beginning interview, read the Informed Consent form to the TGA student. Students and their parents have signed a research and evaluation consent and assent form (summer 2007 and 2008); this form focuses on the intents of this particular study. Ask student to sign Informed Consent.

I. Orally administer the *Psychological Sense of School Membership* (Goodenow, 1993). Record responses. Prior to administration, ask students not to elaborate during the administration of the PSSM, but extend opportunity to elaborate on responses during Section II, Interview.

Item	Not at All True of Me (1)	Somewhat True of Me (2)	Mostly True of Me (3)	Completely True of Me (4)
1. I like learning.				
2. I feel a part of TGA.				
3. The teachers here respect me.				
4. Other students like the way I am.				
5. It is hard for people like me to be accepted here at TGA.				
6. Sometimes I feel as if I do not belong here.				
7. The students here respect me.				
8. I feel proud of belonging to this school.				
9. I wish I were in a different school.				
10. I can really be myself at TGA.				
11. Teachers here are not interested in people like me.				
12. Teachers here notice when I am good at something.				
13. There is at least one teacher I can talk to if I have a problem.				
14. The rules at this school are fair.				
15. The teachers at this school are friendly to me.				
16. I feel nervous to attend this school.				
17. I think school is important.				
18. There is at least one adult I can talk to if I have a problem.				

II. Interview Protocol

1. What did you think of your home high school?

2. Do you feel you belonged, or fit in at, your home high school? Why or why not?

3. What do you think of TGA?

4. Do you feel you belong, or fit in at, TGA? Why or why not?

5. What did you expect of TGA before you came here? What did you think it would be like?

   (Interviewee may divide expectations into categories: housing, academics, peer interaction, academic experiences [TGA, UT, ORNL], modules, field trips and cultural experiences, etc.)

6. Has TGA met those expectations, surpassed those expectations, or is below those expectations? Why or why not?

(Follow up here on academics, housing, faculty, social interactions with peers, etc.)

Probing or follow-up questions will encourage elaborations, as in "Tell me more about….." or "Why do you feel that way about…..?" Use probing or follow-up questions for all items, numbers 1-6.

Appendix B. Participant Interview Informed Consent

INFORMED CONSENT STATEMENT

Interviews with Student Population at TGA

Introduction

You are invited to participate in an interview which is for the purpose of doctoral research aimed at Tennessee Governor's Academy for Mathematics and Science (TGA) program improvement.

Information about Participant's Involvement in the Study

You will be participating in a 30-minute interview which will be audiorecorded. The audiorecording will be transcribed by Verbal Ink based in Santa Monica, CA. No one else will listen to the digital recording or read the transcription besides Amy Sullins. The transcriptions will be stored at Amy Sullins' home in Athens, TN, not on the premises of Tennessee Governor's Academy for Mathematics and Science (TGA) or The University of Tennessee (UT).

Confidentiality

All information from the interview will remain confidential and anonymous. Each TGA student participant will be given a pseudonym, and excerpts of the interview may be extracted to include in the dissertation Results and Discussion chapters and, potentially, for publication purposes. Excerpts that may potentially identify the participant will not be extracted.

Contact Information

If you have questions at any time, you may contact the TGA graduate student researcher, Amy Sullins, at 423.381.9667.

Participation

Your participation in this interview is voluntary; you may decline to participate at any time.

Consent

I have read the above information. **I have received a copy of this form**. I have agreed to participate in this interview.

Participant's Signature _____ Date _____

TGA GRA Program Evaluation _____ Date _____

Appendix C. Table A1. *All Interview Participants' PSSM Scores, Model of Belonging Quadrant, and Persistence*

Table A1. *All Interview Participants' PSSM Scores, Model of Belonging Quadrant, and Persistence*

Part. #	PSSM Sum	Class	Gen	Sense of Belonging	Perception of School Climate	2 x 2 Model of Belonging Quadrant	Persistence
1	65	Sr.	M	Fits	Negative	Adaptive	INP
2	66	Sr.	F	Fits	Negative	Adaptive	Graduated
3	56	Sr.	M	Fits	Negative	Adaptive	Graduated
4	62	Sr.	F	No fit	Negative	Resistant	Graduated
5	56	Sr.	M	Fits	Positive	Connected	Graduated
6	61	Sr.	M	Fits	Positive	Connected	Graduated
7	61	Sr.	F	No fit	Negative	Resistant	Graduated
8	59	Sr.	M	Fits	Negative	Adaptive	Graduated
9	68	Jr.	F	Fits	Positive	Connected	Senior
10	63	Sr.	F	Fits	Negative	Adaptive	Graduated
11	69	Jr.	F	Fits	Positive	Connected	Senior
12	67	Jr.	F	Fits	Negative	Adaptive	INP
13	58	Jr.	F	No fit	Positive	Isolated/rejected	Senior
14	70	Jr.	F	Fits	Positive	Connected	Senior
15	65	Jr.	F	Fits	Positive	Connected	Senior
16	69	Jr.	M	Fits	Positive	Connected	Senior
17	62	Jr.	M	Fits	Negative	Adaptive	Senior
18	71	Jr.	M	Fits	Positive	Connected	Senior
19	68	Jr.	M	Fits	Positive	Connected	VNP
20	54	Jr.	M	No fit	Positive	Isolated/rejected	INP
21	62	Jr.	F	Fits	Positive	Connected	Senior
22	52	Sr.	F	No fit	Negative	Resistant	INP

23	69	Sr.	M	Fits	Positive	Connected	Graduated
24	69	Jr.	F	Fits	Positive	Connected	INP
25	69	Sr.	F	Fits	Positive	Connected	Graduated
26	59	Jr.	F	Fits	Negative	Adaptive	Senior
27	69	Sr.	M	Fits	Positive	Connected	Graduated
28	59	Jr.	M	Fits	Positive	Connected	Senior
29	61	Jr.	F	Fits	Positive	Connected	INP
30	68	Jr.	M	No fit	Positive	Adaptive	VNP
31	68	Jr.	M	Fits	Positive	Connected	Senior
32	69	Jr.	F	No fit	Positive	Isolated/rejected	INP
33	65	Jr.	F	Fits	Positive	Connected	Senior
34	61	Jr.	M	Fits	Positive	Connected	VNP
35	60	Sr.	M	Fits	Positive	Connected	Graduated
36	59	Jr.	M	Fits	Positive	Connected	Senior
37	67	Jr.	F	Fits	Positive	Connected	Senior
38	72	Jr.	M	Fits	Positive	Connected	Senior
39	71	Jr.	F	Fits	Positive	Connected	Senior
40	55	Jr.	F	No fit	Negative	Resistant	VNP
41	57	Jr.	F	No fit	Negative	Resistant	Senior
41	Range 52-72 *M:* 63.68	15 Srs. 26 Jrs	21 F 20 M	32 Fit 9 Do not fit	28 Positive Climate 13 Negative Climate	24 Connected 8 Adaptive 4 Isolated/Rejected 5 Resistant	30 Persistors 11 Non-Persistors

VITA

Amy Cinci Sullins grew up in Coral Springs, Florida and attended Auburn University, in Auburn, Alabama, graduating *summa cum laude* with a Bachelor's of Science in English Education, Grades 7-12 (1993). Amy began teaching English and debate at Auburn High School (1993-1997) while simultaneously working toward her Master's Degree in English Education at Auburn University, which she earned in 1999.

Amy and her husband moved to his hometown of Athens, Tennessee, and Amy taught English and debate at McMinn County High School (1998-2001), followed by serving as Instructor of Secondary Education (tenure-track) at Tennessee Wesleyan College (2001-2006). Amy was accepted into the Curriculum, Research, and Evaluation Doctoral program at the University of Tennessee in 2003. While teaching at TWC, Amy became interested in assessment and evaluation. She began conducting research and evaluation activities of the Education and Psychology Department, particularly when serving as Department Chair (2005-2006).

Amy resigned from TWC in 2006 prior to the birth of her third son and sought research and evaluation opportunities at UT, becoming affiliated with Dr. Vena Long, an Associate Dean at the College of Education, Health, and Human Sciences. Under Dr. Long's tutelage, Amy developed and implemented the evaluation design for the new Tennessee Governor's Academy for Mathematics and Science. Amy served as a Graduate Research Assistant in Assessment and Evaluation for the school for two years (2007-2009) and in 2009 was hired as the Program Evaluator and Director of Recruiting for the school. Amy's areas of interest include educational evaluation (P-16, which encompasses preschool through higher education) and engaging stakeholders in the evaluation process through participatory evaluation.