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Comparison of Academic Achievement, College Readiness, and Perception Between Students From Traditional High Schools and the Gatton Academy

Tim Gott
Western Kentucky University, tim.gott@wku.edu

COMPARISON OF ACADEMIC ACHIEVEMENT, COLLEGE READINESS, AND PERCEPTION BETWEEN STUDENTS FROM TRADITIONAL HIGH SCHOOLS AND THE GATTON ACADEMY

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COMPARISON OF ACADEMIC ACHIEVEMENT, COLLEGE READINESS, AND PERCEPTION BETWEEN STUDENTS FROM TRADITIONAL HIGH SCHOOLS AND THE GATTON ACADEMY

Date Recommended 3-22-12

Janet Tassell, Director of Dissertation

Fred Carter

Fred Carter

Jerald Thomas

Jerald Thomas

Kenneth C Doerner 19-APRIL-2012

Dean, Graduate Studies and Research Date

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COMPARISON OF ACADEMIC ACHIEVEMENT, COLLEGE READINESS, AND PERCEPTION BETWEEN STUDENTS FROM TRADITIONAL HIGH SCHOOLS AND THE GATTON ACADEMY

Tim Gott May 2012 110 Pages

Directed by: Janet Tassell, Fred Carter, and Jerald Thomas

Educational Leadership Doctoral Program Western Kentucky University

Secondary education in the United States has been evolving from the early days of Latin grammar schools to the present broad spectrum of high school structures. This study focuses on one of the latest types of high school models – specialized secondary schools. In particular, the intent of this study was to assess whether high ability students in one such program, the Gatton Academy of Mathematics and Science, demonstrate between-group differences from their high ability peers in traditional high schools in the areas of academic achievement, college readiness, and perceptions on the high school experience.

To determine whether these differences exist, data were collected from 41 students in the Gatton Academy and 267 students from 4 local high schools. The data included PLAN and ACT scores, grade point averages, responses on the Student Strengths Inventory, and the Student Perception Survey. Three phases of analysis were conducted utilizing descriptive statistics and independent t-tests that revealed some statistically significant results: differences in social comfort, relationships with peers and teachers, and perception of meaningfulness of classes. These results indicate some social and emotional issues that might need to be addressed institutionally to provide a balanced and healthy academic environment.

This study was limited by the size of the sample and its geographic narrowness. Additionally, an issue regarding the disparity of how grade point average is calculated

complicated the assessment of academic achievement. Due to these limitations, further research is warranted to address these limitations by expanding the study nationally and utilizing unweighted grade point averages. Likewise, additional longitudinal research would be beneficial to see if differences occur between these two types of programs concerning college and career pathways.

CHAPTER I: STATEMENT OF THE PROBLEM

Introduction

Early History

Since the days of the early settlers, education in America has been evolving. The desire to prepare the brightest young minds has been a driving force in the development of a vast spectrum of schools from traditional and non-traditional, public and private, and charter and magnet. From the home schools of the pilgrims to the establishment of Latin schools, the first American schools were developed for those whose families valued and could afford this level of education. As America culture progressed through the 18th and 19th century, a dual system was in action, one being focused on the classical approach to education and the other with a more vocational bent. The classical approach focused on the disciplines of Latin, Greek, Hebrew, history, Bible, and mathematics while the vocational approach was more centered on work skills and apprenticeship (Copa & Pease, 1992). An example that represents the vocational approach was the Philadelphia Academy and Charitable School created by Benjamin Franklin which shifted the emphasis from the classics to helping students become successful in life and the business world. Particularly, English became the main focus in language. As other academies developed through private and eventually public funds, middle class families were able to participate more fully. By 1850, nearly 6000 academies had been established (Copa & Pease, 1992).

Turn of the 20th Century

At the end of the 19th century, the National Education Association appointed a group of college presidents and other educational leaders to the Committee on Secondary School Studies, also known as the Committee of Ten (Report of the Committee of Ten,

1891). Their charge was to create a set of standards that focused on clarifying the relationship between high school preparation and college admission (Odell, 1939). The recommended curriculum kept much of the classical elements with a stronger focus on English, modern languages, and geography. The committee felt that all students, no matter what their destination, benefitted from this college preparatory curriculum since it was their belief that this was also the best life education. Despite this intention, the context at the time was that only students from elite families were likely to attend high school (Copa & Pease, 1992).

Over the next 25 years, the debate intensified about the purpose of high school, particularly regarding vocational education. According to Copa and Pease (1992), in 1913, the Board of Directors of the NEA appointed the Commission on the Reorganization of Secondary Education, made up of members mostly from secondary schools in contrast to the prior university-focused committee. Their report generated the Cardinal Principles of Secondary Education (Department of the Interior Bureau of Education, 1918). The committee proposed seven essential purposes of secondary education: (a) health, (b) command of fundamental processes, (c) worthy home membership, (d) vocation, (e) citizenship, (f) worthy use of leisure, and (g) ethical character (Odell, 1939). This document, in essence, gave birth to the comprehensive high school. It served to shift the debate from a dual system in education of college prep and vocational to a unified approach (Wraga, 2000).

Following World War II and the influences of the Cold War and Sputnik, the focus of high schools shifted toward a more specialized approach versus a comprehensive one. The need to compete globally created a desire to push the most capable students to their

highest potential (Copa & Pease, 1992). A focus on providing a diverse curriculum with options dictated the 1960s and 1970s. Tracking and ability grouping arose as strategies to deal with this. Simultaneously, with the introduction of cognitive psychology, brain research, and civil rights issues, schools had to address inequalities in educational opportunities. Desegregation, special education laws, and gifted focuses created an overwhelming spectrum that schools needed to address (Copa & Pease, 1992).

Modern Era

The national debate over the purpose of education continued to expand with more and more groups finding a voice in the on-going conversation. As the pendulum continued to swing, there was a cry for a move back to the basics. Some felt that students were getting a random and diluted education. Therefore, in 1983, President Reagan's National Commission on Excellence in Education (NCEE) issued its report, *A Nation at Risk: The Imperative for Educational Reform.* The report recommended a refocusing on vocational and college prep programs by strengthening graduation requirements to include specific numbers of courses in math, English, science, social studies, and foreign language. In addition, the call for greater accountability was heard. This focus evolved into the development of standards, both content and performance. Assessments became the guiding forces as states began to demand levels of proficiency for all students (NCEE, 1983).

With the close of the 20th Century, various leaders in education and business once again called for high school reform. The National Association of Secondary School Principals in response produced a document called *Breaking Ranks* that called for a realignment of curriculum, instruction, and assessment to address the changing environment in society (NASSP, 2002). Simultaneously, many high schools began to work

on increasing the college preparatory levels in their curriculum by incorporating college level courses using programs such as Advanced Placement or International Baccalaureate (Dounay, 2006). Likewise, the increased use of dual-credit courses with surrounding colleges and universities became popular (Klein, 2007).

During this timeframe, a new secondary education model emerged - the magnet school. According to a 2008 WestEd report from the U.S. Department of Education (USDOE):

> Magnet schools originally emerged as a response to involuntary busing to achieve racial integration of schools and the growing demand for variation in traditional public education. Experiments with "alternative schools," "street academies," and "open classrooms" provided models for magnet schools and gained prominence after federal court rulings in the 1970s that accepted magnet programs as a strategy for voluntary desegregation. Between 1982 and 1991, the number of magnet schools doubled, from 1,019 to 2,433, with magnet school enrollment nearly tripling from 441,000 to 1.2 million students. (USDOE Office of Innovation and Improvement, 2008, p. 1)

As of fall 2011, according to Dr. Robert Brooks, the Executive Director of Magnet Schools of America (MSA), a nonprofit education association, there are more than 4,000 magnet schools across the country.

Along with the rise of magnet schools, charter schools have become another educational model of choice. The 2010 report from the National Center for Education Evaluation states:

> Charter schools, first launched in the 1990s, are an important and growing component of the public school system in the United States. As of November 2009, more than

> 5,000 charter schools served over 1.5 million students—approximately three percent of all public school students—in 40 states and the District of Columbia. (Gleason, Clark, Tuttle, & Dwoyer, 2010, p. xvii)

The focus on charter schools intensified with the U.S. Department of Education's issuance of Race to the Top funds. These monies were available to states with a developed plan showing how the state would utilize the extra funding in innovative ways to increase Academic Achievement. Charter schools were prominently highlighted in the rubric for evaluating a state's plan, thus creating intense dialogue among state legislators and educational organizations on how to initiate or increase charter school development (USDOE, 2009).

One other type of secondary school also emerged over the past 30 years. In North Carolina, in the early 1980s, the state legislature established a residential high school to promote science, technology, engineering, and mathematics (STEM) for high ability students from across the state (Green, 1993). Within a few years, other states began to see the impact of this type of school and created specialized secondary schools of their own. These schools served as a foundation for a suggestion in a major national report called *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (National Research Council [NRC], 2006). This report called for states to respond to a national crisis of not being as competitive in global economics due to the decrease of Americans being prepared to enter STEM fields as compared to other nations. From these findings, one of the major suggestions was a call for all states to create more publicly funded STEM schools (NRC, 2006). As of 2010, there were 15 state-funded residential STEM schools (Olszewski-Kubilius, 2010).

One such school is the Carol Martin Gatton Academy of Mathematics and Science in Kentucky. When many of the southern states began to open specialized secondary

schools, leaders in Kentucky were determined to begin one in the Commonwealth. In 1998, a team from Western Kentucky University proposed to the state legislature to open an academy on their campus. While it was favorably accepted, funding became a barrier in getting started. With various budget issues over a span of 8 years, appropriation of building funds were finally approved in 2005. Funding for the actual operations of the school came in 2006, so the Gatton Academy was able to start its first class in August 2007. The stated mission was to offer a residential program for bright, highly motivated Kentucky high school students who have demonstrated interest in pursuing careers in science, technology, engineering, and mathematics (Gatton Academy, 2011). With four graduated classes so far, a major question arises – does this model create a substantial enough difference in addressing the state and national crisis of insufficiently prepared students as to make it worth the investment of scarce resources? This is the underlying premise of this study.

Purpose of the Study

As the national report *A Nation at Risk* suggested, schools need to change to address the global shifts that have occurred in the past 30 years (NCEE, 1983). With the whole gamut of reform suggestions, it is imperative to discern which interventions are truly worth the investment. Are schools that solely utilize a program such as Advanced Placement making a difference in producing prepared students? Are other levels of intervention needed? Are other formats of high school needed to address these needs? Along with these questions come the economic ones. Are there enough resources, financial and human, to meet the needs of students who have the capacity to embrace STEM studies and careers. What will happen if the U.S. does not produce enough qualified candidates in light of the global competition from China, Russia, India, and others?

To answer many of these questions, more research is needed on the effectiveness of the present interventions. Therefore, the purpose of this study is to analyze whether differences in Academic Achievement and college preparedness exist between the educational experiences of high ability high school students in traditional comprehensive high schools as compared to those in a residential STEM school.

This study focused on student data collected from traditional high schools in Kentucky and the Gatton Academy. Data included demographic information, PLAN and ACT scores, grade point averages, Student Strength Inventory (SSI) results, and a student perception survey. The central research question for this study was the following: is there a difference in achievement and perceptions of high ability students in a traditional comprehensive high school versus a residential, early college high school? To address the central research question, these research questions provided the guiding direction for this study:

1. Are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT)?
2. Are there between-group differences in how students report on a college readiness inventory (SSI)?,
3. Are there between-group differences in how students perceive their high school experience?

The following diagram (Figure 1) models the research questions.

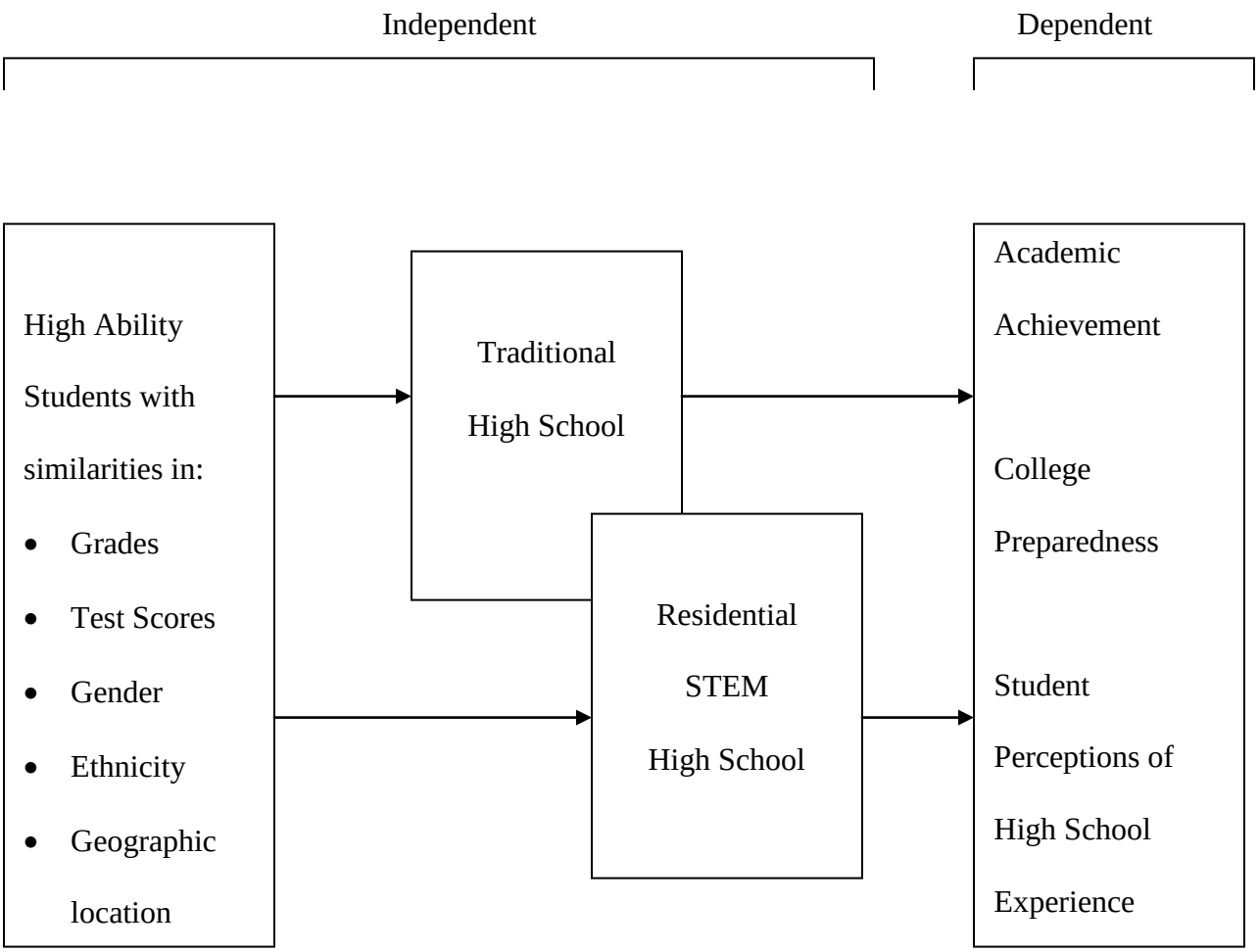


Figure 1. Flowchart depicting the variables of the study

Significance of the Study

With the call for high school reform, the dwindling pool of financial and human resources, and a major emphasis on STEM education, strong research in the effectiveness of new programs is needed. With the influence of dual credit programs, AP initiatives, and early college models, it is imperative to lay a foundation of credence in allocating these scarce resources in alternatives that are truly beneficial. Certainly, the federal and state governments are under pressure to address the gaps in the number of qualified U.S.

candidates entering the STEM fields. This study will address several areas.

First, this study explores the value of a residential specialized secondary school as a viable means to enhance the number of students pursuing and being prepared for STEM fields as compared to the typical programs utilized at a traditional high school such as AP or dual-credit classes. While there is research on these typical programs, very little exists about specialized secondary schools, particularly the residential ones.

Second, the question of whether there is a significant enough difference in the end results of students' experiences to justify creating this type of education environment to address the state and national needs will be greatly valued by the stakeholders involved: legislators, state and national educational leaders, teachers, parents, and students themselves. This study could serve as a defense for the present programs that exist as well as an impetus for other states in creating such schools.

Third, this study will also serve to determine if this type of school provides a significant increase in meeting the needs of high ability students as compared to the traditional comprehensive high school. The literature on gifted high school students presently indicates that more avenues for meeting the needs of high ability students are needed.

Fourth, this study will add to the literature base on what is working or not in developing college readiness in high school students. Much of the present research shows that the vast majority of students are lacking in the fundamental areas of math, reading, and/or writing when they enter their first year of post-secondary education. Exploring options to address this need is greatly desired by the educational community.

Limitations of the Study

While there are many substantial benefits to this study, there are inherent limitations in this type of study. First, the size of the population studied and its narrow geographic boundaries introduces some potential bias that may not be transferrable to all populations. While Kentucky has more diversity than may seem apparent, the state does only account for roughly 3% of the national population. Likewise, despite having pockets of urban development, the vast majority of the students will come from a rural setting.

Second, the relatively young age of the Gatton Academy is a factor. With only four years of having students in the program, many elements of the academy are not fully defined or established and may introduce extraneous variables that will be difficult to recognize fully.

Third, the relatively small number of students who qualify to be considered for the Gatton Academy may create issues. Since this study focused on adolescents who are strong in math and science, relating these findings to other populations of students who may not excel in these subjects may create non-valid comparisons.

Fourth, while tangible comparisons of PLAN scores will provide some foundation for this study, intangible factors such as student personality and willingness to take risks were not assessed. These factors could be major underlying elements for student success in high schools and/or alternative programming.

Fifth, coming up with a strong definition of student success is also problematic. Certainly, test scores and GPAs are only a small fraction of what constitutes a student's accomplishments. Quantifying concepts such as student work ethic, student persistence and resiliency, and student perception and desire creates an uncomfortable subjective

dynamic.

Summary

The evolution of high schools in the United States has been marked by major events throughout American history. From the days of the Pilgrims, the purpose of secondary education has been the topic of discussion and debate among national, state, and local leaders continually. This process is benchmarked by committee reports from the Committee of Ten in 1891 and the Commission on the Reorganization of Secondary Education's Cardinal Principles of Secondary Education in 1918. Through the wars of the 20th Century and the emergence of technology in the last quarter of the century, the debate continued as to how to best prepare adolescents to be productive global citizens.

At the core of this pertinent discussion is the balance between the heterogeneous approach of a comprehensive high school and the homogeneous approach of more specialized programs to address specific populations among the high school spectrum. This dilemma has most recently been energized with the various reports, such as Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA), on how the United States is competing with the rest of the industrialized world in the areas of STEM. Seeing the vast demand for producing a qualified workforce to address STEM field needs, many states have taken the initiative to develop specialized secondary schools to enhance and encourage more students to pursue careers in STEM fields. Simultaneously, traditional comprehensive high schools have strengthened their general curriculum to include more college-preparatory courses such as AP and dual-credit courses.

With the greater demand and at the same time a diminishing amount of financial

and human resources, the question arises as to what are the better programs for intervention into this national situation. This study seeks to provide some initial analysis of the benefit of a residential specialized secondary school. The quantity of research in this area is very limited due to the relatively newness of these types of schools. With the earliest program being created in North Carolina in 1980, only a few studies have looked at the impact this type of education has on Academic Achievement and career choices.

With the establishment of the Gatton Academy of Mathematics and Science in Kentucky, another potential source for data were created as well. As such, this study will seek to increase the knowledge base on what contributes to effective education for high school students. Using the students from the Gatton Academy as a comparative group with a selection of high schools from Kentucky that represent traditional comprehensive schools, data will be collected and analyzed to determine if there are any significant differences in academic achievement, college readiness, and student perception of their high school experience. Answers to these questions could lay the foundation for meaningful change in the near future of secondary education.

CHAPTER II: REVIEW OF THE LITERATURE

The intention of this study was to determine if differences exist between high ability students who attend traditional comprehensive high schools versus high ability students who attend a residential specialized STEM school, particularly in the areas of academic achievement, college preparedness, and student perceptions of their high school experience. To provide a solid foundation for this study, a review of the literature on various aspects of secondary education was needed. This review focused on several elements. First, a brief overview of the development of high schools in the United States, particularly after the Civil War, sets the stage for the present educational environment. Next, since this study focuses on high ability students, an examination of research on the needs of these students was relevant to guide the analysis of how different types of schools address those needs. Thus, the next two sections explore the literature on how comprehensive high schools handle the needs of high ability students and then how specialized secondary schools do so. The last section includes a specific review of the research on residential specialized STEM schools. In each analysis of the various schools, the review includes not only academics but also the social and emotional elements of the particular style of programs.

Historical Perspective of High Schools

1600s

The evolution of the academic institution called high school is an interesting one. The native populations before the Pilgrims landed may have had a form of school but no real documentation is available. Therefore, the first recognized schools emerged during the days of the early settlers in the 1600s. According to Copa and Pease (1992), most of it was home based as families attempted to carry on European traditions and provide their

children with the basics of reading, writing, and arithmetic. The Latin Grammar schools began in the mid-1600s to prepare selected students (initially only boys) for admission to college. The focus of curriculum was on the classics (Latin, Greek, Hebrew, history, the Bible, and mathematics). The first move toward a public institution came in Massachusetts in 1647 with the passage of the Old Deluder law that established criteria for what schooling to provide, based on town population. While this was a first step, generally only the elite were able to receive a true high school education for the next two centuries.

1700s

According to Odell (1939), the next major period of American secondary school evolution was from the late 1700s until the late 1800s with the emergence of academies. Sandwiched between the Revolutionary War and the Civil War, this period defines the time when the focus began to be on non-classical practical curriculum. Historians pinpoint the Philadelphia Academy and Charitable School created by Benjamin Franklin in 1751 as the first true academy. Through the last part of the 18th century, academies were established in New England and New York, and spread through many new states and territories including Georgia, Ohio, and Indiana. Odell (1939) comments, "The high point was reached about 1860, at which time there were approximately twelve thousand teachers and more than two hundred sixty thousand pupils" (p. 78). The decline of the academy model began with the start of the true "public" high school in 1821 (Boston Latin School), but it took most of the rest of the century to take hold as the leading form of secondary education (Odell, 1939).

1800s

In the same way that the academies were a response to the Latin grammar schools, the public high school arose due to the narrowing approach of the academies in the 19th century. Several states moved to enact legislation in the early 1800s (Indiana in 1816 and Tennessee in 1817), but it was Boston that established the actual first school in 1821. Through several decades of social debate on what format best served the country's needs, the public high school became the dominant choice. A major factor in this was the transition to free public education. This took root despite opposition from the academies toward the last part of the 1800s. By 1890, there were 2771 four-year high schools with over 211,000 students (Odell, 1939).

Committee of Ten

With the larger explosion of schools across the nation came a very uneven expansion of curriculum. This led to a need for a national focus on what exactly should be taught at a public high school. This also began to create a debate over what the purpose of the high school should be. Wraga (2000) found:

> The comprehensive high school model emerged from the early twentieth-century debate over whether secondary education in the United States should emulate the class-based European dual systems, or depart from those aristocratic traditions and organize instead as a unitary, democratic system. (p. 3)

Many believed the only purpose for high school was college preparation. As such, they felt the curriculum should mirror colleges fully (Copa & Pease, 1992). Others saw the need to provide vocational training and life skills. This came to a head in 1891 when the National Education Association (NEA) established the Committee on Secondary School

Studies. Consisting of five university presidents, a college professor, a commissioner of education, and three principals (referred to as the Committee of Ten by some), the committee created a report to set the purpose and scope of what a secondary school should do (Copa & Pease, 1992). The committee was charged with answering several questions, one of which stated, "[Question] #7. Should the subject be treated differently for pupils who are going to college, for those who are going to a scientific school, and for those who, presumably, are going to neither?" (Report of the Committee of Ten, 1891). The Committee response was:

> The 7th question is answered unanimously in the negative by the Conferences, and the 8th therefore needs no answer. The Committee of Ten unanimously agrees with the Conferences. Ninety-eight teachers, intimately concerned either with the actual work of American secondary schools, or with the results of that work as they appear in students who come to college, unanimously declare that every subject which is taught at all in a secondary school should be taught in the same way and to the same extent to every pupil so long as he pursues it, no matter what the probable destination of the pupil may be, or at what point his education is to cease. Thus, for all pupils who study Latin, or history' or algebra, for example, the allotment of time and the method of instruction in a given school should be the same year by year. Not that all the pupils should pursue every subject for the same number of years; but so long as they do pursue it, they should all be treated alike. It has been a very general custom in American high schools and academies to make up separate courses of study for pupils of supposed different destinations, the proportions of the several studies in the different courses being various. The principle laid down by

> the Conferences will, if logically carried out, make a great simplification in secondary school programmes. It will lead to each subject's being treated by the school in the same way by the year for all pupils, and this, whether the individual pupil be required to choose between courses which run through several years, or be allowed some choice among subjects year by year. (p.17)

In addition, the Committee of Ten proposed a curriculum scope and sequence which set the tone for the nation. In Table 2.1, the curriculum is defined over four years with a designation of how many points a student earns for each course.

Cardinal Principles of Secondary Education

Over the next 25 years, the debate intensified about the purpose of high school, particularly regarding vocational education. 1n 1913, the Board of Directors of the NEA appointed the Commission on the Reorganization of Secondary Education, made up of members mostly from secondary schools in contrast to the prior university-focused committee (Copa & Pease, 1992). Their report in 1918 generated the Cardinal Principles of Secondary Education. There were seven essential purposes of secondary education:

a) Health,

b) Command of fundamental processes,

c) Worthy home membership,

d) Vocation,

e) Citizenship,

f) Worthy use of leisure, and

g) Ethical character.

(Department of the Interior Bureau of Education, 1918, pp. 10, 11)

Table 2.1

Prescribed Course Sequence for Public High Schools, 1891

1st Secondary School Year		
Latin		5 p.
English Literature,	2 p.	4 p.
English Composition,	2 p.	
German [or French]		5 p.
Algebra		4 p.
History of Italy, Spain, and France		3 p.
Applied Geography (European political —continental and oceanic flora and fauna		4 p.
		25 p.

2nd Secondary School Year		
Latin		4 p.
Greek		5 p.
English Literature,	2 p.	4 p.
English Composition,	2 p.	
German, continued		4 p.
French, begun		5 p.
Algebra,*	2 p.	4 p.
Geometry,	2 p.	
Botany or Zoology		4 p.
English History to 1688		3 p.
33 p.		

* Option of book-keeping and commercial arithmetic.

(continued)

3rd Secondary School Year		
Latin		4 p.
Greek		4 p.
English Literature,	2 p.	
English Composition,	1 p.	4 p.
Rhetoric,	1 p.	
German		4 p.
French		4 p.
Algebra*	2 p.	4 p.
Geometry	2 p.	
Physics		4 p.
History, English and American		3 p.
Astronomy,	3 p. 1st 1/2 yr.	3 p.
Meteorology,	3 p. 2nd 1/2 yr.	
		34 p.

* Option of book-keeping and commercial arithmetic.

4th Secondary School Year		
Latin		4 p.
Greek		4 p.
English Literature,	2 p.	
English Composition,	1 p.	4 p.
English Grammar,	1 p.	
German		4 p.
French		4 p.
Trigonometry,		2 p.
Higher Algebra,		
Chemistry		4 p.
History (intensive) and Civil Government		3 p.
Geol. or Physiography,	4 p. 1st 1/2 yr.	4 p.
Anatomy, Physiology, Hygiene,	4 p. 2nd 1/2 yr.	
		33 p

Note. Table III from *Report of the Committee of Ten*, 1891, p. 41

This document, in essence, gave birth to the comprehensive high school. The authors of the report commented, “The comprehensive (sometimes called composite, or cosmopolitan) high school, embracing all curriculums in one unified organization, should remain the standard type of secondary school in the United States” (Department of the Interior Bureau of Education, p. 24). This report served to shift the debate from a dual system in education of college prep and vocational to a unified approach (Wraga, 2000).Through the next few decades, the comprehensive high school served to provide some stability during two World Wars and the Great Depression. Student populations rose from 2.5 million in 1920 to 7.1 million in 1940 (Copa & Pease, 1992). During the 30s and 40s, various education groups such as the National Association of Secondary School Principals, American Association of School Administrators, and the NEA continued the dialogue and debate on major issues in education. Concerns about federal vs. state and local control clouded the discussion. Likewise, the emergence of a broader skill base for students led to a list of “Imperative Educational Needs of Youth”. Taking the basics of the Cardinal Principles, the new focus included science, rational thinking, business skills, and communication skills (Copa & Pease, 1992).

A Nation at Risk

The national debate over the purpose of education continued to expand with more and more groups finding a voice in the on-going conversation over the next 30 years. Some groups such as the John Dewey Society fought for the comprehensive school to be the leading force in developing common goals and values for all of society. Others saw the schools as ineffective in meeting the specific academic needs that were arising in the country, particularly after the Sputnik crisis of the late 1950s (Wraga, 2000). As the

pendulum continued to swing for the next two decades, there was a cry for a move back to the basics. So, in 1983, President Reagan's National Commission on Excellence in Education (1983) issued its report, *A Nation at Risk: The Imperative for Educational Reform.* The report stated:

> We recommend *that state and local high school graduation requirements be strengthened and that, at a minimum, all students seeking a diploma be required to lay the foundations in the Five New Basics by taking the following curriculum during their 4 years of high school: (a) 4 years of English; (b) 3 years of mathematics; (c) 3 years of science; (d) 3 years of social studies; and (e) one-half year of computer science. For the college-bound, 2 years of foreign language in high school are strongly recommended in addition to those taken earlier*. (p. 70)

Likewise, the level of expectations was addressed:

> We recommend *that schools, colleges, and universities adopt more rigorous and measurable standards, and higher expectations, for academic performance and student conduct, and that 4-year colleges and universities raise their requirements for admission. This will help students do their best educationally with challenging materials in an environment that supports learning and authentic accomplishment*. (p. 73)

The Commission captured the essence of the report in the summary:

> We must emphasize that the variety of student aspirations, abilities, and preparation requires that appropriate content be available to satisfy diverse needs. Attention must be directed to both the nature of the content available and to the needs of particular learners. The most gifted students, for example, may need a curriculum

> enriched and accelerated beyond even the needs of other students of high ability. Similarly, educationally disadvantaged students may require special curriculum materials, smaller classes, or individual tutoring to help them master the material presented. Nevertheless, there remains a common expectation: We must demand the best effort and performance from all students, whether they are gifted or less able, affluent or disadvantaged, whether destined for college, the farm, or industry. (p. 70)

Simultaneously, certain states began to see a need to address the demand for greater production of students in the STEM fields. North Carolina established the first residential specialized secondary school for STEM in 1980. The North Carolina School of Science and Mathematics (NCSSM) became the prototype for many other states. By the early 1990s, nine states had established similar institutions (Green, 1993).

Rising Above the Gathering Storm

Global changes and technological advances created new dilemmas at the turn of the century. A shift in educational preparedness and international competitiveness led to yet another call for reform (Friedman, 2005). In 2007, two major reports came out addressing these needs. The first, *Rising above the Gathering Storm* (RAGS; NRC, 2006), came from the NRC's Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology. This was a charge from the National Academy of Sciences. In Chapter 5 entitled, *What Actions Should America Take in K-12 Science and Mathematics Education to Remain Prosperous in the 21st Century?*, the committee recommended three major actions to increase America's talent pool:

- ACTION A-1: 10,000 TEACHERS FOR 10 MILLION MINDS

Annually recruit 10,000 science and mathematics teachers by awarding 4-year scholarships and thereby educating 10 million minds. (p. 115)

- ACTION A-2: A QUARTER OF A MILLION TEACHERS INSPIRING YOUNG MINDS EVERY DAY

  Strengthen the skills of 250,000 teachers through training and education programs at summer institutes, in master's programs, and in Advanced Placement (AP) and International Baccalaureate (IB) training programs. (p. 119)

- ACTION A-3: ENLARGE THE PIPELINE

  Enlarge the pipeline of students who are prepared to enter college and graduate with a degree in science, engineering, or mathematics by increasing the number of students who pass AP and IB science and mathematics courses. (p. 129)

In addition, the committee proposed expansion of statewide specialty high schools and inquiry based learning (NRC, 2006).

America COMPETES Act

In response to RAGS and the national political and educational climate, the federal government created the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (America COMPETES) Act (U.S. Congress, 2007). This act focused on (a) increasing research investment; (b) strengthening educational opportunities in science, technology, engineering, and mathematics from elementary through graduate school; and (c) developing an innovation infrastructure (Thomas & Williams, 2010). The educational recommendations were:

> Scholarship and training programs to recruit new K-12 STEM teachers who would simultaneously earn STEM degrees plus teacher certification, and enhance the skills of existing STEM teachers through a variety of activities administered by the DOE, NASA, NSF, and ED;
>
> Student-focused STEM programs at ED, DOE, and NSF including Math Now for elementary and middle school students, grants to states for public, statewide, specialty, secondary schools in science and mathematics, Advanced Placement (AP) or International Baccalaureate (IB) courses at the high school level, scholarships and fellowships for undergraduate and graduate students, and enhanced mentoring for postdoctoral scholars. (U.S. Congress, 2007)

President Obama signed the reauthorization of the America COMPETES Act in 2011, keeping the national focus on investing in innovation.

Characteristics and Needs of High Ability Students

From the historical perspective, high schools have wrestled with meeting the needs of the wide spectrum of abilities of students continuously throughout the years. Before there can be a strong review of how the different models are addressing this issue, it is important to understand the characteristics and needs of high ability students so as to be able to ascertain whether a program is meeting those needs. According to Green, referencing Van Tassel-Baska (1988), “Research has revealed three characteristics that distinguish gifted from normal students. Gifted students are capable of learning at faster rates; they are more capable of finding, solving, and acting on problems; and they are more capable of abstract thought” (Green, 1993, p. 23).

One of the most recent contributions to the literature on giftedness is the monograph from Subotnik, Olszewski-Kubilius, and Worrell (2011). As a meta-analysis of the history of scholarly work on gifted and talented (GT) as well as a call for a more focused and better-defined approach to working with gifted people, this work provides a strong comprehensive foundation for a deeper understanding of the concepts and implied needs of the gifted community. Particularly, the authors suggest a substantive and inclusive definition of giftedness:

> Giftedness is the manifestation of performance that is clearly at the upper end of the distribution in a talent domain even relative to other high-functioning individuals in that domain. Further, giftedness can be viewed as developmental in that in the beginning stages, potential is the key variable; in later stages, achievement is the measure of giftedness; and in fully developed talents, eminence is the basis on which this label is granted. Psychosocial variables play an essential role in the manifestation of giftedness at every developmental stage. Both cognitive and psychosocial variables are malleable and need to be deliberately cultivated. (p. 7)

In synthesizing the diverse perspectives of giftedness, five concepts arose from their study: "high IQ; emotional fragility; creative-productive giftedness; talent development in various domains; unequal opportunities and practice, practice, practice." (p. 6) From the broad spectrum of work, the authors focused on:

> *[G]iftedness as a developmental process that is domain specific and malleable.* Although the path to outstanding performance may begin with demonstrated potential, *giftedness must be developed and sustained by way of training and interventions in domain-specific skills, the acquisition of the psychological and*

> *social skills needed to pursue difficult new paths, and the individual's conscious decision to engage fully in a domain. The goal of this developmental process is to transform potential talent during youth into outstanding performance and innovation in adulthood.* (p. 6)

In their conclusion, the authors summarized these essential elements of giftedness:

- Abilities matter
- Domains of talent have unique developmental trajectories across the life span
- Effort and opportunity are important at every stage of the talent-development process
- Psychosocial variables are important contributors to outstanding performance at every stage of development
- Eminence should be the goal of gifted education (pp. 39, 40)

To broaden the definition of high ability students, it is important to encompass the diverse elements associated with giftedness. Cross (2010) describes several characteristics of gifted students in Table 2.2. Specifically, he emphasizes some specific characteristics that genuinely originate from being gifted: overexcitabilities, asynchronous development, perfectionism, excessive self-criticism, and multipotentiality. Due to these particular characteristics, there are unique dynamics at work when dealing with gifted students. Particularly at the high school level, students reveal these characteristics in situations such as strong emotional reactions to events, heightened awareness of their sexuality, boredom with tedious work, over extension into multiple areas of activities, and dichotic ranges of maturity and immaturity depending on the situation (Cross, 2010). Additional research over the last 20 years reveals some deeper contrasts.

Table 2.2

Characteristic of Gifted Students

Personality	Intellectual
▪ Insightfulness	▪ Capacity for reflection
▪ Intensity	▪ Passion for Learning
▪ Perseverance	▪ Early Moral Concern
▪ Non Conformity	▪ Analytical Thinking
▪ Sensitivity/Empathy	▪ Complex Thought Processes
▪ Need to Understand	▪ Exceptional Reasoning Ability
▪ Acute Self-Awareness	▪ Divergent Thinking/Creativity
▪ Need for Mental Stimulation	▪ Facility with Abstraction
▪ Excellent Sense of Humor	▪ Intellectual Curiosity
▪ Need for Precision/Logic	▪ Rapid Learning Rate
▪ Questioning Rules/Authority	▪ Vivid Imagination
▪ Perfectionism	

Note. From Gatton Academy Summer Retreat presentation, Cross, 2010.

In Schommer and Dunnell's article (1994), they look at the potential differences in metacognition between gifted and non-gifted students. Specifically, this work focused on the differences in epistemological beliefs of students in four factors: fixed ability (the ability to learn is unchangeable), quick learning (learning occurs in a short amount of time or not-at-all), simple knowledge (knowledge is best characterized as isolated facts), and certain knowledge (knowledge is unchanging). A total of 1165 students from an urban high school participated in this study which was based on a survey that included demographic information and an epistemological questionnaire that explored students' preferences to statements about knowledge and learning. Students were identified as either lower division (9^{th} and 10^{th} grade) or upper division (11^{th} or 12^{th}) and either gifted or non-gifted. The results from several 2 X 2 ANCOVAS were analyzed and showed that there were consistent findings that gifted and non-gifted students differ in their belief in simple

knowledge. Specifically, gifted students were less likely to believe in simple knowledge. This difference was most apparent in the students from the upper division. This suggests that gifted students change their beliefs across their high school career where non-gifted students tend to remain more stable. The implications suggested by the authors are that teachers should be cognizant of the epistemological beliefs that students bring to the classroom. These beliefs appear to have a significant impact on students' cognition. Additionally, these results may provide insight to why all students, not just gifted ones, struggle with addressing complex problems. A limitation for this study is the longitudinal nature of epistemological belief development.

Another study on gifted students by Lee and Olszewski-Kubilius (2006) explored emotional intelligence (EQ), moral judgment, and leadership among academically gifted adolescents. When comparing gifted and non-gifted, most studies have focused on cognitive elements. This study investigated how students compare across measures of nonintellectual domains. It focused on 234 students who participated in one of two summer programs featuring academics and/or leadership. Using three psychological scales (BarOn Emotional Quotient Inventory, Defining Issues Test-2, and the Roets Rating Scale for Leadership), these students were compared across several domains of EQ, moral development, and leadership to normative samples. Using descriptive statistics, the authors found that on emotional intelligence, gifted males were comparable to students in the age normative sample, while gifted females lagged behind the norm group. Regardless of gender, gifted students had higher scores on adaptability but lower scores on stress management and impulse control ability compared to the normative sample. On moral judgment, gifted students were comparable to the level of individuals with master's

degrees or professional degrees, and they showed an above-average level of leadership compared to the normative sample. This suggests that educators could expect that gifted students may have stronger leadership and moral reasoning skills but that these students will need additional support in handling emotional situations, particularly in the areas of stress management and impulse control. One of the major limitations for this study was the lack of a more adequate comparison group. Since the gifted group came from two summer programs, this creates a homogenous group that is relatively affluent as compared to the more diverse normative group in regards to socioeconomic status. This also created some noticeable differences in the ethnic representation between the gifted and normative samples.

In an article by Amini (2005), he explored the potential differences in how gifted students deal with stressors as compared to non-gifted students. His work focused on the contradictory pool of studies that divide the findings across three distinct possibilities: gifted students have better self-esteem than non-gifted, they have lower self-esteem than non-gifted, or there are no differences. There are significant studies supporting each of the three options. To try to get a clearer understanding, the purposes of this study were:

1. To identify stressors and reaction to stressors in gifted students and compare them to non- gifted students.
2. To compare self-esteem in gifted and non-gifted students.
3. To investigate the relationship between self-esteem and level of stress.
4. To examine gender differences with regard to stressors and reaction to stressors in gifted students.

5. To analyze the stressors and reaction to stressors in relation to some socio-demographic variables. (p. 137)

In Amini's study, he surveyed 340 students from four high schools in Shiraz, Iran, using the Student Life Inventory and the Coopersmith Self-Esteem Inventory. Using descriptive statistics, he found that there was no significant difference between gifted and non-gifted students in stressors but that gifted students showed significantly more cognitive reactions to stressors. Additionally, gifted students did show significantly higher self-esteem than the non-gifted. One interesting element that was found was a significant negative relationship between the father's education and the experience of frustration in gifted students. The study showed that the greater the level of education the father had attained, the higher the level of reported frustration among the students. One potential limitation of this study is the cultural dynamics of a sample. Middle Eastern customs and expectations may create a substantially different context than European or Northern American populations.

Another study focusing on characteristics of gifted students is the work of Hoekman, McCormick, and Gross (1999). The purpose of their study was to look at motivational and affective factors and how these influence cognitive factors. The core of this research is to investigate how social context influences perspectives and behavior and to explore what variables might be useful indicators in analyzing the optimal context for learning. The team worked with 540 Year 7 students from five selective high schools in Sydney, Australia. The total student sample was made up of 402 individuals from the full-time ability-grouped classrooms, 76 from an accelerated cohort who were eliminating a year of high school, and a mixed-ability group. They used the "Feelings about School

Inventory" (FASI), an eight-page, 135-item questionnaire that is based on the conceptual framework of Csikszentmihalyi's work on flow. The three sections of the survey explored general satisfaction with school, a tedium measure, and an anxiety inventory. Using principal components analysis and multiple regression analyses, the authors determined that the social-constructivist conceptual framework of Csikszentmihalyi was supported. Positive correlation between the satisfaction with school and intrinsic motivation was statistically significant. These results support the exploration of motivational orientation as a situational state that may be affected by classroom variables.

Traditional Comprehensive High School

Format and Structure

With a basic understanding now of the needs of gifted students, it is possible to look at how those needs are met in the United States presently. First, it is important to understand the general format that most secondary schools follow. The typical traditional comprehensive high school is a 9^{th} – 12^{th} grade institution with an average student population of 850. The size of the schools ranges from 1 to 8,539 students (Chen, 2010). Most schools utilize one of the following formats: six or seven yearlong periods, block or modified block scheduling, or trimesters. The working model in most schools is the Carnegie unit where students earn a half or whole credit for each class completed.

Curriculum

The typical high school follows its state's guideline on requirements. For instance, in Kentucky, the requirement for a college preparatory diploma is strictly defined (See Table 2.3).

In comparison to the curriculum established in the early 1900s, the focus of the content is essentially the same core set of courses in the areas of English, math, social studies, and science but a major shift away from the classical courses such as Latin, Greek, and Bible. Information from the Digest of Education Statistics 2010 suggests schools have shown a significant response to the 1983 National Commission on Excellence. Across the nation, there was an increase in the number of mathematics and science courses students took. In science in 2005, students took on average 3.3 credits as compared to 2.2 in 1982. In math, the numbers moved from 2.6 in 1982 to 3.7 in 2005. However, only 36 percent of the students met the recommended college-bound curriculum in 2005 (Snyder & Dillow, 2010).

Methods to address the needs of high ability students

The traditional comprehensive high school has seen several iterations of reform over the past 30 years. As was referenced earlier, A Nation at Risk set the tone for the following years in terms of expectations. Many states moved toward a greater level of accountability in the 90s. From this educational mentality, the federal government under the Bush administration passed the No Child Left Behind Act (NCLB) reauthorizing the Elementary and Secondary Education Act of 1965 (USDOE, 2001). With this focus, schools moved toward an assessment-based intensity on mathematics and reading.

In the midst of this national movement, it has been challenging for schools to meet the needs of high ability students consistently. Two of the major strategies chosen by high schools to address these needs have been the Advanced Placement (AP) curriculum and the use of dual enrollment courses.

Table 2.3

Pre-College Curriculum for Kentucky

Pre-College Curriculum
English/Language Arts
4 credits required English I English II English III English IV (or AP English)
Mathematics
3 credits required Algebra I Algebra II Geometry (see note below on substitutions
Science
3 credits required Credits to include life science, physical science, and earth/space science (at least one lab course)
Social Studies
3 credits required From U.S. History, Economics, Government, World Geography, and World Civilization
Health
½ credit required
Physical Education
½ credit required
History and Appreciation of Visual, Performing Arts
1 credit required History and appreciation of visual and performing arts or another arts course that incorporates such content
Foreign Language
2 credits required or demonstrated competency [effective date: fall 2004 semester]
Electives
7 credits required (*5 rigorous*) Recommended strongly: 1 or more courses that develop computer literacy
[In 2004, requirement is 5 credits (*3 rigorous*)]
TOTAL CREDITS:
22 15 required credits; 7 elective credits (2002) [17 required credits; 5 elective credits (2004)]

Note. From KDE website, 2011.

Advanced Placement Program

In most comprehensive high schools today, AP is the most common intervention for high ability students (Van Tassel-Baska, 2001). Created in 1955 by the College Board, it was initially established to provide gifted students access to entry-level college coursework. It has since broadened its approach to allow a wide spectrum of students to have rigorous high school curriculum (Dounay, 2006). The program is structured to evaluate the level of student proficiency in college level content by an end-of-course examination. While this exam is not mandatory, it is a significant measure of how well students have internalized the material from the course. Presently, there are 34 courses in a vast array of subject areas that schools may choose to offer (AP, 2011).

A breadth of research has been conducted on the impact of AP on the educational experience of high ability students. Van Tassel-Baska (2001) states that there are five substantial benefits for gifted students: accelerated learning, emphasis on higher order learning, emphasis on advanced topics, setting of high-level expectations, and provision of powerful incentives. She acknowledges that there are arguments against AP such as the courses do not have sufficient differentiation in areas like depth and complexity, the courses sacrifice some real-world relevance for a narrower core content emphasis, and the courses are geared toward convergent thinking students who value content-laden instructional approaches. As such, she states that,

> While AP coursework may not be for every college-bound student, the program puts those students who choose it on a deliberate path toward accrual of educational advantage in key areas of learning that can only over time enhance individual and societal education progress. (p. 131)

Research in the effectiveness of AP courses reveals mixed factors. In a study by Greer (2010) of the state of the AP program in Indiana, the researcher explored whether the AP program in Indiana had a significant impact on students. He states, "Overall the researcher has concluded that the AP curriculum which includes the exam is not a significant factor in getting public high schools students to college and that the school districts might find some other curriculum which might be more college preparatory for all if that is the purpose of public education" (p. 117). He goes on to say, "The fact is this: AP does not nor it did not at least in 2006 in the public schools in Indiana make a significant difference in the number of graduates attending high education" (p. 117). Similarly, in a study by Williams (2010), the research sought to determine if any differences existed between students who took AP courses, dual enrollment courses, both, or neither. Based on the statistical analysis, no significant difference was found.

In stark contrast, a study by Sherman Valentine (2010) showed significant correlation between students taking either AP or dual enrollment courses on their success at the university level. Her work was based on the analysis of data from 2,279 first-time, full-time, first-year students who entered IUP in the fall of 2005. While the single university focus has its limitations in being fully comparable to all schools, the research suggests strong positive correlations exist. Using Chi-square and ANOVA analyses, the researcher found "that students who participated in dual enrollment and/or AP programs had higher retention and four-year graduation rates than those students who did not participate in either program. The study also revealed that participating in dual enrollment and/or AP programs had a significant influence on first semester GPA and time-to-degree-attainment" (Sherman Valentine, 2010).

Dual Enrollment Programs

The other common intervention used by high schools is dual enrollment. Several models have emerged that implement college level coursework. Some schools offer college courses on their own campus, taught either by college instructors or by high school teachers certified in some way to teach that course level. Other programs focus on allowing students to attend university or community college campuses part-time to take specific courses. These programs may use this format for acceleration of content for high-ability students or they may use it to motivate under-performing students. The latter is the case in the Middle College model. One other form of dual enrollment is the Early College model where students fully finish their final few high school years by taking courses on a college campus (Plucker, Chien, & Zaman, 2006; Andrews & Davis, 2003).

Reasons and rationale for dual enrollment.

There are many reasons that a dual enrollment program is needed. The main demand is for students to become college-ready. The number of students entering college has increased dramatically but the number of students finishing is proportionally decreasing. It is obvious that taking university-level courses should, in turn, provide a transition to a full college load (Klein, 2007; Krueger, 2006). Additionally, these programs provide an effective avenue for acceleration for high-ability students. By removing the ceiling of curriculum for these students, their capacity to learn is greatly enhanced (Windham, 1998; McCarthy, 1999). Likewise, taking college courses provides a high level of relevance for all students, leading to a stronger motivation to be successful at the high school level. When a student knows that they are getting college credit which can

ultimately save time and money for the student and his or her family, this generates a much more enticing and engaging environment (Cornett, 1986).

Benefits of dual enrollment.

One of the most obvious benefits is the genuine college preparation. Research has shown that students who participate in a dual enrollment program have higher grades in college, less need for remediation, and higher rates of persistence (Plucker et al., 2006). Another major benefit of dual enrollment programs is the enhanced learning community that evolves from the accelerated learning, particularly in programs where there has been intentional support systems put into place. When students have the opportunity to be among peers who have a similar desire to learn in a context of challenging and engaging class work, a strong synergy is created (Koszoru, 2005; USDOE National High School Center, 2007).

Another beneficial consequence is that these programs expand access to college for many students who traditionally may not have pursued a post-secondary opportunity. Particularly in the Middle College model, students are given the chance to taste the college experience and gain confidence to pursue a degree fully (Klein, 2007). Similarly, students who engage in these programs early enough have the potential to earn an associate's degree or two years of a bachelor's in some cases. Students and families can save on the tuition and fees for the course work and be substantially ahead of schedule in terms of the time it takes to complete a degree (USDOE National High School Center, 2007).

Issues and concerns with dual enrollment.

While there are certainly plenty of benefits, there have been many concerns as well regarding dual enrollment programs. One of the concerns is the cost and financial burden

associated with conducting a program. If the school cannot afford to cover the tuition and fees for these courses, this becomes a major obstacle for many students and families. On the other hand, a district may be financially strapped as well but may sacrifice some programs to implement a dual enrollment model (USDOE National High School Center, 2007). This situation can contribute to another problem, equitable selection across underrepresented groups. If finances become an issue, this can lead to biased selection based on who can afford the program. Similarly, there may be some cultural differences that might make this type of program seem elitist in nature such as generational expectations and local perception of higher education (Hughes, Karp, Fermin, & Bailey, 2005).

Another issue arises from having two systems (the high school and the university or college) working together. If there is not buy-in from one of the partners, mistrust and minimal effort can lead to a dysfunctional program. Lack of communication can also lead to ineffective implementation (USDOE National High School Center, 2007).

One other major factor that must be addressed as well is the need for vertical alignment throughout the school system. For students to prepare adequately to enter a dual enrollment program, timely notification and academic planning is critical. Likewise, content acceleration may be necessary to enable some students to be properly prepared for this type of transition. As well, how a school handles the merger of course credits from the college model to the high school transcript can be problematic (McCarthy, 1999). Regarding course credits, there is also the issue of transferability to other universities. Some schools will not accept dual credit if earned for high school and others may not accept any transfer credit, nullifying the advantage of year acceleration (Weiss, 2005).

Components of effective dual enrollment models.

From the literature, there are specific criteria that must be in place to create an effective dual enrollment program. First, close cooperation between the school and university must be established so that curriculum, instruction, assessment, and communication can be congruent with the needs of the students and both institutions (Barak, 2008). Second, a clear pathway should be established as to what coursework students should be taking as early as middle school to be prepared to make the transition to dual enrollment possible (McCarthy, 1999). Third, any program should be balanced with a support network that addresses social and emotional needs for students who will be challenged in ways with which they will not be familiar. Additionally, the program should be more than just an academic experience. Attention should be given to experiential activities that will give students a broad view of the college experience (Klein, 2007; Weiss, 2005).

Specialized Secondary Schools

As stated earlier, educational commission reports such as RAGS and America COMPETES Act suggest an increase in specialized secondary schools, particularly those that focus on STEM education. The development of this type of school has its roots in the establishment of Stuyvesant High School in New York City in 1904 (Thomas & Williams, 2010). According to Thomas & William (2010), "Specialized STEM schools were first created due to the concerns about American economic competitiveness and a predicted shortage of such talent" (p. 18). Since Stuyvesant's creation, many other schools have been initiated across the country. Programs such as Brooklyn Technical High School in New York, Thomas Jefferson High School in Virginia, and the Illinois Math and Science

Academy have set the standard of the effectiveness of this type of program (Thomas & Williams, 2010). To help support these schools and encourage development of others, the National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology (NCSSSMST) was created in 1988. This organization has since reached over 100 members with schools from coast to coast, providing networking, professional development, and resources for these STEM schools (Thomas & Williams, 2010).

While the impetus to develop STEM schools has been at work for over a century, the driving philosophy for their creation is still very much at work in the economic and political arenas today. In September 2010, a Presidential report, *Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math for America's Future* was released by the President's Council of Advisors on Science and Technology (PCAST; Executive Office of the President, 2010). One of the major recommendations is to "create 1000 new STEM-focused schools over the next decade" (p. x). The environment for continued development of such programs appears to be a major influence on the pathway of education for the near future. As the authors of this report put it, "PCAST believes that the Nation has an urgent need –but also, thanks to recent developments, an unprecedented opportunity – to bring together stakeholders at all levels to transform STEM education to lay the groundwork for a new century of American progress and prosperity" (p. x).

Regarding the significance of these types of schools in meeting the needs of high ability students, Olszewski-Kubilius (2010) created a table to compare the benefits and disadvantages of various educational structures including STEM schools (See appendix A). She states,

> The advantage of STEM secondary schools is that they are or can be designed to move students from abilities to competency to expertise. Most typical high schools would not be able to give students who are interested and talented in STEM areas contact with practicing scientists or opportunities to be mentored and to work in research laboratories as apprentices. Most typical high schools would, at best, be able to move students from ability to competency and technical proficiency in some areas, whereas specialized STEM secondary schools are able to take students further into the stage of expertise in their talent development. (p. 68)

More specifically, Olszewski-Kubilius (2010) delineates the following advantages and disadvantages for STEM schools:

Advantages

Provide students access to true intellectual peers on a full-time basis

Can give students a more elaborated and complete picture of authentic scientific work through mentorships and internships

Builds motivation through involvement in real-life science and math activities

Develops independent life skills if residential

Can prepare students for the most selective college and university math and science programs

Work with practicing scientists gives students career knowledge

Can really foster the development of friendships and a peer group

Enables students to experience academic challenge

Because of workloads, can develop good study habits and stress-management techniques

Provides better benchmarking, i.e., with true peers, for students in terms of their scientific

and mathematical knowledge and skills

State-sponsored schools are free or at minimal cost to the student and his or her family

Disadvantages

Intense, competitive environment may cause stress for some students

School may not have a wide range of extracurricular opportunities in athletics, arts, etc.

Might cause initial and temporary decline in self-esteem

May not be right for child with intense interest and ability in STEM areas but lacking maturity

Places students with older, college-aged students, if program exists on a college campus

May be problematic if student interests change (pp. 62, 63)

Residential STEM schools

One unique form of a specialized secondary school is the residential STEM school. While there have been boarding schools since the early American history of education, the emergence of a state-sponsored residential program to address STEM education has only been in existence for 30 years with the establishment of the North Carolina School of Science and Mathematics (NCSSM) in 1980 (Green, 1993). In subsequent years, other states also established similar programs. Presently, there are 15 existing programs. These programs can be divided into two distinct models: self-contained or university-based.

NCSSM is a self-contained program and the majority of the other programs are as well. These include the Illinois Mathematics and Science Academy (IMSA), the Oklahoma School of Science and Mathematics (OSSM), and the Alabama School of Mathematics and Science (ASMS) (Green, 1993).

In 1988, the first university-based program, the Texas Academy for Mathematics and Science, was established at the University of North Texas (Green, 1993). This model incorporates the early-college structure by utilizing a university for all of its instruction. Each course is a university course taught by college instructors or professors that then serves as a dual credit for both high school and college. Since then, Missouri, Georgia, Kentucky, and Kansas have created similar programs (NCSSSMST, 2011).

While research on specialized secondary schools is limited, one particular study produced significant results. Thomas & Love (2002) conducted a sustained longitudinal study focusing on NCSSSMST member schools. The study was developed on these questions:

1. Are there differences in learning styles and information processing among Consortium school graduates? Do we change the way students think?
2. What are the distinguishing habits of mind among Consortium school graduates?
3. Do the Consortium schools meet the needs of their students?
4. How do Consortium school graduates compare with high ability college-bound students from other secondary schools in their aspirations, expectations, and secondary school preparations? (p. 4)

This study focused on both college freshmen and college seniors from Consortium schools over a 3-year period, 1998-2000. A total of 1032 students were surveyed, representing 10 schools. Over the three years, the number of schools continuing in the study reduced to 5.

The findings showed:

> Graduates are consistently satisfied with their high school experiences, and that they are entering in significant numbers majors related to mathematics and science, that they are active in campus activities and leadership roles, and that they earn many attendant academic honors as undergraduates. (Thomas & Love, 2002, p. 8)

One other significant result came from the comparison of residential vs. non-residential programs. The students from non-residential schools indicated that they felt that college level courses and teachers brought a much higher level of intellectual challenge than reported by students from residential programs. One area the results did not address was how these results compare to non-Consortium schools. While there was reference to national statistics when available, a full comparison to traditional high school outcomes was not completed.

Another study conducted by Boazman (2010) focused on psychological constructs such as general self-efficacy, disposition, and resiliency and how these characteristics manifest themselves in a residential STEM school population. She worked with 213 subjects from two specific programs at the University of North Texas (UNT): the Texas Academy of Mathematics and Science (TAMs) and the UNT Honors College. The purpose of the study was to look for guiding data in determining factors for continued success for gifted students at the collegiate level. The fundamental research question was, “What are

the effects of various psychological measures (i.e. general self-efficacy, theories of intelligence, hope, gratitude, religiosity, disposition, and resiliency) on personal development of gifted college students between the start of college and after one year" (p.11)?

Findings derived from latent transition, latent class, general linear model repeated measures, and regression analyses suggest that "positive disposition and hope-agency were significantly related to academic success during the first year at college. (Boazman, 2010, Abstract)". Specifically, Boazman's (2010) results showed that "self-theories of intelligence – fixed explained a 10.6% of variance in GPA for the TAMS A student class, and hope-pathways explained 8.9% of variance in GPA for the Honors A student class" (p. 119). One interesting finding in comparing the TAMS students with those students from the Honors College was that at the start of the year, the TAMS students reported a higher level of personal well-being than the honors students did. Yet at the midyear measurement, that trend switched with the Honors College students reporting higher in personal well-being.

One other study that is underway is an evaluation of how specialized secondary schools in STEM affects the number of students entering science research careers (Subotnik, Tai, Rickoff, & Almarode, 2010). In an article from the Roeper Review, the authors state, "Questions regarding the impact and influence of specialized STEM high schools abound. To date, no large-scale data-based research study has addressed these questions" (Subotnik et. al, 2010, p. 8). This project encompasses surveying 5000 graduates from STEM high schools in comparison to 1000 similarly talented students from

the Midwest Academic Talent Search who graduated from traditional high schools. The study hoped to answer these two questions initially:

1. Are graduates from specialized STEM high schools more likely to enroll in STEM-related

   studies and career fields when compared with graduates from regular nonmagnet, nonexamination high schools with comparable academic and demographic backgrounds?
2. What school models employed by specialized STEM high schools are most associated with entrance into STEM-related studies and career fields? (School models include residential schools, schools-within-schools, regional centers with half-day courses.) (p. 13)

The authors suggest that large-scale research may help guide decision-making by showing evidence that these types of programs do have an impact of STEM career development. However, they are concerned that it is very possible that the findings will show mixed results. One other emphasis from the article is that each individual school should maintain internal data and should do internal action research on the impact of the program on its own graduates.

Presently, this study is in phase II with some results that are yet to be published. Subotnik, Tai, and Almarode (2011) report that their analysis centered on a group of eight specialized science, math, and technology (SMT) schools, two each from four distinct models: 1) residential, 2) comprehensive, 3) school within a school, and 4) half-day. With this phase, Table 2.4 shows the distribution of the students surveyed so far (p. 9).

Table 2.4

Distribution of Survey Respondents across Four Specialized School Types and Gender

	Frequency	Percentage
School Type		
Residential	192	15.4
Comprehensive	502	40.2
School in School	220	17.6
Half-day	336	26.9
Gender		
Females	657	51.2
Males	626	48.8
Total	1250	

Note. From Subotnik et al, 2011.

Based on the population and the evolution of the study, the authors modified the research questions for the study from the original design as follows:

- Research Question 1: Are graduates from specialized science, mathematics, and technology (SMT)-focused high schools likely to complete STEM majors?
- Research Question 2: What school models employed by specialized SMT high schools are most associated with completing STEM majors? (p. 6)

In seeking to address question 1, they used the National Educational Longitudinal Study of 1988 – 2000. Their results are shown in Table 2.5 (p. 10). The evidence from the table indicates a strong relationship between all students entering school with a defined interest in STEM and the percentage of those students going into a STEM major in college, particularly those who attend a specialized SMT school.

Table 2.5

Comparison of Percentages of College Graduates Majoring in STEM-related areas who graduated from Specialized SMT high school graduates (age range 22-25 years) to the nationally representative data from NELS: 1988-2000 (age range 25-26) of individuals who did not attend Specialized SMT high schools.

	Percentage
Initially STEM-Interested Students – Entering SMT HS	
National Educational Longitudinal Study of 1988-2000	
All Students	40.7
High Performers in Science and Mathematics	46.6
Specialized SMT High School Graduates	64.9
Initially Non-STEM- Interested Students – Entering SMT HS	
National Educational Longitudinal Study of 1988-2000	
All Students	21.9
High Performers in Science and Mathematics	34.0
Specialized SMT High School Graduates	27.5

Note. From Subotnik et al, 2011

Concerning question two, the study examined four factors: 1) participation in authentic high school research experiences, 2) participation in internships or mentorships, 3) feelings of belonging in the academic setting, and 4) teacher efforts to make cross-disciplinary connections in SMT courses (p. 12). The results from a comparison of odds ratios across binary logistic regression models reveal a significant positive association of research experience with completion of STEM-related concentration. The other three factors showed a moderate positive association.

In an overall summary, the authors state:

> Evidence from biographical and longitudinal data and from expert opinion suggests that adolescents with interests and talents in mathematics and science are more likely to pursue STEM in postsecondary environments when provided with challenging curricula, expert instruction, and peer stimulation. There are many mechanisms for generating these academically stimulating conditions. According to our research thus far, opportunities for conducting original research, a signature component of selective SMT schools, is a powerful tool for enhancing and maintaining interest in SMT disciplines, particularly for females. (Subotnik et al., 2011, p. 18)

Summary

Over the past 400 years, the American high school has evolved in its focus and function. As the needs of the country change, the structure and model of secondary education has responded, sometimes reluctantly and slowly. Through the early foundations of private education to a full public high school experience for all American youth, the mission and vision for these institutions has been to prepare young people to be functional and successful citizens. However, the debate has often been how to accomplish those goals. The move from a classic curriculum to more pragmatic concepts still is at play in the development of education. The concerns remain on whether a comprehensive model or a specialized secondary school is the best pathway to meet the needs of a wide range of abilities and needs among students. Particularly for high ability students, which type of program provides more avenues for teens to excel?

In the last few decades, there has been an emergence of different models of schools to address the demands of the changing national needs. Magnet, charter, STEM,

residential, and hybrid schools have been established in nearly every major city in the U.S. Do these schools provide a better educational environment than the typical comprehensive high school? Is it possible to provide a meaningful educational experience for the whole spectrum of student capacities and needs without creating focused formats that can tailor the curriculum and instruction for students?

In regard to residential STEM schools, very little research has been conducted to answer these questions. As such, this study was conducted to contribute to the body of knowledge involving these types of schools.

CHAPTER III: METHODOLOGY

Overview

This research study is a quantitative analysis of data collected from two types of secondary schools: traditional and residential STEM. The purpose of the study is to determine if there is a difference in achievement and perceptions of high ability students in a traditional comprehensive high school versus a residential, early college high school. Specifically, data were collected to assess:

1. Are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT)?
2. Are there between-group differences in how students report on a college readiness inventory (SSI)?
3. Are there between-group differences in how students perceive their high school experience?

Using a causal-comparative design, this study utilized a matched comparison group from local high schools in south central Kentucky in contrast to students from a residential STEM school located on the campus of WKU. The four local schools represented a wide variety of demographics ranging from a diverse city school to a significantly homogeneous rural school. To attempt to create a more equitable comparison, the selected students from the local schools were chosen based on their enrollment in pre-calculus or a higher mathematics course. Data were collected on each student in the sample including PLAN scores from the sophomore year, ACT scores from the junior year, grade point average (GPA) from the 7^{th} semester, results from the SSI, and results from a student perception survey.

Using descriptive and inferential statistics, the data were analyzed to determine if there was any correlation between how students performed in their sophomore year, their junior year, and their perceptions of their schools and to determine if there was any significant difference statistically between the two types of schools.

Definition of Terms

Advanced Placement (AP): A curricular program established in 1955 by the College Board to increase the rigor of high school courses to the collegiate level. The program was designed to encourage high school students to engage in college-level work. Presently, there are 34 courses schools may choose to offer with an accompanying test that students can take to earn college credit. (AP, 2011)

ACT: A high school standardized achievement test created in 1959 by ACT, Inc. It is used as a college entrance exam in the United State (ACT, 2007).

Charter School: A type of public school that is established and governed by a charter that allows the school to function under different guidelines than a typical public school and gives the school the potential for alternative operations. While open to the public in the defined district, enrollment in a charter school may require a lottery system if interest supersedes available slots.

Dual Credit/Enrollment: Courses offered to high school students that, upon successful completion, allow the student to earn college credit. These courses may be offered on the high school campus or students may participate on the college or university campus.

Early College Model: A high school model where students complete the last years of high school by taking their coursework partially or entirely through a college or university.

Magnet School: A school that offers a specialized curriculum to students in a district, across a region, or across the state or nation. Typical magnet schools focus on math and science, fine arts, or vocational emphases.

Middle College Model: An alternative high school model that utilizes a local community college or university to offer students dual credit courses. Typically, these programs are geared toward at-risk students who have disengaged from the traditional school environment. The general schedule is a combination of standard courses and college courses provided in a less structured environment.

PLAN: A standardized achievement test from ACT, Inc. designed for 10^{th} grade students as a preliminary assessment in preparation for taking the ACT exam (PLAN, 2007).

Residential School: A school where students reside in a living/learning environment with their peers on the school campus. This type of program creates the opportunity for students from remote or distant locations to attend an alternative school program.

Specialized Secondary School: An alternative high school model that focuses on specific subjects, typically STEM focused. This type of program may include magnet, charter, residential, or other alternative formats.

Student Strengths Inventory (SSI): An evidence-based assessment developed to support the retention efforts of post-secondary institutions. The SSI is a non-cognitive focused tool used to evaluate and assist students in their transition from high school to college (SSI, 2011; See Appendix D).

STEM: An acronym created from the words science, technology, engineering, and mathematics. This label is used frequently today in political, educational, and business circles when referencing fields, careers, and research areas in these disciplines.

Participants

The study focused on high ability students from Gatton Academy and a variety of local high schools. There were 41 seniors from Gatton and 267 from four local high schools: Bowling Green High School (BGHS), Warren Central High School (WCHS), Warren East High School (WEHS), and South Warren High School (SWHS). The students from the local schools were selected from those students who have taken or are taking Pre-calculus. This was done to align the academic experience of all students since everyone at the Gatton Academy would have completed that level of mathematics thereby creating a matched comparison.

The four local schools are distinctly different in their ethnic, racial, and socioeconomic profile. BGHS is a city school with a diverse population. There are 1158 students in 9^{th}-12^{th} grade with 68.4% White, 19.0% African-American, 8.1% Latino, 3.4% Asian, and 1.1% others. The school has 43.5% on free or reduced lunch. The school has an English Language Learners (ELL) population of 5.9% (Bowling Green City Schools, personal communication, October, 12, 2011). Warren East is a substantially rural school located in the northern part of Warren County. There are 872 students in 9^{th}-12^{th} with 86% white, 7% African-American, 4% Latino, 1% Asian, and 2% others. The school has 56% on free or reduced lunch. The school has an ELL population of 3% (WEHS, personal communication, February 27, 2012). Warren Central is more urban in its demographics, located within the city limits of Bowling Green. There are 1003 students in 9^{th}-12^{th} with 64% white, 19% African-American, 9% Latino, 5% Asian, and 3% others. The school has 65% on free or reduced lunch. The school has an ELL population of 10% (WCHS, personal communication, October 13, 2011). Similarly, South Warren, the newest school

in Warren County, is also more suburban-oriented with a higher middle class population than Warren Central or Warren East. There are 899 students in 9^{th}-12^{th} with 90% white, 4% African-American, and 3% Latino, 1% Asian, and 2% others. The school has 26% on free or reduced lunch. The school has an ELL population of 1% (SWHS, personal communication, February 20, 2012).

The Gatton Academy selects students from all across the state. There are 126 students in 11^{th} and 12^{th} grade with 86% white, 2% African-American, 3% Latino, and 9% Asian. While the academy does not participate in the free or reduced lunch program, based on knowledge of each family, approximately 20% would qualify. There are no students designated as ELL.

Each student was given a research informed consent form to assure that students understood the process and were willing to participate (See Appendix A). For those students under the age of 18, a parental informed consent form was sent (See Appendix B). For those who wished not to participate, an opt-out option was provided.

Instruments and Measures

PLAN

All sophomores in the state of Kentucky take the PLAN test as part of the statewide accountability model. The test was mandated by Kentucky Senate Bill 130, which requires Kentucky students to take a series of assessments called the Educational Planning and Assessment System (EPAS). As a "pre-ACT" test, the PLAN test serves as a nationally normed assessment to determine college readiness (Kentucky Department of Education [KDE], 2011). The format of this test is structured to parallel the ACT test. Students receive scale scores in English, math, reading, and science along with a composite score.

The scores range from 1-32 (ACT, 2011). This assessment will be used in this study to provide a baseline of measurement since all students in each school will have taken this test while they were in a traditional high school setting. It will serve as a preassessment in comparison to the ACT.

According to the PLAN Technical Report (2007), a systematic sample of 4356 examinees from the 2005-2006 school year was used to determine reliability across each test and subtest. Scale score reliability was found to range from .70 to .81 among subtests and from .80 - .85 among the 4 core tests. The overall scale score reliability for the composite score had a median value of .94 with a median SEM of 0.91 (PLAN).

ACT

The state of Kentucky chose the ACT to be the assessment for all juniors in order to determine progression toward college readiness (KDE, 2011). The ACT test is one of the two main college entrance exams utilized by universities across the nation. This assessment will serve as the posttest to measure potential differences between the types of schools. The format is like the PLAN in that a scale score is derived for English, math, reading, science, and composite. The range differs with scores that go from 1 – 36. Comparative analysis will be used to determine if there are any significant differences in student performance with a year in two different environments.

According to the ACT Technical Report (2007), a systematic sample of 2000 examinees from the 2005-2006 school year was used to determine reliability across each test and subtest. Scale score reliability was found to range from .69 to .88 among subtests and from .85 - .91 among the 4 core tests. The overall scale score reliability for the composite score had a median value of .96 with a median SEM of 0.94.

GPA

Grade point averages are computed for each grading term from the overall grades students earn in each class. For the purpose of this study, the GPA will be cumulatively derived from the seventh semester for each student. A comparison will be done on the GPAs to determine if any significant difference exists between students from the two types of schools in the area of student academic achievement.

While the computation of grade point averages is mathematically straightforward (the total number of grade points divided by the number of courses), this measure is the most subjective of the measures used. The issue of grade inflation will have an impact on the validity of this measure.

Student Strengths Inventory

The Student Strengths Inventory, according to its creators, "was developed to help institutions improve their efforts at promoting student success and persistence" (SSI, 2011). The inventory consists of 48 self-reported items that focus on 6 motivation factors: academic engagement, academic self-efficacy, educational commitment, resiliency, social comfort, and campus engagement (see Appendix C). Student responses generate a percentile score based on the normed group. The results also include two success/risk indices: probability of retention and probability of academic performance (see Appendix D). This study will use these percentiles and indices in comparative analyses to determine if any significant difference exists between students from the two types of schools in the area of college readiness.

Information obtained from the SSI website states:

The SSI was developed using commonly employed test development techniques

including rational and factor-analytic methods. An initial item pool of over 280 items was reduced to 48 items (8 on each of 6 scales) through psychometric evaluation of the responses of over 8000 high school and college students. The SSI has excellent reliability (alphas range from .81 to .90). The results of analysis from a nationwide longitudinal validity study suggest that scores on the SSI significantly enhance an institution's ability to predict college student outcomes (GPA and retention). (SSI, 2011)

Student Perception Survey

The Student Perception Survey is a short survey made up of 10 questions developed at the Gatton Academy (see Appendix E) that address students' personal evaluation of their high school experience and their relationships in school. This survey is intended to measure non-cognitive data that will provide some affective context to how students perform academically. The questions were designed using a 5-point Likert scale to elicit a student's degree of involvement or engagement. A comparison analysis will be conducted to determine if student perceptions are significantly different between the two types of schools. The Cronbach alphas for this administration ranged from .766 - .786.

Procedure

This study included several steps. 1) Once approval was granted by all the involved entities, students were selected from each school that were minimally taking or had completed pre-calculus. 2) Working with resources teachers from each school, a meeting with the selected students was conducted to discuss the project and distribute the informed consent forms. 3) After the necessary window of time to determine those students who wished to opt out, a classroom session was conducted to give both the SSI and the SPS. 4)

Baseline data were collected from each student's 10th grade PLAN score, 11th grade ACT score, and end of 7th semester GPA.

Data Analysis

All the data were entered into an Excel spreadsheet where each student was assigned a numeric code to allow confidentiality to be upheld. All references to specific students were eliminated once the coding was completed. Utilizing Statistical Package for the Social Sciences (SPSS) 19, descriptive statistics and independent *t*-tests were completed on the data set of test scores, grade point averages, and results from the SSI and SPS to determine how students from the Gatton Academy and the local schools differ across these measures. Cronbach alphas were determined for the SPS across all three sample sets to determine internal reliability.

From the assessment of the data, three phases were necessary to better analyze the differences: a whole sample assessment, a PLAN controlled sample assessment, and a matched pair sample assessment. The phases start with a broad view of the whole student sample. This set was too broad in its scope introducing extraneous variables that weakened the comparison. The PLAN controlled group was created to include only participants with a 21 composite or higher. This sample still had imbalance between the two groups. Thus, the third sample was created that matched students directly one-to-one, aligning the actual PLAN score and gender. All three phases were utilized for a broader perspective on the two groups but the matched pair sample was the more appropriate sample for the direct comparison of the two sets.

Summary

This study was conducted in order to assess whether differences exist between how

high ability students from traditional high schools compare to students from the Gatton Academy in the areas of academic achievement, student perception of their high school experience, and college readiness factors. Working with students from four local high schools and the Gatton Academy, data were collected from transcripts and surveys to address the research questions. In total, 41 students from Gatton Academy and 267 from the local schools participated in the study. Utilizing the SPSS 19 statistical analysis package, descriptive statistics and independent *t*-tests were completed for the data set. To fine-tune the analysis, three phases of samples were used. The first series of statistic tests were completed on the whole sample. The next level focused on restricting the sample to only those who had a 21 on the PLAN test from their sophomore year. Finally, the last sample was created by matching students from each group with equal PLAN scores and same gender. The results will be discussed fully in the next chapter.

CHAPTER IV: RESULTS

The purpose of this study was to determine if any significant differences exist in how students from the Gatton Academy achieve academically and in how they perceive their high school experience and their preparedness for college as compared to high ability students from traditional high schools. Specifically, the research questions guiding the process were:

1. Are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT)?
2. Are there between-group differences in how students report on a college readiness inventory (SSI)?
3. Are there between-group differences in how students perceive their high school experience?

Each question is addressed in this chapter supported by the appropriate analysis and accompanying tables and charts.

Analysis of Academic Achievement for Question 1 (Q1)

To address the question, are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT), 267 seniors from local traditional high schools were selected based on whether they were presently taking or had completed a minimum of pre-calculus. This criterion was used to align the level of academic preparation with 41 students from Gatton Academy, since the initial entry requirement for Gatton students is to have completed through Geometry and Algebra II. Along with this alignment, the PLAN test was used to match groups more closely. The PLAN is a required exam for all sophomores, providing a common measure

that both groups of students would have taken in equivalent environments prior to the selection process for the Gatton Academy. The following analysis has three phases: a whole sample analysis, a sample controlled by PLAN scores, and a matched-pair sample. The significance level chosen for this study was $p < .05$.

Whole sample analysis for Academic Achievement (Q1)

The descriptive statistics for Academic Achievement of the entire sample are found in Table 4.1.

Table 4.1

Descriptive Statistics of Whole Sample - Academic Achievement

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	PLAN	26.54	3.107	.485	41	21	32
Traditional		19.72	3.379	.217	242	14	32
Gatton	ACT	30.51	3.565	.557	41	21	36
Traditional		23.24	4.291	.268	256	14	35
Gatton	GPA	3.71/4.20*	.207	.032	41	3.25/3.69	4.00/4.47
Traditional		3.51	.498	.031	266	2.15	4.40

*Unweighted GPA/Weighted GPA only for Gatton

To determine if there is a significant difference between the two group means, an independent t-test was used. The results of the t-test analysis are found in Table 4.2.

For the whole sample, on average, the Gatton group had higher mean GPA, PLAN, and ACT scores than the Traditional group. These differences were significant with $t(128.1) = 4.258,\ p < .05$; $t(281) = 12.082,\ p < .05$; $t(295) = 10.291,\ p < .05$, respectively. Equal variances were assumed for the latter two scores due to the Levene's Test.

Table 4.2

Independent Sample Tests on Whole Sample – Academic Achievement

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
GPA	Equal variances not assumed	24.317	.000	4.528	128.1	.000
PLAN	Equal variances assumed	.099	.753	12.082	281.0	.000
ACT	Equal variances assumed	.958	.328	10.291	295.0	.000

PLAN controlled sample analysis for Academic Achievement (Q1)

To address the difference between the PLAN test scores of the two groups, another data set was created from the whole sample that eliminated any traditional students who scored below a 21 on the PLAN (21 was the minimum for the Gatton group). The descriptive statistics for this sample are found in Table 4.3.

Table 4.3

Descriptive Statistics of PLAN Controlled Sample - Academic Achievement

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	PLAN	26.54	3.107	.485	41	21	32
Traditional		23.54	2.389	.264	82	21	32
Gatton	ACT	30.51	3.565	.557	41	21	36
Traditional		27.37	3.238	.360	81	21	35
Gatton	GPA	3.71	.207	.032	41	3.25	4.00
Traditional		3.81	.403	.046	82	2.58	4.40

The independent t-tests results for the PLAN controlled sample for Academic Achievement are found in Table 4.4.

For the PLAN controlled sample, on average, the Gatton group had higher mean PLAN and ACT scores than the Traditional group. The Traditional group had a higher mean GPA score than the Gatton group. The differences in the GPA, PLAN, and ACT were significant $t(102.9) = -2.910$, $p < .05$; $t(66.3) = 4.173$, $p < .05$; and $t(104) = 3.635$, $p < .05$, respectively.

Table 4.4

Independent Sample Tests on PLAN Controlled Sample – Academic Achievement

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
GPA	Equal variances not assumed	7.147	.009	-2.910	102.9	.004
PLAN	Equal variances not assumed	6.571	.012	4.173	66.3	.000
ACT	Equal variances assumed	1.884	.173	3.635	104.0	.000

Matched pair analysis for Academic Achievement (Q1)

In looking at the distribution among the PLAN controlled sample, differences in clustering in certain score ranges occur. To address this situation, matched pairs were created from the data set. Gender and PLAN scores were the control variables in the matching. Where multiple pairings could occur, random selection was used. Since there were some scores within the Gatton group that did not have a complement in the Traditional group, some participants were removed. This process created 27 matched pairs. The descriptive statistics of the matched pairs are found in Table 4.5.

Table 4.5

Descriptive Statistics of Matched Pair Sample - Academic Achievement

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	PLAN	25.37	2.844	.547	27	21	32
Traditional		25.37	2.844	.547	27	21	32
Gatton	ACT	29.74	3.460	.666	27	21	36
Traditional		29.11	3.598	.693	27	21	35
Gatton	GPA	3.68	.201	.039	27	3.31	4.00
Traditional		3.88	.353	.068	27	2.80	4.40

The independent t-test results from the matched pair sample are found in Table 4.6. For the matched pair sample, on average, the Gatton group had a higher mean ACT score than the Traditional group. The Traditional group had a higher mean GPA score than the

Table 4.6

Independent Sample Test of Matched Pair Sample – Academic Achievement

		Levene's Test for Equality of Variances		*t*-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
GPA	Equal variances not assumed	4.211	.045	-2.539	41.2	.015
PLAN	Equal variances assumed	.000	1.000	.000	52	1.000
ACT	Equal variances assumed	.069	.794	.655	52	.515

Gatton group. Due to the matching, the PLAN scores are equal. The difference of the mean GPA score was significant $t(41.2) = -2.539$, $p < .05$ while difference of the mean ACT was not significant $t(52) = .655$, $p > .05$.

Analysis of College Preparedness Factors for Question 2 (Q2)

The second research question, are there between-group differences in how students report on a college readiness inventory (SSI), was analyzed in parallel fashion to the manner in which the first research question was addressed.

Whole sample analysis for SSI (Q2)

The descriptive statistics on how the whole sample responded to the SSI are found in Table 4.7. The independent t-test results for this set are found in Table 4.8.For the whole sample, on average, the Gatton group had higher means for Probability of Retention, Probability of Academic Success, Academic Engagement, and Academic Self-Efficacy than the Traditional group. The Traditional group had higher means for Campus Engagement, Educational Commitment, Resiliency, and Social Comfort than the Gatton group. The differences for Probability of Retention, Probability of Academic Success, and Social Comfort were significant with $t(63.006) = 6.914$, $p < .05$; $t(89.527) = 8.656$, $p < .05$; and $t(57.363) = -4.437$, $p < .05$, respectively.

PLAN controlled sample analysis for SSI (Q2)

The descriptive statistics from the SSI data for the PLAN-controlled sample are found in Table 4.9. The results of the t-test analysis for the PLAN Controlled sample are found in Table 4.10.

Table 4.7

Descriptive Statistics of Whole Sample on SSI

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	Probability of Retention	75.59	8.944	1.397	41	41	88
Traditional		64.74	11.672	.714	267	4	86
Gatton	Probability of Academic Success	90.15	8.320	1.299	41	62	99
Traditional		76.25	15.413	.943	267	24	98
Gatton	Academic Engagement	60.61	25.641	4.004	41	1	96
Traditional		58.50	28.706	1.757	267	1	99
Gatton	Academic Self-Efficacy	66.05	27.284	4.261	41	1	99
Traditional		62.61	27.899	1.707	267	1	99
Gatton	Campus Engagement	49.29	30.500	4.763	41	1	91
Traditional		53.41	29.414	1.800	267	1	99
Gatton	Educational Commitment	44.88	26.179	4.089	41	1	99
Traditional		53.46	28.851	1.766	267	1	99
Gatton	Resiliency	49.29	33.440	5.223	41	1	97
Traditional		55.15	28.480	1.743	267	1	99
Gatton	Social Comfort	33.46	27.729	4.331	41	1	97
Traditional		54.52	31.738	1.942	267	1	99

Table 4.8

Independent Sample Tests on Whole Sample-SSI

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
Probability of Retention	Equal variances not assumed	5.245	.023	6.914	63.006	.000
Probability of Academic Success	Equal variances not assumed	23.342	.000	8.656	89.527	.000
Academic Engagement	Equal variances assumed	2.837	.093	.444	306	.657
Academic Self-efficacy	Equal variances assumed	.457	.499	.737	306	.462
Campus Engagement	Equal variances assumed	.555	.457	-.830	306	.407
Educational Commitment	Equal variances assumed	.959	.328	-1.794	306	.074
Resiliency	Equal variances not assumed	3.940	.048	-1.064	49.315	.293
Social Comfort	Equal variances not assumed	4.353	.038	-4.437	57.363	.000

Table 4.9

Descriptive Statistics of PLAN-Controlled Sample - SSI

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	Probability of Retention	75.59	8.944	1.397	41	41	88
Traditional		72.38	9.031	1.003	81	45	86
Gatton	Probability of Academic Success	90.15	8.320	1.299	41	62	99
Traditional		86.48	9.901	1.100	81	58	98
Gatton	Academic Engagement	60.61	25.641	4.004	41	1	96
Traditional		51.80	29.290	3.254	81	1	99
Gatton	Academic Self-Efficacy	66.05	27.284	4.261	41	1	99
Traditional		68.35	27.056	3.006	81	8	99
Gatton	Campus Engagement	49.29	30.500	4.763	41	1	91
Traditional		57.37	29.036	3.226	81	1	99
Gatton	Educational Commitment	44.88	26.179	4.089	41	1	99
Traditional		52.31	29.131	3.237	81	2	99
Gatton	Resiliency	49.29	33.440	5.223	41	1	97
Traditional		48.19	29.084	3.232	81	1	99
Gatton	Social Comfort	33.46	27.729	4.331	41	1	97
Traditional		55.63	31.798	3.533	81	1	99

Table 4.10

Independent Sample Tests on PLAN Controlled Sample-SSI

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
Probability of Retention	Equal variances assumed	.044	.834	.770	103	.443
Probability of Academic Success	Equal variances assumed	.232	.631	1.071	103	.287
Academic Engagement	Equal variances assumed	3.646	.059	1.739	103	.085
Academic Self-efficacy	Equal variances assumed	.006	.940	-.636	103	.526
Campus Engagement	Equal variances assumed	.494	.484	-1.464	103	.146
Educational Commitment	Equal variances assumed	.810	.370	-1.682	103	.096
Resiliency	Equal variances assumed	3.794	.054	.172	103	.864
Social Comfort	Equal variances assumed	2.865	.094	-3.339	103	.001

For the PLAN controlled sample, on average, the Gatton group had higher means for Probability of Retention, Probability of Academic Success, Academic Engagement, and Resiliency than the Traditional group. The Traditional group had higher means for Academic Self-Efficacy, Campus Engagement, Educational Commitment, and Social Comfort than the Gatton group. The difference for Social Comfort was significant with $t(103) = -3.339$.

Matched pair analysis for SSI (Q2)

The descriptive statistics from the SSI data for the matched pair sample are found in Table 4.11. The independent t-test results for the matched pair sample are found in Table 4.12.

For the matched pair sample, on average, the Gatton group had higher means for Probability of Retention, Probability of Academic Success, Academic Engagement, and Educational Commitment than the Traditional group. The Traditional group had higher means for Academic Self-Efficacy, Campus Engagement, Resiliency, and Social Comfort than the Gatton group. The difference for Social Comfort was significant with $t(52.0) = -2.328$, $p < .05$.

Analysis of Student Perception for Question 3 (Q3)

The third research question, are there between-group differences in how students perceive their high school experience?, was addressed like the first two research questions.

Whole sample analysis for SPS (Q3)

Descriptive statistics for the whole sample are found in Table 4.13. To determine if there is a significant difference between the two group means, an independent t-test was used. The results of the t-test analysis are found in Table 4.14.

For the whole sample, on average, the Gatton group had higher means for questions 1, 2, 3, 5, and 10 than the Traditional group. The Traditional group had higher means for question 4, 6, 7, 8, and 9 than the Gatton group. The differences for questions 2, 4, 7, and 8 were significant with $t(304) = 2.774$, $p < .05$; $t(304) = -2.648$, $p < .05$; $t(47.3) = -3.195$, $p < .05$; $t(304) = -6.061$, $p < .05$, respectively.

Table 4.11

Descriptive Statistics of Matched Pair Sample - SSI

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	Probability of Retention	74.81	8.634	1.662	27	41	86
Traditional		74.22	11.517	2.216	27	45	86
Gatton	Probability of Academic Success	89.48	7.856	1.512	27	62	98
Traditional		87.70	12.003	2.310	27	58	98
Gatton	Academic Engagement	60.78	25.236	4.857	27	1	96
Traditional		47.59	30.059	5.785	27	1	93
Gatton	Academic Self-Efficacy	64.85	28.134	5.414	27	1	99
Traditional		67.48	29.050	5.591	27	8	99
Gatton	Campus Engagement	47.56	33.238	5.999	27	1	91
Traditional		61.48	26.682	5.135	27	1	99
Gatton	Educational Commitment	52.41	27.308	5.255	27	1	99
Traditional		51.56	32.532	6.261	27	2	99
Gatton	Resiliency	47.56	33.238	6.397	27	2	97
Traditional		51.30	28.773	5.537	27	1	97
Gatton	Social Comfort	36.07	31.601	6.082	27	1	97
Traditional		55.85	30.835	5.934	27	1	97

Table 4.12

Independent Samples Test – SSI

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
Probability of Retention	Equal variances assumed	2.824	.099	.214	52	.831
Probability of Academic Success	Equal variances not assumed	4.244	.044	.644	44.8	.523
Academic Engagement	Equal variances assumed	3.798	.057	1.746	52	.087
Academic Self-Efficacy	Equal variances assumed	.193	.662	-.338	52	.737
Campus Engagement	Equal variances assumed	2.412	.126	-1.768	52	.083
Educational Commitment	Equal variances assumed	1.956	.168	.104	52	.917
Resiliency	Equal variances assumed	1.100	.299	-.442	52	.660
Social Comfort	Equal variances assumed	.421	.519	-2.328	52	.024

Table 4.13

Descriptive Statistics of Whole Sample on SPS

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	1. I enjoy attending high	3.90	.970	.151	41	1	5
Traditional	school	3.80	.833	.051	265	1	5
Gatton	2. My courses are challenging	4.02	.880	.137	41	2	5
Traditional		3.63	.852	.052	265	2	5

(continued)

Type of School	Measure	M	SD	SE	N	Min	Max
Gatton	3. My classes are meaningful	3.90	.768	.120	41	2	5
Traditional		3.77	.900	.055	264	1	5
Gatton	4. I get good grades in my classes	4.05	.740	.116	41	2	5
Traditional		4.34	.651	.040	265	2	5
Gatton	5. I am involved in extracurricular activities	4.00	.837	.131	41	2	5
Traditional		3.94	1.179	.072	265	1	5
Gatton	6. I am a designated leader in the activities I do	3.10	1.044	.163	41	1	5
Traditional		3.28	1.220	.075	265	1	5
Gatton	7. I have good relationships with my peers	4.02	.758	.118	41	1	5
Traditional		4.42	.572	.035	265	3	5
Gatton	8. I have good relationships with my teachers	3.80	.715	.112	41	2	5
Traditional		4.44	.607	.037	265	1	5
Gatton	9. I have good relationships with the administration	4.07	.905	.141	41	1	5
Traditional		4.14	.793	.049	265	1	5
Gatton	10. I am prepared to go to college	4.27	.975	.152	41	1	5
Traditional		4.25	.783	.048	265	1	5

PLAN controlled sample analysis for SPS (Q3)

Similarly, the descriptive statistics for the PLAN controlled sample are found in Table 4.15.

Table 4.14

Independent Sample Tests on Whole Sample - SPS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
1. I enjoy attending high school	Equal variances assumed	.559	.455	.743	304.0	.458
2. My courses are challenging	Equal variances assumed	2.035	.155	2.744	304.0	.006
3. My classes are meaningful	Equal variances not assumed	5.295	.022	1.010	58.5	.317
4. I get good grades in my classes	Equal variances assumed	1.265	.262	-2.648	304.0	.009
5. I am involved in extracurricular activities	Equal variances not assumed	12.420	.000	.404	67.4	.687
6. I am a designated leader in the activities I do	Equal variances not assumed	4.563	.033	-.991	58.3	.326
7. I have good relationships with my peers	Equal variances not assumed	9.296	.002	-3.195	47.3	.002
8. I have good relationships with my teachers	Equal variances assumed	.130	.718	-6.061	304.0	.000
9. I have good relationships with the administration	Equal variances assumed	.241	.624	-.490	304.0	.625
10. I am prepared to go to college	Equal variances assumed	1.543	.215	.114	304.0	.910

Table 4.15

Descriptive Statistics of PLAN Controlled Sample - SPS

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	1. I enjoy attending high school	3.90	.970	.151	41	1	5
Traditional		3.62	.870	.096	82	1	5
Gatton	2. My courses are challenging	4.02	.880	.137	41	2	5
Traditional		3.73	.832	.092	82	2	5
Gatton	3. My classes are meaningful	3.90	.768	.120	41	2	5
Traditional		3.65	.894	.099	82	2	5
Gatton	4. I get good grades in my classes	4.05	.740	.116	41	2	5
Traditional		4.41	.666	.074	82	3	5
Gatton	5. I am involved in extracurricular activities	4.00	.837	.131	41	2	5
Traditional		4.01	1.036	.114	82	1	5
Gatton	6. I am a designated leader in the activities I do	3.10	1.044	.163	41	1	5
Traditional		3.29	1.071	.118	82	1	5
Gatton	7. I have good relationships with my peers	4.02	.758	.118	41	1	5
Traditional		4.38	.536	.059	82	3	5
Gatton	8. I have good relationships with my teachers	3.80	.715	.112	41	2	5
Traditional		4.32	.701	.077	82	1	5

(continued)

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	9. I have good relationships with the administration	4.07	.905	.141	41	1	5
Traditional		4.06	.851	.094	82	1	5
Gatton	10. I am prepared to go to college	4.27	.975	.152	41	1	5
Traditional		4.39	.750	.083	82	2	5

The independent t-test results for the PLAN controlled sample for the SPS are found in Table 4.16.

For the PLAN controlled sample, on average, the Gatton group had higher means for questions 1, 2, 3, and 9 than the Traditional group. The Traditional group had higher means for question 4, 5, 6, 7, 8, and 10 than the Gatton group. The differences for questions 4, 7, and 8 were significant with $t(104) = -2.983$, $p < .05$; $t(104) = -2.717$, $p < .05$; and $t(104) = -3.395$, $p < .05$, respectively.

Matched pair analysis for SPS (Q3)

The descriptive statistics for the matched pairs are found in Table 4.17. The independent t-test results for the matched pair sample are found in Table 4.18.

For the matched pair sample, on average, the Gatton group had higher means for questions 1, 2, 3, and 5 than the Traditional group. The Traditional group had higher means for question 4, 6, 7, 8, 9, and 10 than the Gatton group. The differences for questions 3, 4, 7, and 8 were significant with $t(46.3) = 2.111$, $p < .05$; $t(52) = -3.310$, $p < .05$; $t(52) = -2.427$, $p < .05$; and $t(52) = -2.049$, $p < .05$, respectively.

Table 4.16

Independent Sample Tests on PLAN Controlled Sample - SPS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
1. I enjoy attending high school	Equal variances assumed	.026	.872	1.821	104	.071
2. My courses are challenging	Equal variances assumed	.055	.815	1.532	104	.129
3. My classes are meaningful	Equal variances not assumed	4.800	.031	1.864	93.6	.065
4. I get good grades in my classes	Equal variances assumed	1.191	.278	-2.983	104	.004
5. I am involved in extracurricular activities	Equal variances assumed	3.348	.070	-.162	104	.871
6. I am a designated leader in the activities I do	Equal variances assumed	.833	.363	-.849	104	.398
7. I have good relationships with my peers	Equal variances assumed	2.046	.156	-2.717	104	.008
8. I have good relationships with my teachers	Equal variances assumed	.163	.687	-3.395	104	.001
9. I have good relationships with the administration	Equal variances assumed	.095	.758	-.022	104	.983
10. I am prepared to go to college	Equal variances assumed	.827	.365	-.685	104	.495

Table 4.17

Descriptive Statistics of Matched Pairs - SPS

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	1. I enjoy attending high school	3.78	.892	.172	27	2	5
Traditional		3.44	1.086	.209	27	1	5
Gatton	2. My courses are challenging	4.11	.801	.154	27	2	5
Traditional		3.70	.869	.167	27	2	5
Gatton	3. My classes are meaningful	3.93	.675	.130	27	3	5
Traditional		3.44	.974	.187	27	2	5
Gatton	4. I get good grades in my classes	3.89	.698	.134	27	2	5
Traditional		4.52	.700	.135	27	3	5
Gatton	5. I am involved in extracurricular activities	4.00	.877	.169	27	2	5
Traditional		3.89	1.251	.241	27	1	5
Gatton	6. I am a designated leader in the activities I do	3.00	1.144	.220	27	1	5
Traditional		3.26	1.228	.236	27	1	5
Gatton	7. I have good relationships with my peers	3.96	.854	.164	27	1	5
Traditional		4.44	.577	.111	27	3	5
Gatton	8. I have good relationships with my teachers	3.70	.724	.139	27	2	5
Traditional		4.15	.864	.166	27	1	5

(continued)

Type of School	Measure	*M*	*SD*	*SE*	*N*	*Min*	*Max*
Gatton	9. I have good relationships with the administration	3.96	1.018	.196	27	1	5
Traditional		4.00	.961	.185	27	1	5
Gatton	10. I am prepared to go to college	4.26	.944	.182	27	1	5
Traditional		4.41	.750	.179	27	2	5

Conclusion

From the analysis of the students from Gatton Academy and four local traditional high schools, the three research questions were addressed across the three phases utilizing descriptive statistics and independent t-tests. The *t*-tests were used to determine statistical significance between the appropriate means.

For the first question, "Are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT)", the analysis revealed that the Gatton Academy students had significantly higher scores for the PLAN, ACT, and GPA than the whole group sample. Since the intention was to use the PLAN as a control variable to align the two groups, a second group was designed which accounted for all students who scored at least a 21 on the PLAN. For that set, the analysis revealed that Gatton Academy students had significantly higher scores still on the PLAN as well as the ACT. The traditional group scored significantly higher on GPA.

Even with the alignment of a 21 composite on the PLAN, there were distinct differences in the clustering and distribution of PLAN scores between the two groups. To address this discrepancy, matched pairs were created to align the PLAN scores fully. Gender was also used so that each pair had the same PLAN score and the same gender. In the matched pair

Table 4.18

Independent Samples Test for Matched Pair Sample - SPS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
Measure	Equal Variance Factor	F	Sig.	t	df	Sig. (2-tailed)
1. I enjoy attending high school	Equal variances assumed	1.530	.222	1.233	52	.223
2. My courses are challenging	Equal variances assumed	.915	.343	1.792	52	.079
3. My classes are meaningful	Equal variances not assumed	7.439	.009	2.111	46.3	.040
4. I get good grades in my classes	Equal variances assumed	1.385	.245	-3.310	52	.002
5. I am involved in extracurricular activities	Equal variances not assumed	4.906	.031	.378	46.6	.707
6. I am a designated leader in the activities I do	Equal variances assumed	.960	.332	-.803	52	.426
7. I have good relationships with my peers	Equal variances assumed	.464	.499	-2.427	52	.019
8. I have good relationships with my teachers	Equal variances assumed	.000	.985	-2.049	52	.046
9. I have good relationships with the administration	Equal variances assumed	.005	.945	-.137	52	.891
10. I am prepared to go to college	Equal variances assumed	.026	.872	-.581	52	.564

group, the analysis revealed that while the ACT scores were higher for the Gatton students, they were not statistically significant. The GPAs for the traditional students was significantly higher than the Gatton students' GPAs. For the second question regarding the SSI scores, the same three groupings were utilized. For the whole group sample, three factors were found to be significant: Probability of Retention (PR), Probability of Academic Success (PAS), and Social Comfort (SC). The Gatton students scored higher in PR and PAS whereas the traditional students scored higher in SC. Analysis on the PLAN controlled sample revealed that only PAS and SC were significantly different between the two groups with Gatton students scoring higher on PAS and lower on SC. For the matched pair sample, the only factor determined to be significant was that traditional students scored higher in SC.

For the third question that addressed student perception as reported on the SPS, the same three groupings were analyzed. For the whole group sample, Gatton students responded significantly higher on question 2: "My courses are challenging". The traditional students responded significantly higher for question 4: "I get good grades in my classes", question 7: "I have good relationships with my peers", and question 8: "I have good relationships with my teachers". For the PLAN controlled sample, the traditional students continued to respond significantly higher on questions 4, 7, and 8. For the matched pair sample, the traditional students once again responded significantly higher on questions 4, 7, and 8. The Gatton students responded significantly higher on question 3: "My classes are meaningful to me".

A full discussion on the results and the implications of these analyses will be addressed in the next chapter.

CHAPTER V: DISCUSSION

Introduction

The purpose of this study was to assess whether there are distinct differences between high ability students from the Gatton Academy and traditional high schools in the areas of academic achievement, college readiness, and perception of their high school experience. This study focused on these three research questions:

1. Are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT)?
2. Are there between-group differences in how students report on a college readiness inventory (SSI)?
3. Are there between-group differences in how students perceive their high school experience?

The results of the analysis are discussed in the following section.

Discussion of Findings

Discussion of Research Question 1

Based on the analysis of the results of research question 1, are there between-group differences of academic achievement in the areas of grade point average and standardized test scores (ACT), Table 5.1 shows the areas that were statistically significant in each of the three phases. From the analysis of the results of these questions, the following areas of discussion arose as substantial issues of focus.

Table 5.1

Areas of Statistically Significance for Research Question 1

Academic Achievement	Whole Group		PLAN Controlled		Matched Pairs	
	Gatton	Traditional	Gatton	Traditional	Gatton	Traditional
PLAN	Sig. Higher		Sig. Higher		NSD	
ACT	Sig. Higher		Sig. Higher		NSD	
GPA	Sig. Higher			Sig. Higher		Sig. Higher

GPA

In attempting to define what academic achievement includes, GPA was one of the elements that is most often used. The results from all three phases of sampling revealed significant differences. However, there was a substantial issue of comparable data regarding weighted and unweighted GPA. In the process of collecting GPAs from the local schools, it was discovered that each of the local schools reported only weighted GPAs. Access to students' full transcript was difficult, so unweighted GPAs for the traditional students were not possible to attain. To compound the issue, each school used a different formula for weighting grades. For instance, the Gatton Academy weighs every course that is considered a core subject. This creates a higher potential GPA than most schools on a 4.0 scale. For the purpose of this study, the unweighted GPA for Gatton was chosen to see what the difference might be with the typical GPA reported by traditional schools (Table 4.1 shows both unweighted and weighted GPAs for Gatton students). In the comparison of GPAs in the matched pair sample, the traditional students were significantly higher. However, if the Gatton scores were adjusted to weighted, Gatton GPAs would be

significantly higher than traditional students. So, while there is some reasonable similarity in GPAs, any conclusions regarding GPAs cannot be legitimately made from the data collected for this study.

ACT

Another measure of academic achievement often used is standardized test scores from ACT. In this study, to minimize other variables, only the March 2011 test data were used for all students. This particular test date encompasses all students who were juniors enrolled in a Kentucky public school because it is the mandated test used by the state for accountability. As such, the students in the whole sample would have taken the same version in the same time frame.

Across all three sample phases, the Gatton students had, on average, higher ACT composite scores. However, when analyzing the matched pair sample which accounted for many of the extraneous variables, the difference in the means between the two groups (M_G = 29.74 vs. M_T = 29.11) was not statistically significant. Therefore, no conclusive statement can be made as to whether there is a difference in how students score on this assessment.

Discussion of Research Question 2

Based on the analysis of the results of research question 2, "Are there between-group differences in how students report on a college readiness inventory (Student Strengths Inventory (SSI))", Table 5.2 shows the areas that were statistically significant in each of the three phases. The crux of research question 2 focused on how student responded on The Student Strengths Inventory. The SSI was designed to evaluate how students compare on non-cognitive factors determined to be significant for success in

completing a college degree. In addition, from the students' self-reported demographics and ACT scores, probabilities of academic success and retention were determined. Once again, using the matched pair sample as the more accurate comparison, there were differences across many of the domains. The only statistically significant area was in social comfort where Gatton students scored lower than traditional students were. This result was consistent across all three samples indicating that this factor may be substantiated in a much broader population.

Table 5.2

Areas of Statistically Significance for Research Question 1

SSI	Whole Group		PLAN Controlled		Matched Pairs	
	Gatton	Traditional	Gatton	Traditional	Gatton	Traditional
Probability of Retention	Sig. Higher		NSD		NSD	
Probability of Academic Success	Sig. Higher		NSD		NSD	
Academic Engagement	NSD		NSD		NSD	
Academic Self-efficacy	NSD		NSD		NSD	
Campus Engagement	NSD		NSD		NSD	
Educational Commitment	NSD		NSD		NSD	
Resiliency	NSD		NSD		NSD	
Social Comfort		Sig. Higher		Sig. Higher		Sig. Higher

The social comfort score was determined from questions such as “I avoid social events”, “I am comfortable in groups”, and “I enjoy meeting new people”. Analysis of these questions and the scores that were generated might indicate that Gatton students tend to be more introverted and prefer to be more independent. Likewise, there could be some correlation between students who chose to leave their home school for a program like the Gatton Academy and how comfortable those students were with their peers from their home school. A lack of social comfort might have been a factor in a student’s willingness to seek another academic opportunity.

From the literature, Olszewski-Kubilius (2010) delineated some factors that align with these findings. She mentions that residential programs “provide students access to true intellectual peers on a full-time basis” and “can really foster the development of friendships and a peer group”. A question arises in whether the Gatton experience influences social comfort to a higher level or whether it may actually decrease it in light of their traditional peers.

While no other factors were statistically significant at $p < .05$, two factors would have been at $p < .10$, academic engagement and campus engagement. Gatton students scored higher in academic engagement and lower in campus engagement than the traditional students. The academic engagement factor is indicative of work ethic and the level of study skills employed by students. The difference may be due to the level of rigor required for college courses as compared to typical high school courses. Regarding campus engagement, this may be another reflection of how comfortable students are socially and the impact that would have on involvement in social organizations and group activities.

Discussion of Research Question 3

Based on the analysis of the results of research question 3, "Are there between-group differences in how students perceive their high school experience", Table 5.3 shows the areas that were statistically significant in each of the three phases.

Table 5.3

Areas of Statistically Significance for Research Question 3

SPS	Whole Group		PLAN Controlled		Matched Pairs	
	Gatton	Traditional	Gatton	Traditional	Gatton	Traditional
1. I enjoy attending high school	NSD		NSD		NSD	
2. My courses are challenging	Sig. Higher		NSD		NSD	
3. My classes are meaningful	NSD		NSD		Sig. Higher	
4. I get good grades in my classes	NSD	Sig. Higher		Sig. Higher	NSD	Sig. Higher
5. I am involved in extracurricular activities	NSD		NSD		NSD	
6. I am a designated leader in the activities I do	NSD		NSD		NSD	
7. I have good relationships with my peers		Sig. Higher		Sig. Higher		Sig. Higher
8. I have good relationships with my teachers		Sig. Higher		Sig. Higher		Sig. Higher
9. I have good relationships with the administration	NSD		NSD		NSD	
10. I am prepared to go to college	NSD		NSD		NSD	

In regards to relationships with peers as well as teachers, on average, traditional students respond that they strongly agree that they have good relationships with peers and teachers. Gatton students tend to be more between “not sure” and “agree”. This might imply that Gatton students have fewer relationships with peers and teachers than they might at a traditional school. It is conceivable that it is more difficult to get to know college instructors and professors than it would be the traditional classroom teacher. Also, these results seem to align with the Social Comfort factor from the SSI.

In the matched pair sample, one other area showed significant difference. Students from Gatton reported more frequently that their classes were meaningful to them. It could be inferred that students perceive college courses as being more important and having greater value than typical high school courses. These findings link with the work of Thomas and Love (2002) in which they found that non-residential students in their first year in college found the course work to be much more academically challenging. With Gatton students taking solely college courses, they would experience what these non-residential students did two years earlier.

Discussion of Crossover Results from All Research Questions

While the analysis of the differences between the two groups was the primary intention of the study, many common characteristics between the Gatton and traditional students became apparent. The entire sample can be described as students who have participated in advanced mathematics study as compared to the general population. By taking pre-calculus or higher, these students have a stronger preparation path for collegiate level courses, particularly in terms of mathematics and science. As such, particular results reveal patterns among this level of student.

In terms of academic achievement, the mean scores for GPA, whether weighted or not, shows strong academic success in coursework. The mean score for the total sample was 3.54. With the PLAN controlled group, the mean GPA was 3.78 for the combined groups. This level of excellence shows strong academic performance for students scoring 21 or higher on the PLAN. From this data it could be concluded that the PLAN test does appear to be a good predictor for academic success.

With the SSI, the six areas were normed with a broad group of college and high school students (N = 8000). In the areas measured by the SSI, on average, all students in both groups had a higher response on Academic Self-Efficacy (M = 63) than the normed mean (M = 50). Another area of interest was the Probability of Retention. This index measures the probability that a student will return for the second year of college. Analyzing the PLAN controlled sample, the combined group mean was 73.45. The reverse statement of this would be that there is a 26.55% chance that these students might not return for the 2nd year. This value corresponds strongly with the national attrition rate of college freshmen across the board of 26.7% (ACT, 2011). This suggests that despite strong academic capacities, student retention rates are greatly impacted by other factors such as campus engagement and social comfort.

Analysis of the SPS, in light of the whole sample, reveals that, in general, these students believe they have good relationships with their peers, their teachers, and the administration. These students also indicate that they moderately enjoy attending school (M = 3.83 on a 5 point Likert scale). One factor that may have impacted this score is the phenomenon of senior year fatigue that afflicts many students in their last year. Another substantial revelation from the whole data is the low responses in regards to how students

see themselves as leaders. The question asked students to respond on the range from Never to Always to the question, “I am a designated leader in the activities I do (officer, team captain, or other titles)”. The mean score for the whole group was lower than expected across all groups (M_W = 3.26, M_P = 3.23, and M_M = 3.13, respectively). This score indicates that these students only sometimes are the designated leaders. This may be another correlated effect to the low social comfort reported by these students.

Implications

Implications from Research Question 1

While there are no conclusive differences in academic achievement on the ACT statistically, students from the Gatton Academy perform at least as high as their matched pairs in the first year of being in the program. This suggests that the academic environment provides sufficient academic support for students to continue to achieve at least at the same high levels as do their counterparts in the traditional high schools. With the addition of research opportunities, international travel, opportunities to present locally and nationally, and transitional residential living experiences, the academic experiences may be enhanced more than the typical high school pathway.

Conversely, the data suggests that high ability students are achieving similarly as students from specialized secondary schools. From a strictly academic perspective, high ability students seem to achieve the same levels of performance on the ACT independent of their high school program. This raises another question of whether both programs are equal contributors to a student’s academic achievement in regard to standardized testing or are students of this caliber likely to score high coming from any environment.

One other factor to be considered is the actual use of the PLAN/ACT pairing. The Pearson correlation coefficient for these two scores for the matched pair sample was .91, which is a very strong correlation. If the tests are mapped to each other so strongly, it might be difficult to see significant differences between the two groups if they are being initially paired by the PLAN score. As such, the difference between the scores (M_G = 29.74 vs. M_T = 29.11) may take on greater significance. If so, there could be some causal inferences based on the difference in programs.

Implications from Research Question 2 and Question 3

Both research questions 2 and 3 focus on affective components of a student's high school experience. Dealing with the social and emotional dynamics impacting students is critical for helping young people be successful holistically. One implication from these results is that students attending residential specialized secondary schools may need additional support in developing relationships and becoming more socially comfortable. Realizing the importance of teamwork and interacting socially in most work places, these students would be at a disadvantage unless they increase their skill levels in communication, empathy, and leadership. Intentional programming to teach social and emotional intelligence would be beneficial for students in these situations.

From research question 3, the SPS reveals that relationships with peers are lower in comparison to their traditional school counterparts. Implied from this data, students at the Gatton Academy may be more independent or introverted. The nature of the academy is to select students who are some of the more advanced students in their home schools. Often these students are emotionally isolated from their peers or sometimes ostracized. Coming to the academy allows many students to start in a fresh environment. In one year, it may be

difficult to determine if this level of awkwardness in relationships will improve with another year in the program.

Limitations of Study

This study must be viewed in light of several limitations. First, in regard to the broader community of specialized programs and traditional high schools, the sample is very narrow. It would be very difficult to generalize across the whole spectrum of schools given that all of the selected schools are from one community. Another factor is the relatively small size of the Gatton Academy. Only having 41 qualifying seniors to assess limits the depth of the study. Additionally, the size of the matched pair sample only included 27 pairings. While this is statistically acceptable, a larger sampling would certainly provide stronger results.

Second, the scope of time on this study is very small. The data from the PLAN and ACT is determined within a year of each other. The Gatton students would have only been in the academy for a total of 8 months prior to taking the March ACT. This is a relatively short window of time to assess the impact of the difference in instruction. Similarly, the difference in time in each group for the other factors is only a year and a half in contrast to the 11 years of common schooling.

Third, the complexity of the determination of grade point averages disallows any meaningful interpretation of the collected GPA data in this study. Depending on the format used, the mean scores could shift above or below each other making it impossible to have an equitable comparison. Unweighted GPAs would be the desired data but even then the impact of grade inflation and different grading scales minimizes the true comparability of the data.

Fourth, even with close alignment of PLAN scores and gender, many non-cognitive factors that were not measured in the study such as work ethic, family influence, socioeconomic status, and level of determination may have substantial impact on how students perform and respond. Other factors that would lead a student to choose a residential program but would be difficult to determine could significantly influence how students respond or perform.

Recommendations for Future Research

Since the integration of specialized secondary schools is relatively new in the educational arena, there are multiple areas for needed research. From this study, several extensions or new directions for research are possible. For research question 1, a deeper study on academic performance using data from the full two year experience would be beneficial. In addition, looking at unweighted grade point averages would give a much truer look at how students may differ academically.

Similarly, another area that could be explored is how does authentic research opportunities impact academic performance as well as college readiness and career choice. A case study or a qualitative examination of students who participate in research while in high school is needed to add credence to the belief that these types of opportunities greatly enhance a student's high school preparation.

Questions 2 and 3 could be taken further by looking at how these non-cognitive factors extend into the first few years of the students' college experiences. It would be beneficial to see how students' relationship and leadership skills differ after completing each type of educational experience. A study that followed these students longitudinally would also provide greater strength to this research.

Above and beyond the results of this study, a broader study across several specialized secondary schools would benefit the academic community. Utilizing matched pairs from the accompanying states would provide insight into whether high ability students respond similarly in various locations. This may help answer questions regarding how universal is student achievement across the country.

Focusing on the impact of specialized secondary schools, it would be helpful to do more longitudinal research on the career pathways these students pursue and how these choices may differ from traditional students. Similarly, further research is needed on how the residential aspect of some of the specialized secondary schools influences the success of a postsecondary experience. Does the early opportunity to have a residential experience with a supportive climate create a better transition to the collegiate environment?

Conclusion

Throughout the history of the United States, secondary education has been evolving. From the days of Latin grammar schools and academies to the comprehensive high schools and specialized secondary schools, people have discussed, debated, and restructured the fabric of what a high school education should be. Presently, the nation is once again faced with how to reform secondary education to meet the needs of 21st Century society and the demands it creates. This study was designed to look at a small segment of this dialogue, specifically, the impact of a residential STEM school on high ability adolescents. Through three research questions focusing on academic achievement, college readiness factors, and student perceptions of their high school experience, students from the Gatton Academy were compared to high ability students from four local traditional high schools to determine if any differences existed.

The results from this study show several things. In terms of academic achievement, GPAs do differ. However, because there is inequity in the way GPAs are determined, no conclusion can be made accurately. Regarding ACT scores, the results show that Gatton students do score slightly higher than the comparison group, but it is not statistically significant. It warrants additional study to see if this result would be more substantial with scores from the end of the senior year.

In terms of college readiness, both groups show strong probabilities of academic success in the first year of college and the likelihood of returning the second year in college with no significant differences between the groups. However, Gatton students scored substantially lower in the area of social comfort. This could be further studied to determine if this is characteristic of the type of student who would choose to attend a residential program. While not statistically significant at the .05 level, two other areas were moderately different, academic engagement and campus engagement. Gatton students scored higher in academic engagement while the traditional students scored higher in campus engagement. The difference in campus engagement could be associated with the level of social comfort.

Finally, in regards to the student perceptions, Gatton students responded more strongly that their course work was challenging and meaningful than the other group. The traditional students indicated that they had good grades and had good relationships with peers and teachers at a higher response level than Gatton students. From the academic standpoint, these results may suggest a difference in the rigor of the work between the two styles of schools. Additionally, in terms of the relationship questions, this possibly connects with the results on social comfort from the SSI.

In the analysis of the final results, the question of whether the pathway of a residential STEM school is more academically beneficial is inconclusive. The data indicates that the students are at least performing at the same level as high ability students from traditional schools. However, the results also suggest that there are social and psychological differences that may need to be addressed as well. Further research is certainly warranted to determine if the differences in these types of schools have longitudinal impact on student success in post-secondary education and career choices.

In a relatively new era of specialized secondary schools, many additional research projects will be needed to evaluate the strength and effectiveness of these programs. These research projects would serve to evaluate various aspects of secondary education including appropriate practices for teaching high ability students, principles in the development of new programs for students, and rationales for efficient use of educational funding. As the nation moves forward in determining what the next generation of learners needs, it is imperative to assess what is working and what is not.

REFERENCES

ACT. (2007). *The ACT technical manual*. Retrieved from www.act.org/aap/pdf/ACT_Technical_Manual.pdf.

ACT. (2011). *ACT Institutional Data File.* Retrieved from https://act.org/research/policymakers/pdf/retain_2011.pdf.

Amini, M. (2005). Identifying stressors and reactions to stressors in gifted and non-gifted students. *International Education Journal*, *6*(2), 136-140.

Andrews, H., & Davis, J. (2003). When high school is not enough. *American School Board Journal*, *190*(8), 38-39.

AP. (2011, October). Retrieved from http://www.collegeboard.com/student/testing/ap/about.html.

Barak, M. (2008). Concurrent high school-university studies as a route to higher education. *Educational Research and Reviews*, *3*(1), 14-22.

Boazman, J. (2010). Well-being and academic success in gifted college students: Early-college entrants and honors college students. Ph.D. dissertation, University of North Texas, United States -- Texas. Retrieved August 11, 2011, from Dissertations & Theses: Full Text. (Publication No. AAT 3448580).

Chen, C. (2010). *Numbers and types of public elementary and secondary schools from the common core of data: School year 2009–10* (NCES 2011-345). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch.

Copa, G, & Pease, V. (1992). *The comprehensive high school: An historical perspective* (V051A80004-92A). Washington, DC: Office of Vocational and Adult Education, National Center for Research in Vocational Education.

Cornett, L. (1986). *Improving student preparation: higher education and the schools working together*. Atlanta, GA: SREB.

Cross, T. (2010). *Current research on the social and emotional development of gifted students*. Gatton Academy Summer Retreat. Leitchfield, KY.

Department of the Interior Bureau of Education. (1918). *Cardinal principles of secondary education*. Washington: Government Printing Office. Retrieved from http://www.archive.org/details/cardinalprincipl00natiuoft.

Dounay, J. (2006). *Advanced placement. ECS policy brief: High school--advanced placement* (ED490987). Denver, CO.

Executive Office of the President, President's Council of Advisors on Science and Technology. (2010). *Prepare and inspire: K-12 education in science, technology, engineering, and math (stem) for America's future*. Washington D.C.: Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf.

Friedman, T. (2005). *The world is flat*. New York, NY: Farrar, Staus and Giroux.

Gatton Academy. (2011). *School Profile*. Retrieved from www.wku.edu/academy.

Gleason, P., Clark, M., Tuttle, C. C., and Dwoyer, E. (2010). *The evaluation of charter school impacts: Final report* (NCEE 2010-4029). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Green, J. (1993). *State academies for the academically gifted. Fastback 349*. Bloomington, IN: Phi Delta Kappa Educational Foundation.

Greer, T. (2010). *The status of the Advanced Placement program in Indiana as of 2006*. Ph.D. dissertation, Ball State University, United States -- Indiana. Retrieved August 11, 2011, from Dissertations & Theses: Full Text. (Publication No. AAT 3438763).

Hoekman, K., McCormick, J., & Gross, M. (1999). The optimal context for gifted students: a preliminary exploration of motivational and affective considerations. *Gifted Child Quarterly*, *43*(3), 170-193.

Hughes, K., Karp, M., Fermin, B., & Bailey, T. (2005). *Pathways to college: Access and success* (ED497055). Jessup, MD: ED Pubs.

Kentucky Department of Education. (2011). *Pre-College curriculum*. Retrieved from http://www.education.ky.gov.

Kentucky Department of Education. (2011, September 22). *PLAN assessment*. Retrieved from http://www.education.ky.gov.

Klein, A. (2007). Acceleration under review. *Education Week*, *26*(44), 22-24.

Koszoru, J. (2005). When a high school goes to college. *English Journal*, *94*(6), 25-30.

Krueger, C. (2006). *Dual enrollment: Policy issues confronting state policymakers*. Denver, CO: ECS Distribution Center.

Lee, S., & Olszewski-Kubilius, P. (2006). The emotional intelligence, moral judgment, and leadership of academically gifted adolescents. *Journal for the Education of the Gifted*, 30(1), 29-67.

McCarthy, C. (1999). Dual-enrollment programs: Legislation helps high school students enroll in college courses. *Journal of Secondary Gifted Education*, *11*(1), 24-32.

National Association of Secondary School Principals. (2002). *Breaking ranks*. Reston, VA.

National Commission on Excellence in Education, (1983). *A nation at risk: The imperative for educational reform*. Washington DC: U.S. Government Printing Office.

National Consortium of Specialized Secondary Schools in Mathematics, Science, and Technology. (2011, October 7). *Overview.* Retrieved from http://www.ncsssmst.org/overview.aspx.

National Research Council. (2006). Rising above the gathering storm: Energizing and employing America for a brighter economic future. Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology. Washington, DC: National Academies Press.

Odell, C. (1939). *The secondary school*. Champaign, IL: The Garrard Press.

Olszewski-Kubilius, P. (2010). Special schools and other options for gifted stem students. *Roeper Review*, *32*(1), 61-70.

PLAN. (2007). *The PLAN technical manual*. Retrieved from www.act.org/aap/pdf/PlanTechnicalManual.pdf.

Plucker, J., Chien, R., & Zaman, K. (2006). *Enriching the high school curriculum through postsecondary credit-based transition programs. Education policy brief* (Volume 4, Number 2). Bloomington, IN: Center for Evaluation and Education Policy.

Report of the Committee of Ten. (1891). Paper presented at National Council of Education yearly meeting, New York, NY.

Schommer, M., & Dunnell, P. (1994). A comparison of epistemological beliefs between gifted and non-gifted high school students. *Roeper Review*, 16(3), 207-210.

Sherman Valentine, A. (2010). *Dual enrollment and Advanced Placement programs: A comparison of persistence, student academic achievement, graduation completion and time-to-degree attainment*. D.Ed. dissertation, Indiana University of Pennsylvania, United States -- Pennsylvania. Retrieved August 11, 2011, from Dissertations & Theses: Full Text. (Publication No. AAT 3403205).

Snyder, T., & Dillow, S. (2010). *Digest of Educational Statistics 2010* (NCES 2011-015). Washington, DC: U.S. Department of Education.

SSI. (2011, October 09). *Student strengths inventory*. Retrieved from www.studentstrengthsinventory.com/index.html.

Subotnik, R., Olszewski-Kubilius, P., & Worrell, F. (2011). Rethinking giftedness and gifted education: A proposed direction forward based on psychological science. *Psychological Science in the Public Interest*, *12*(1), 3-54.

Subotnik, R., Tai, R., Rickoff, R., & Almarode, J. (2010). Specialized public high schools of science, mathematics, and technology and the stem pipeline: What do we know now and what will we know in 5 years? *Roeper Review, 32*, 7-16.

Subotnik, R., Tai, R., & Almarode, J. (2011). *Study of the impact of selective smt high schools: Reflections on learners gifted and motivated in science and mathematics*. Unpublished manuscript.

Thomas, J., & Love, B. (2002). NCSSSMST longitudinal study of graduates: A three-year analysis of college freshmen & college seniors. *NCSSSMST Journal*, *7*(2), 4-8.

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

U.S. Congress. (2007). *America COMPETES act* (PL 110-69). Washington DC: Government Printing Office.

U.S. Department of Education. (2001). *Executive summary: NCLB*. Washington, DC: Retrieved from http://ed.gov/nclb/overview/intro/execsumm.html.

U.S Department of Education, (2009). *Race to the top executive summary*. Washington D.C. Retrieved from http://www2.ed.gov/programs/racetothetop/executive-summary.pdf.

U.S. Department of Education National High School Center. (2007). *Findings from the early college high school initiative: A look at best practices and lessons learned regarding a dual enrollment program*. (ED501071). Washington, DC: American Institutes for Research.

U.S. Department of Education Office of Innovation and Improvement. (2008). *Successful magnet high schools*. Washington, DC.

Van Tassel-Baska, J. (2001). The role of advanced placement in talent development. *Journal of Secondary Gifted Education, 12*(3), 126-132.

Weiss, S. (2005). *The progress of education reform 2005: Dual enrollment* (Volume 6, Number 3). Denver, CO: ECS.

Williams, J. (2010). *Early college academic performance: Studying the effects of earning college credits from Advanced Placement and dual enrollment*. Ed.D. dissertation, Temple University, United States -- Pennsylvania. Retrieved August 11, 2011, from Dissertations & Theses: Full Text. (Publication No. AAT 3390529).

Windham, P. (1998). High school and community college dual enrollment: Issues of rigor and transferability. *Journal of Applied Research in the Community College*, *5*(2), 111-115.

Wraga, W. (2000). *The comprehensive high school in the United States: A historical perspective*. Paper presented at Annual meeting of the American Educational Research Association. New Orleans, LA.

Appendix A: Student Assent Form

Student Assent Form

I, _____, understand that my parents have given permission for me to participate in the High School Experience and College Readiness Comparison study under the direction of Tim Gott, Director of the Gatton Academy.

My participation in this project is voluntary, and I have been told that I may stop my participation in this study at any time. If I choose not to participate, it will not affect my grade in any way.

Signature _____ Date _____

Appendix B: Parent Assent Form

INFORMED CONSENT DOCUMENT

For Parents/Guardians

Hello, my name is Tim Gott and I am the Director of the Gatton Academy of Mathematics and Science at WKU. Your son or daughter has been selected to participate in a research project that I am leading entitled **High School Experience and College Readiness Comparison** because she or he has been identified as a high ability student. The following information describes this project.

1. **Nature and Purpose of the Project:** This research project is designed to compare similar students from traditional high schools and students from the Gatton Academy to determine if students from these two types of programs have similar outcomes from their high school experience.

2. **Explanation of Procedures:** I will be meeting with groups of students and administering two surveys on student perceptions and college readiness as well as collecting ACT scores, PLAN scores, and grade point average. Upon total completion of the surveys by all students, a follow up meeting to discuss the results with students will be conducted.

3. **Discomfort and Risks:** No anticipated physical risks will be involved. It is possible that there may be nominal psychological stress from questions that ask about future decision-making regarding post-secondary options.

4. **Benefits:** Students will get feedback on how they rate on a national college readiness profile as well as receive suggestions on how to be successful at the collegiate level.

5. **Confidentiality:** All student data will be coded so that after the results are returned to students, no identifying information for individual students will be maintained.

6. **Refusal/Withdrawal:** All participation is strictly voluntary. A student may opt out at any time in this process with no impact on grades.

If you have any questions or concerns, feel free to contact me at tim.gott@wku.edu or 270-307-0135.

OPT OUT option

If you would prefer that your student not participate, please sign below and return to your student's math classroom within five "business" days of receiving this form. You only need to return this form if the student will be opting out.

Student Name_____

Parent/Guardian Name_____

Parent/Guardian Signature _____

Appendix C: SSI Survey

Directions: Below are statements that describe various attitudes, opinions, and behaviors. Read each statement carefully and indicate how well it describes you by darkening the appropriate circle preceding the statement. The circles are numbered to form a scale from 1 to 6, where 1 means you strongly disagree and 6 means you strongly agree.

Strongly Disagree ↓ Strongly Agree ↓

1. I will succeed in my chosen major.
2. I sometimes skip classes.
3. I intend to seek volunteer or service learning experiences in college.
4. I am comfortable in groups.
5. I am a pretty calm person.
6. Getting a college degree is very important to me.
7. If I was offered a good job, I might not finish college.
8. I tend to work well with others.
9. I find it hard to relax.
10. It is important for me to be involved in the school I am attending.
11. I often go to class without being fully prepared.
12. I am willing to do whatever it takes to stay in college.
13. I manage stress well.
14. I am confident that I will excel in college.
15. Little things upset me.
16. I consider myself to be shy.
17. I am a worrier.
18. I will be able to complete college English requirements with a B or better.
19. I am confident I can maintain a B average in college.
20. I plan to take part in many campus social activities.
21. I never know what to say when meeting new people.
22. Getting good grades is important to me.
23. Graduating from college is necessary for me to achieve my career goals.
24. I wait until the last moment to get my assignments done.
25. I will be able to complete college math requirements with a B or better.
26. I will participate in orientation activities to learn about the college I attend.
27. I see value in completing a college education.
28. I am easily frustrated.
29. I intend to join campus clubs.
30. I get to school on time.
31. I strive for excellence in all of my school work.
32. I enjoy meeting new people.
33. I avoid social events.
34. I am quick to react emotionally.
35. I am confident that I will succeed in college.
36. I want to feel a part of the college I attend.
37. I plan to take on campus leadership roles when I'm in college.
38. I rarely get anxious.
39. Being active in extra-curricular activities in college is important to me.
40. School is a priority for me.
41. I will excel in my chosen major.
42. I have many friends.
43. I find it easy to talk with strangers.
44. I waste a lot of time before settling down to do my homework.
45. My parents often have to remind me to do my homework.
46. I turn my homework in on time.
47. I will be able to complete college science requirements with a B or better.
48. I am sure that a college education is the right goal for me.

Custom Items **Statements provided by administrator.**

49. 51. 53. 55.
50. 52. 54. 56.

Appendix D: SSI report

THE GATTON ACADEMY
OF MATHEMATICS AND SCIENCE IN KENTUCKY

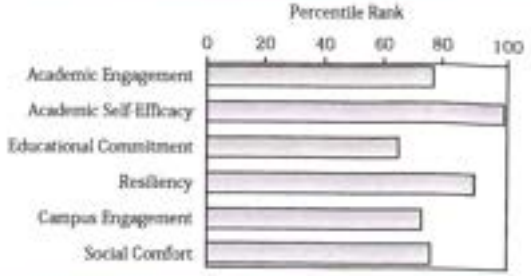
Student Strengths Profile℠ *Advisor Report*

Name: GOTT, TIM ID Number: 800009387

Student Success Indices

Probability of Retention	*80*
Probability of Academic Success	*95*

Success Indices are based on colleges and universities with widely varying retention rates and academic expectations. Use caution when interpreting these values at your institution.



Academic Self-Efficacy

Your confidence that you can achieve academically and succeed in college

99 - High

Your responses suggest that you are very confident in your ability to be a successful college student. You believe that you can attain a high grade point average in required courses as well as perform well in your major. Having high confidence in your academic abilities is a valuable asset and will support your efforts to be successful in college and beyond.

What's Next?

- Continue to challenge yourself to set high performance goals.
- If your performance falls short of your expectations talk with your counselor or teachers about the outcome.

Resiliency

Your approach to challenging situations and stressful events

90 - High

Your responses suggest that you have a relaxed and positive approach to managing challenging situations. You probably possess a range of effective coping strategies and you do not generally overreact to problems. Students with high scores such as yours are effective problem solvers and are not easily derailed in obtaining their goals.

What's Next?

- Find leadership opportunities to further enhance your problem solving or organizational skills.
- Expand your coping strategies, for example a new exercise program or music lessons.

Academic Engagement

Your commitment to school work and the value you place on academics

77 - High

Your responses indicate that you take school work very seriously. You are conscientious and responsible about completing your assignments and attending classes. Strong academic performance is important to you. If you ever experience any trouble with coursework or completing work on time talk with your professors or advisors to get back on track.

What's Next?

- Consider volunteering to tutor other students at your school.
- Talk with your teachers about getting involved in research or service projects.

AEO ASEO ECO RO CEO SCO TOTO

Assessment Date: 09/23/2010 Group Code: 1

Social Comfort

Your comfort in social situations and ability to communicate with others

76 - High

Your responses suggest that you are comfortable around people and find socializing with others enjoyable. You may find it easy working in groups. These skills serve you well as you are able to build connections and a social network to support your educational goals. You may consider activities that take advantage of your social skills such as leadership positions on campus.

What's Next?

- Seek leadership positions in groups or organizations that will further build your skills.
- Explore people oriented roles on campus.

Campus Engagement

Your involvement in campus activities and your connection to your school

73 - Moderate

Your responses suggest that you value becoming involved in campus activities. You may enjoy participating in campus clubs or volunteer activities. Campus involvement offers many benefits - both now and as you apply for jobs in a few years. Consider getting involved by researching opportunities your campus has to offer.

What's Next?

- Contact theguidance office to learn about the many groups and organizations at your school.
- Talk with your teachers about academic or professional organizations in your field of study.

Educational Commitment

Your dedication to obtaining a college degree

65 - Moderate

Your responses indicate that you are moderately committed to the goal of attaining a college degree. You believe college is somewhat important for your future and that a college degree might further your career goals.

What's Next?

- Talk with your counselor to identify potential occupations for individuals with a college degree.
- Speak with your teachers or individuals in your field(s) of interest about the value of a college education.

Next Steps

Use Your Strengths

- Your skills will help you achieve college and workplace success.
- Find opportunities to further develop these skills and to apply them at school and in your community.

Look for Opportunities to Improve

- Low scores are an opportunity for growth.
- Identify strategies to improve areas with low to moderate scores.

Identify Your Resources

- There are many resources on and off campus that can help you succeed.
- Take advantage of resources such as your academic advisor, professors, RA, friends and family, the tutoring center, recreation services, campus clubs and organizations, and the career center.

Personal Development Plan

Students with specific goals are more likely to attain positive outcomes. Use the space below to set achievable goals.

I will . .

1. _____
2. _____
3. _____
4. _____

Appendix E: SPS

Student Perception Survey

The following questions are intended to evaluate your overall experiences in high school. While some questions may have a slightly different scale in wording, the format is the same:
1 is the lowest score and 5 is the highest.

1.	I enjoy attending high school.	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
2.	My courses are challenging.	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
3.	My classes are meaningful to me.	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
4.	I get good grades in my classes.	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
5.	I am involved in extracurricular activities (sports, clubs, or service organizations).	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
6.	I am a designated leader in the activities I do (officer, team captain, or other titles).	1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
7.	I have good relationships with my peers.	1 Strongly Disagree	2 Disagree	3 Not Sure	4 Agree	5 Strongly Agree
8.	I have good relationships with my teachers.	1 Strongly Disagree	2 Disagree	3 Not Sure	4 Agree	5 Strongly Agree
9.	I have good relationships with the administration.	1 Strongly Disagree	2 Disagree	3 Not Sure	4 Agree	5 Strongly Agree
10.	I am prepared to go to college.	1 Strongly Disagree	2 Disagree	3 Not Sure	4 Agree	5 Strongly Agree