ABSTRACT OF CAPSTONE

Paul David Green

The Graduate School

Morehead State University

March 28, 2016

# APPALACHIAN TECHNOLOGY INITIATIVE

Abstract of capstone

A capstone submitted in partial fulfillment of the
Requirements for the degree of Doctor of Education in the
College of Education
At Morehead State University

By

Paul David Green

Booneville, Kentucy

Committee Chair: Dr. Michael W. Kessinger, Assistant Professor

Morehead, Kentucky

March 28, 2016

ABSTRACT OF CAPSTONE

APPALACHIAN TECHNOLOGY INITIATIVE

The area served by the Kentucky Valley Educational Cooperative has traditionally been dominated by the extraction of its valuable resources. Whether it is coal, oil, timber, or its people, resources have left the region with little to show in return. The Appalachian Technology Initiative was developed to leverage K-12 education as an economic driver for a traditionally distressed region. The ATI was designed to examine characteristics and skills needed in the 21$^{st}$ century work place. The ATI emphasized high-tech content in the fields of computer science, aerospace engineering, and aviation. The ATI also focused on the 21$^{st}$ century skills of critical thinking, collaboration, problem solving, and communication.

The Appalachian Technology Initiative was launched during the 2015-2016 school year with considerable results. More than 500 students participated in the initiative by enrolling in Introduction to Computer Science and in Introduction to Aerospace and Aviation. The ATI was designed to match the talent needs of the region with the skills necessary to create economic conditions necessary for growth. The purpose of the ATI is to provide high-level technology education to the students of the region that could become a driver to help shape the future of southeast Kentucky.

KEYWORDS: Technology, Economic Development, Distance Learning, Computer Science, Innovation

__________________________________

Candidate Signature

__________________________________

Date

APPALACHIAN TECHNOLOGY INITIATIVE

By

Paul David Green

Approved by

Stephen D. Hooker, EdD
Committee Member Date

James Evans, EdD
Committee Member Date

Michael W. Kessinger, EdD
Committee Chair Date

Christopher T. Miller, EdD
Department Chair Date

RULES FOR THE USE OF CAPSTONES



| Name | Date |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

CAPSTONE

Paul David Green

The Graduate School

Morehead State University

March 28, 2016

# APPALACHIAN TECHNOLOGY INITIATIVE

---

Capstone

---

A capstone submitted in partial fulfillment of the
Requirements for the degree of Doctor of Education in the
College of Education
At Morehead State University

By

Paul David Green

Booneville, Kentucky

Committee Chair: Michael Kessinger, Ed.D

Morehead, Kentucky

March 28, 2016

## DEDICATION

This capstone is dedicated to my wonderful wife, Shellean. You are my heart and soul, and I would not have made it with out you. To my four wonderful children, Owen, Courtney, Lauren, and Karley. May you set your sights high in life, and don't let anything stand in the way of your potential.

To my amazing dad, James, who I admire and respect more than any person on Earth. In memory of my mother, Sharon, the most talented person I ever knew. I know she would be proud.

To Betsy, for always being there. To my mother-in-law, Shirley, for letting me know you should never stop with education. To my grandmother, Millie Rose and my late grandfather, Monroe for their love and encouragement. Finally, to all my friends and family, for their inspiration and always being there for me. Thank you all for the wisdom, knowledge, and experiences. I appreciate you all!

## ACKNOWLEDGEMENTS

First, I would like to extend an enormous thank you to Dr. Jeff Hawkins and Dr. Dessie Bowling at KVEC. It is your leadership that has allowed me the autonomy to create the ATI. I admire you both and will always be indebted for the kindness and opportunities you have bestowed on me.

I would like to thank all my friends and former colleagues in Owsley County. Gary, Stacy, Vanessa, Charlie, Melinda, Charlie T., Deron, and so many, many others. I would not be where I am today without your support and friendship. Thank you all!

A special thank you to my committee chair, Dr. Michael Kessinger, for his leadership and guidance through this process. I also extend my gratitude to committee members Dr. Stephen Hooker and Dr. Jim Evans. Finally, to all the members of Cohort IV, it was an uphill battle, but we finally made it. Thank you for your support and encouragement.

TABLE OF CONTENTS

LIST OF TABLES

## What is the core of the capstone?

### Introduction

The Appalachian Technology Initiative was designed to bring world-class educational opportunities to students in the mountains. By creating a culture of innovation, while at the same time leveraging resources such as area wide broadband Internet access, the ultimate goal of the ATI was to bring about systemic economic change to the region. While idealistic, it is believed the ATI will be a driver that will help shape the future of the entire region.

In 1966, Howard Bost published an article about the state of health and poverty in southeast Kentucky. In the article Bost outlines the needs of the distressed region. While much of the article centers on the need of comprehensive health care, it also relates to the correlations of excessive poverty and health. The article outlines a plan that will help lift the region out of such a distressed environment (Bost, 1966). Fast-forward almost 50 years and this same region of southeast Kentucky ranks as the second poorest United States Congressional District in the United States (Census Bureau Data, 2010), and also ranks as one the unhealthiest places to live in the United States with Owsley and Lee Counties ranking in the bottom 10 counties in the country (County Health Rankings, 2014). Efforts to improve conditions in southeast Kentucky have not been successful in the past 50 years.

For generations, the region has been too reliant on a cyclical niche. Coal mining for much of the region served by Kentucky Valley Education Cooperative (KVEC) service area has dominated the economy. This over dependence on one source can result in economic distress. Menken, (2000) states, “when the niche that sustains a system contracts, the system will also contract” (p. 141). The Appalachian region “was never more than a satellite of modern American Industry” (DeYoung, 1995, p. 173). DeYoung goes on to discuss how the regions only impact of the industrial age was that of a producer of natural resources. These resources were exported from the region and only created low wage, low skill jobs (DeYoung).

In order for the region to change its economic outlook, it must diversify. Only if the region recognizes the emerging global economy as potential opportunity will the region have a chance to compete (Schwab, 2011). For more than a century, schools in the United States have maintained a standard system of educational curriculum (Aulbach, 1994). The standard was developed before the invention of the airplane, computer, or television. Schools must understand the need to re-examine the curricular needs of their students to best fit the emerging economy. Carol Aulbach (1994) states, “we are fighting the control of high school curricula by forces who would narrowly construe what ought to be” (p. 17). This diversification can come through technology innovation and education.

**Impact of Traditional Education**

The history of high school curriculum today can be traced back to the 19th century. In 1892, the Committee of Ten was commissioned to study curriculum and instructional time for each content area. The Committee of Ten’s work has been utilized to drive curricular decisions in secondary schools for generations. The Committee’s work outlined the need for eight years of grade school and four years of high school. They created the curriculum all students needed in order to be college preparatory (Bohan, 2003).

The Committee's work matched the needs of the day. Schools needed to prepare students to work in the modern industrialized world. Students would enter school in first grade and move through the assembly line of grade school, gaining skills each year. In the end, they would be a complete product ready to enter college (Most likely to succeed, 2015). This approach was innovative in the 1890's. Today, it is outdated and does not prepare students for the 21st century (Bollinger, 2015). Schools throughout the country continue, however, to hold on to these long standing traditions, including those in southeast Kentucky. In fact, education in the mountains is a primary reason for the lack of economic success (Bollinger, 2015). It is not that schools have been failures, but schools have been organized to train people to leave. Instead of examining the economic conditions and creating an educational system to match the potential strengths of the region, southeast Kentucky followed the industrial model in an area not known for industry (Bollinger, 2015).

As a state, Kentucky has proposed changes. One initiative, Kentucky Rising, lists nine building blocks for a world-class education system (Tucker, 2014). While this reform model could improve schools, the model ignores critical attributes such as personalized learning, student agency, and technology. The model focuses on teacher effectiveness, student readiness, and leadership. It seeks to improve the current system (Tucker, 2014). At some point, however, the system needs to move beyond reform. Old systems and standards need to be re-examined. Instead of reforming the system, the system may need to be discarded and a new system created to replace it. The ATI was created as an alternative approach to education by moving beyond reform, but to create a new alternative model that may be replicated throughout the country.

**Change Theory**

Change is often difficult. Some people say they promote change, however, in order to make a profound difference, peripheral changes are not enough. Systemic change must occur. When thinking about systemic change, the work of Larry Cuban (1988), outlining the difference in first-order and second-order change, must be examined. Many people believe in change, in fact, they will often champion change in their schools, businesses, work places, and community (Cuban, 1988). Despite the people's proclamation for change, often the change discussed is first-order change, or change that simply works to improve the existing structures in place. First-order change is a change that does not want to abolish practices or policies currently in place. Instead, changes occur from working to refine and improve these current structures (Cuban, 1988). First-order change is adjusting or tweaking the existing model. Today, education in the Kentucky Valley Educational Cooperative region is still based on a model created in the late 19$^{th}$ century. It has gone through numerous reforms, but the reforms are adjustments to the same old model.

Cuban defines second-order change as the

> Aim at altering the fundamental ways of achieving organizational goals because of major dissatisfaction with current arrangements.

> Second order changes introduce new goals and interventions that transform the familiar way of doing things into novel solutions to persistent problems. …Engineers would call these solutions design problems… The history of school reform has been largely first-order improvements on the basic structures of schooling established in the late nineteenth century. (Cuban, 1988 as quoted in Greaves, Hayes, Wilson, Gielniak, & Peterson, 2010, p. 2)

In order to enact second-order change, the entire approach to learning must be revisited. Second-order change is a much bigger process and will not take place unless there is a commitment to significant change. In education, while there has been discontent with the current educational model, there has not been enough angst to create a total educational overhaul. Ross Wirth (2004) in his work *Lewin/Schein's Change Theory* called this the unfreezing process. In order to create an environment of change, people first must overcome the anxieties and see the need for change. If the unfreezing does not occur, change will not follow (Wirth, 2004).

Throughout the $20^{th}$ century, people have seen the need for educational change; however, the level of discontent has only led to first-order change. In order to truly redefine the educational system, second-order change must occur. We must examine the entire educational model in place today and look to totally overhaul the system. Daggett and Gendro (2014) state it as follows: "The changing nature of work, technology, and competition in the global job market has far outpaced what the

U.S. education system provides for students, despite the ongoing efforts of educators and communities to improve their schools” (p. 2).

In the Appalachian region of Kentucky, change has historically been resisted. Appalachia’s isolation has allowed it to hold on its culture norms and ethic systems. Many people in the deep hollows of the region did not have access to the larger world. Because of this, they held on to the cultures of years past (Caudill, 1963). Elam (2002) summarizes this with the following:

> The basic premise of the model describes how values and norms of a culture pass from generation to generation through socialization. If the cultural norms and values are mountain-rural and poverty-based, each generation appears to be unable to accommodate changing conditions in order to take advantage of opportunities for improvement and modernization. (Elam, 2002, p. 12)

The harsh isolationism of southeast Kentucky has created a system where outside ideas were not accepted (Elam, 2002). One of these ideas was that high-level education was important for all children in the region. It was acceptable not to be educated and in some instances one was looked upon as a traitor to the family if they tried to improve their conditions (Caudill, 1963). It is this mindset that caused education in Appalachia to lag behind the rest of the state and country. It is also why systemic education change and opportunity must occur.

**Problem Statement**

The Appalachian Technology Initiative (ATI) is a regional rural technology education consortium under the direction of the Kentucky Valley Educational Cooperative (KVEC), a primary provider of professional learning for 19 rural southeast Kentucky school districts contained in 14 Kentucky counties. KVEC serves the most rural area of Kentucky, the southeastern part of the state. The KVEC region is of significant size, serving 123 schools, 3,189 teachers and 45,046 students. The Appalachian Technology Initiative was developed to combine the human, financial, technological, and physical resources from the region in order to deliver first class learning opportunities to every student. Because of the remote location and size of schools in the region, many schools have very limited course offerings outside of Kentucky state requirements. Some schools in the region only offer a few career pathways, none of which are in high-tech fields such as computer science or aerospace engineering. The ATI was designed to offer students in the most rural, remote areas access to high-level curriculum.

In order to be successful, a system must be created in the region to match the 21$^{st}$ century skills needed in the workforce with our student population. Schools must move from an improving system of learning to an innovative approach that prepares students for the careers of the future. An innovative work force must be created to attract global business to the area.

Because the jobs of tomorrow are outpacing our current educational model, changes in what and how we teach must occur. A new educational model must be constructed from the ground up. One that is forward thinking and progressive, not steeped in the traditional approaches that prepared students to be proficient in the jobs of the $19^{th}$ century. The ATI continues to evolve to meet the needs of students in the region.

**Purpose**

The purpose of the Appalachian Technology Initiative is to provide high-level technology education to the students of the region. The opportunities were selected to align with the future economic opportunities in the region. According to Code.org, by 2020 more than 1.4 million jobs will be available in the field of computer science (Partovi, 2014). However, in the 2014-2015 school year, only two districts in the KVEC region offered programming courses. Also, Kentucky's number one export industry was aerospace engineering. Again, no schools in the region offered courses in these content areas.

The ATI also worked to develop and instill an entrepreneurial spirit in students. Feldman (2014) noted "entrepreneurs are pivotal as agents of change that can transform local communities" (p. 9). She further states,

> Economic development requires effective institutions grounded in norms of openness, tolerance for risk, appreciation for diversity, and confidence in the realization of mutual gain for the public and the private sector. Economic development is essential to creating the conditions for economic growth and ensuring our economic future. (Feldman, 2014, p. 18)

The ATI also was designed to promote risk-taking and create a culture where failure is acceptable, as long as students understand failure can lead to success. In the *World Economic Report*, Schwab (2011) outlines 12 pillars of economic competitiveness. Schwab (2011) stated in the report, "today's globalizing economy requires countries to nurture pools of well-educated workers who are able to adapt rapidly to their changing environment and the evolving needs of the production system" (Schwab, 2011, p. 5). The vision of the Appalachian Technology Initiative is to create a technological Appalachian renaissance by creating a culture of creativity, innovation, and design thinking in our youth.

In order for the KVEC region to meet the workforce needs of the 21st century high tech economy, students must be prepared with these skills. Again, the purpose of the ATI was to provide high tech learning opportunities to all students in the KVEC region.

**Mission of ATI**

In discussing learning centers of the future, Leonard Waks (2014), in Education 2.0, indicated that "learning centers will do much more: they will support independent learning; they will generate, or collaborate in creating new courses and programs to the changing needs, interests and passions of their students" (p. xii). The Appalachian Technology Initiative was developed to give students the opportunity to think and learn outside the traditional factory-like educational model (Waks, 2014). The ATI was designed for students to learn independently, while also exposing students to curriculum not offered in any of the schools in the 19 school districts supported by the Kentucky Valley Educational Cooperative. The Appalachian Technology Initiative was designed to be THE model of rural innovation and technology education in the nation. The ATI would also leverage K-12 education as an economic driver of central Appalachia. The goal of the ATI is to use education as a vehicle to bring about systemic economic development and progress to the region.

## Guiding Questions

The two guiding questions for this capstone are:

1. How has the Appalachian Technology Initiative impacted enrollment and engagement in computer science and aerospace engineering in the region?
2. What are some of the potential economic opportunities for teachers and students participating in the ATI courses?

## Review of Literature

In order for students in southeast Kentucky to compete in the emerging digital economy, students must have skills necessary to compete in the global world (Thomas, Ge, & Greene, 2011). Students need the opportunity to gain skills beyond the curriculum and content typically instructed in the core subjects in schools in the region. For instance, in Magoffin County Schools, no student has the opportunity to take courses in computer science, robotics, or aviation.

In order for students to be competitive in the new global economy, they must gain skills such as critical thinking, creativity, collaboration and communication (Partnership for 21st Century Skills, 2011). In addition to those skills, technology skills are a must. Thomas, Ge, and Greene (2011) argue coding, critical thinking, and computer program development must be learned in order for students to be competitive in the 21st century. If students do not have these technical skills, they will be unable to compete against students throughout the world (Thomas, Ge, & Greene, 2011).

Code.org claims that in 2020, over 1.4 million jobs will exist in computer science; however, there will only be 400,000 students with computer science degrees (Partovi, 2014). Other countries are focusing on these skills and are working to close this gap (Schwab, 2012). In Indonesia, 90% of students enrolled in secondary education schools want to learn computer programming because they think it is important to their future (Yuniar, 2015).

Keefe (1986) contends "no educational program can be successful without attending to the personal learning needs of individual students" (p. 85). In order to meet individual needs of students, education must be connected to real-life and real-world applications. However, the United States educational model continues to separate content from real connections for students. Wraga (2009) states,

> Recent reform efforts have continued to extol the separate subject curriculum. From the National Commission on Excellence call in *A Nation At Risk* for all students to complete the five 'new basics', to the national educational goal of *America 2000* to improve academic achievement, the separate subject curriculum has dominated

> reformers' thinking about secondary education for the past quarter-century. (p. 89)

A study conducted by Daun-Barnett and St. John (2012) note that students who graduate from high school in states with more rigorous math course requirements were more likely to attend college. However, the study also found these policies "may prevent some students from completing high school, particularly in the near term" (Daun-Barnett & St. John, 2012, p. 1). States with rigorous course requirements has further taken the American education system away from a personalized approach. In order to meet the individual needs of students, a singular approach to instruction and curriculum will not work. Schools and teachers must work together to meet each student's individual needs (Keefe, 1986).

In order to personalize education for students, educators must look at the individual interests, strengths, and experiences of each student. Advisement and mentoring is a large part of the personalized process as students must have guidance and support to help them to make sound decisions (Keefe, 1986). The Finnish approach emphasizes the connection between the teacher and student (Ahola, 1997). Teachers often take it upon themselves to find ways to connect learning to their student's interests (Ahola, 1997). Schools in the United States must do more to connect with students on an individual level. Student failure is often linked to a lack of identification of student barriers. Schools must take a "comprehensive analysis of policies, instructional practices and the selection and continued to development of motivated teachers" (Smink, 2001, p. 5).

To truly meet the individual needs of students, one must look not only at the delivery of instruction, but also the curriculum choices available to students. Students should be allowed to have more control over their curricular choices. State and Federal requirements continue to limit the curricular choices of students. Only five states in the United States still allow local schools and district to set their own graduation requirements (Rays, Dingman, Nevels, & Teuscher, 2007).

Research shows that forcing students to take higher level curriculum can have a negative effect, especially in states with exit exam criteria (Daun-Barnett & St. John, 2012). Because of this, schools need to look more at meeting the curriculum needs and interests of students. This includes developing courses that challenge students, but also interest the students and can be connected to real-world scenarios. Massive open online courses (MOOCs) can be an effective source of expanding curriculum options. Giving students the ability to individualize instruction by accomplishing "self-defined goals rather than criteria set by the instructors" (DeBoer, Ho, Stump, & Breslow, 2014, p.82). Options such as MOOCS and more local control of student curriculum needs are examples of ways to ensure that all barriers to student success are removed.

To effectively personalize education for students, differentiation of both curriculum and educational delivery structures are key. Students are taught the same curriculum, but instructional "differentiation is the preferred methodology of personalizing student education" (Weber, Johnson, & Tripp, 2013, p. 179). This must include different methodologies within the classroom, but it must also expand to curricular offerings and opportunities in non-traditional settings. Virtual schools and courses are rapidly changing the landscape of traditional education.

The ability of students to access unlimited curriculum in various frameworks allow students to participate in ever expanding differentiated modalities. From blended models, web-facilitated to completely online classes, students have a wide range of differentiated approaches available to them. The way technology is being used in the educational environment is rapidly changing and expanding. These new approaches can be great assets in the ability to meet individual students diverse learning needs (LaFrance & Beck, 2014).

Cavanaugh, Gillian, Kromrey, Hess and Blomeyer (2004) published a meta-analysis that concluded there were no statistical differences among students who attended virtual schools verses students in traditional school settings. Also, Blaylock and Newman (2005) reported, “equal access to both college preparatory and life preparatory knowledge and skill can be given to students no matter how geographically isolated they may be from population centers” (p. 383). Benefits of virtual learning also include the ability for students to connect with peers throughout the world. Synchronous virtual classrooms allow students to get to know one another and interact with all peers. It breaks down many barriers of isolation, as distance is not a factor as students in multiple countries can connect at one time (Gedera, 2014).

Asynchronous discussion can be more beneficial than traditional face-to-face discussion. Written communication can be seen as an advantage over oral communication because of the thought process involved in the writing process

(Peterson & Slotta, 2009). Written work allows communication to be archived for future reference and can allow deeper reflection. Oral discussion is lost soon after delivery. This distinction gives written asynchronous discussion an advantage over oral discussions in the traditional classroom (Clarke, 2012).

Despite findings of the benefits of virtual learning, evidence exists which shows students attending and participating in virtual environments are not always as successful as those in traditional settings (Miron & Urschell, 2012). "Only 27.7% of K-12 online schools reported meeting Adequate Yearly Progress (AYP)… In the nation as a whole, an estimated 52% of public schools met AYP in 2010-11" (Miron & Urschel, 2012, p. v).

School officials often cite lack of motivation as one reason students are unsuccessful in virtual schools when compared to traditional school settings (Brown, 2012). Lack of motivation may come from the fact that many students enrolled in virtual school enrolled to avoid discipline issues or were failing in the traditional setting (Schomburg & Rippeth, 2009). In an Ohio study, students enrolled in virtual courses at home had lower success rates on achievement tests than those that were enrolled in the same courses in an at-school lab environment (Schomburg & Rippeth, 2009). A cause of this failure could be attributed to leadership. LaFrance and Beck (2014) found the 91% of school administrators lacked field experience with virtual schools. This lack of experience limits administrators' ability to determine if online instruction is effective, thus impacting student results.

Other issues with online instruction include clarity of assignment, tasks, communication, and support for students. Unlike the traditional school setting, students often are not oriented to the expectations of the class. Tallman and Fitzgerald (2005) write, “face-to-face classes provide the instructor access for explaining, modeling, and rewording assignments for people who need that support” (p. 27). In online settings, this support may not exist or happen in a delayed manner. For example, JCPSeschool instructors offer answers to student’s emailed questions, but stipulate that answers may take up to 24 hours (Jefferson County Public Schools, 2015). Instructors with ATI were available a couple of hours each day. This could result in a lag of time between student questions and instructor responses.

According to Gedara (2014), students taking courses in synchronous environments are often frustrated by connectivity and technology issues. Students with inadequate bandwidth are unable to participate in real-time activities. Also, when conducting class using videoconferencing tools, students can only speak one at a time. When multiple students engage in conversation, audio is distorted often limiting conversation and causing communication issues (Gedera, 2014).

**Models**

The Appalachian Technology Initiative model was designed after examining virtual school models in other areas of the state of Kentucky and throughout the nation. In 2014, more than 40 states had virtual schools (Schoolquest.org, 2014). In Kentucky, three virtual schools exist, the Barren Academy of Virtual Expanded

Learning, Jefferson County Public School's eSchool, and Kentucky Education Television.

**Barren Academy of Virtual and Expanded Learning (BAVEL).** The Barren County School District developed their virtual school model in 2003. The Barren Academy of Virtual and Expanded Learning (BAVEL) was created to give students opportunities outside the traditional school day (Barren County Public Schools, 2015). It allowed students to advance beyond traditional high school coursework by developing partnerships with many post-secondary institutions. BAVEL offers many dual-credit and advanced placement opportunities. BAVEL also provided opportunities for students who were unsuccessful or were uncomfortable in the traditional schools settings (Barren County Public Schools, 2015). BAVEL used the Florida Virtual High School content to create courses for students to take at home (Barren County Public Schools, 2015).

Barren County School District staff serve as facilitators and assist students with their course work. BAVEL also increased the offerings provided by the Barren County School by being able to access all content available with the Florida Virtual High School. As a result of this partnership, Barren County Schools offers more curriculum pathways, electives, and foreign languages because of the digital curriculum than many other districts in Kentucky (Barren County Public Schools, 2015).

**Jefferson County Public School (JCPSeSchool).** Jefferson County Public school has a virtual school known as JCPSeSchool. JCPSeSchool was founded in

2000 and now serves more than 6,000 students from across the United States (Jefferson County Public Schools, 2015). The virtual school offers 56 courses in the subjects of science, social studies, math, language arts, Spanish, and business. Each 0.5 credit course has a tuition fee of $125. A full year, 1 credit course tuition is $175 (Jefferson County Public Schools, 2015). Students can enroll in a single course or be enrolled in up to 8 courses at any one time. The JCPSeSchool is an alternative approach to education that allows students an opportunity to complete Kentucky's high school graduation requirements within a virtual environment (Jefferson County Public Schools, 2015).

**Kentucky Educational Television (KET).** Kentucky Educational Television virtual school focuses on physics, foreign language, and arts and humanities content areas (Kentucky Education Television, 2015). KET Distance learning started in 1989 and "has been a trusted provider of standards-based, media rich courses to middle and high school students in Kentucky" (Kentucky Education Television, 2015, p. 1). KET Distance Learning (dl.ket.org) allows schools the opportunity to offer interactive courses in languages such as German, Chinese, Latin and Spanish. Tutors fluent in the various languages support students enrolled in the foreign language courses (Kentucky Education Television, 2015). KET Distance courses are available at a cost of $100 per student per course for in-state students. Students outside the state may have additional fees (Kentucky Education Television, 2015).

Outside of the state of Kentucky, two other models of course sharing and virtual learning include the Iowa Department of Education and the Niswonger Foundation of northeast Tennessee.

**Iowa Department of Education.** The Iowa Department of Education allows for the formation of regional academies. In the Iowa regional academy approach, one school district serves as the host school. They will specialize their curriculum and will provide open access to students in other school districts. Students then have opportunities to attend other school districts for all or part of the day to access a variety of curriculum needs. However, because of the vast land areas of Iowa School Districts, much of the instructional curriculum are delivered through digital or virtual capacities (Iowa Department of Education, 2014).

Students may physically attend school in one district while taking courses in another. This academy model allows schools to specialize in a specific content. For instance, one school may become a center for agriculture curriculum, while another may specialize in math and science (Iowa Department of Education, 2014). Students then have access to a much greater variety of content because they have access to content in multiple districts that have created pathways not offered in their home school districts. This instructional program-sharing model is supported by the Iowa Department of Education (Iowa Department of Education, 2014).

**Niswonger Foundation.** Another example of virtual/distance learning is the Niswonger Foundation in northeast Tennessee. The Niswonger Foundation was founded in 2001 by Scott Niswonger and serves 17 school districts (Niswonger

Foundation, 2014). The Appalachian region served by the Niswonger Foundation is very similar to that of KVEC. The Niswonger Foundation created a virtual/distance-learning model to allow students in rural Tennessee to have the same opportunities as students in larger metropolitan areas. The Foundation developed an online learning management system as well as established distance-learning classrooms in each high school they serve. A regional catalog of courses was created to allow students in differing parts of the region to take courses from multiple locations.

Schools participate by sharing staff and courses with all schools in the Niswonger Foundation consortium (Niswonger Foundation, 2014). For instance, a school district that does not offer Mandarin Chinese may enroll students in the course via distance learning offered by another school. In return, the school receiving the Mandarin Chinese class will offer other courses to schools in the foundation. The courses offered are distance, online, or blended with a combination of online and distance learning approaches. In 2014, 577 students participated in distance/virtual courses in the region (Holian, 2014).

These examples outline regional approaches to learning. All use some type of virtual environment and outside content to improve the curriculum offerings for their student populations. The Appalachian Technology Initiative is very similar to these models in its differing approaches to the delivery of instruction. The difference is that the content of BAVEL, Iowa Academies, and the Niswonger Foundation are traditional content providers. They are designed to ensure their students have access to all traditional curricula and do not have a focus on any particular content. The ATI is focused more on the STEM strands and is being designed to stretch curricular offerings in computer technology, robotics, aeronautics, computational thinking, ideation, creativity, and computer product development.

**Summary**

The educational program of the Appalachian Technology Initiative allows students in southeast Kentucky to compete in the global economy. According to Ravi (2014), "all developed and under developed countries accept that economic development takes place only as a result in the development of education (p. 56). The Kentucky Valley Education Cooperative leads the initiative and worked with multiple groups, including private business, foundations, public post-secondary institutions, and government agencies to develop a comprehensive educational model. The delivery model is a hybrid approach, which includes online, virtual, face-to-face, and blended learning opportunities.

Online learning is when students take courses that are fully developed and delivered via the Internet. In online courses, students only interact with instructors and peers through an online environment. Virtual classrooms are often synchronous classes in which the instructor is teaching students in different locations. The instructor uses Skype for Business to link directly with classrooms in order for students to participate in class from other locations.

In a face-to-face setting, students are actually in the classroom and participate directly with the instructor. Face-to-face settings are more typical in traditional schools. Finally, blended approaches involve instruction that combines the other forms of instruction. An example of a blended environment may occur if a teacher instructs with online content, but requires students to synchronously videoconference once per week. The ATI offers courses using all of the aforementioned approaches to instruction.

Teachers (ATI Fellows) from throughout the region work to develop, instruct, facilitate and are support courses for all participating school districts. ATI Fellows were independently contracted through the ATI. They were paid weekly office hours to assist students in all environments. ATI Fellows were available during and after school hours, and also on weekends. The Fellows also worked to help in the development of construct future courses for ATI. They were paid by KVEC using grant funds for the Race-to-the-Top District award. The ATI Fellows also worked with content providers from CodeHS, Microsoft's CCGA, and the Institute for Aerospace Education for course and curriculum development.

Students used the online digital platforms TheHoller, Microsoft's Touch Develop, and Moodle to receive digital content and curriculum. TheHoller is a social learning network developed for the people of central Appalachian. It was created by Bruce Parsons and partially funded using Race-to-the-Top District award. The site was created to promote learning and economic development in central Appalachia (theHoller.org). The use of this site allowed ATI Fellows to be available to support and assist students. Content was housed within TheHoller platform, Microsoft's Touch Develop, or Moodle. Both synchronous and asynchronous approaches are used, as students had access to regional teachers through video conferencing, forums, chats, and blogs.

Appalachian Technology Initiative Fellows participated in professional development to enhance skills in virtual learning environments. During the summer of 2015, ATI Fellows had an opportunity to attend a Microsoft IT boot camp, attended learning management training at TheHoller studios, and participated in three-day seminar at the Initiative of Aerospace Education.

School level personnel were selected to work directly with the regional ATI Fellows. School level personnel worked to assist with ATI Fellows to facilitate the courses. School level staff attended trainings held by ATI Fellows to work through details and to ensure students could access digital content. ATI Fellows served as the regional experts, while school level personnel worked more directly with students ensuring they completed day-to-day tasks.

## Who is the capstone meant to impact?

### Context

The 19 school districts served by the Appalachian Technology Initiative include some of the most economically depressed counties in Kentucky and the United States (Kim, 2010). The economic report identified the poorest counties in the nation and 11 of the 14 counties in the KVEC region are among the 100 poorest counties in the United States (Kim, 2010). Owsley (#3), Lee (#14), Leslie (#15) and Harlan Counties (#17) rank in the top 20 poorest counties in the nation (Kim, 2010).

Since 2010, all 14 counties served by KVEC have seen a decrease in total population (Table 1). All counties also are below the state average for median household income.

The average free and reduced lunch rate of the districts in the KVEC region is 70.67 % as compared to the national average of 48.1 % (Digest of Educational Statistics, 2013). The highest percentage of students receiving free and reduced lunch is Owsley County with 88.3% of students qualifying for free or reduced priced meals (Kim, 2010).

Table 1

*KVEC Counties Poverty and Population Statistics*

| County | Median Income (in dollars) | Population Change (since 2010) | % of Population Living below Poverty |
|---|---|---|---|
| Bell | 26,228 | -3.2 | 33.5 |
| Breathitt | 24,045 | -3.4 | 32.5 |
| Harlan | 25,906 | -3.8 | 31.3 |
| Johnson | 34,090 | -0.4 | 24.3 |
| Knott | 33,899 | -2.8 | 23.1 |
| Lee | 22,920 | -3.7 | 37.2 |
| Leslie | 29,253 | -3.5 | 22.6 |
| Letcher | 31,200 | -4.7 | 25.3 |
| Magoffin | 26,977 | -3.2 | 28.6 |
| Owsley | 19,980 | -5.2 | 37.7 |
| Perry | 33,528 | -3.9 | 25.3 |
| Wolfe | 22,574 | -1.9 | 40.5 |
| Kentucky | 43,036 | +1.7 | 18.8 |
| United States | 53,482 | +3.3 | 14.8 |

Source: census.gov, 2015

Sam Williams, former CEO of the Atlanta Chamber of Commerce, said, “workforce development is the lifeline for community economic development” (personal communication, January 27, 2016). In order to impact the economy of a region, a workforce development plan must look to the future needs of the economy. In a 2013 study by Frey and Osborne, half the jobs in America are at risk due to technology innovation. Future jobs will almost all be tied to technological innovation (Frey & Osborne, 2013). It is for this reason southeast Kentucky must transition education models to train the future workforce for these high tech jobs. The impact of the ATI will be to develop students to be prepared for the workforce of the future.

In 2013, Democrat Governor Steve Beshear and Republican United States Representative Hal Rogers crossed party lines and joined together to create Shaping Our Appalachian Region, also known as SOAR (Shaping our Appalachian Region, 2015). SOAR was created to create economic opportunity in the region by connecting federal, state, and local resource. They also work to create private and public partnerships to benefit the region (Shaping Our Appalachian Region, 2015).

As part of the initiative, funding was allocated to provide fiber optic line to all the counties in southeastern Kentucky. The initiative, known as KentuckyWired has a goal of having high-speed fiber connectivity to all counties in Kentucky by 2018. The first counties to be connected are counties served by KVEC (Rural Policy Research Initiative, 2013). With high speed Internet, the KVEC area will have an infrastructural advantage over many rural areas in the United States (Rural Policy Research Initiative, 2013). The advantage could lead to a window of opportunity for the region to break out of its economical hardship.

For generations, the region has been too reliant on a cyclical niche. Coal mining for much of the KVEC area has dominated the economy. This over-dependence on one source can result in economic distress (Mencken, 2000). The Appalachian Technology Initiative was designed to help assist in the diversification of the region. By leveraging SOAR initiatives, such as the dark fiber initiatives, creating a culture of technology innovation, and a spirit of entrepreneurialism the region must diversify if it is going to compete in the global economy.

**Who is impacted?**

The Appalachian Technology Initiative was designed to impact communities by creating a new generation of students that would have an opportunity to remain in the region and participate in the new economy. In Kentucky, aerospace manufacturing is the number one export in the state (Clair, 2014). Computer science jobs are expected to grow by 22% by 2020 (Partovi, 2014).

In order for students to take advantage of these emerging trends, the students had to be provided the opportunity to take courses in computer science and aerospace engineering. The ATI provided schools the opportunity to add additional vocational pathways in computer science and aerospace. Communities also benefited from a more highly skilled workforce, and students with skills to assist in projects such as website design for local businesses.

## How was the capstone implemented?

### Course offerings

The initial timeline for implementation of the Appalachian Technology Initiative launch was the fall of the 2015 (Appendix A). Planning began in the spring of 2015, with the original idea to only offer courses in computer science. As the plan for the ATI emerged it quickly expanded to include other contents such as aviation, aerospace, and robotics. During the 2015-16 school year, Introduction to Computer Programming and Introduction to Aviation and Aerospace Engineering were offered as courses to all students in the KVEC region.

In order to reach all students in the region, six teachers were selected from throughout the area to serve as regional instructors (ATI Fellows). The ATI Fellows held teacher certifications in the areas of math, science, or technology. They were hired to act as the regional content experts and used multiple approaches to deliver content to students. At the school level, schools provided personnel to assist in the facilitation of coursework for students enrolled in ATI courses throughout the school day. The school level facilitators did not have to be technology instructors or hold certifications for the courses they facilitated. However, they were charged with assisting the students with procedural tasks such as log-ins and technology. They also worked as liaisons between the students and the regional teacher.

### Content Providers

All content was provided through digital platforms. Students enrolled in Introduction to Computer Science used curriculum provided by Microsoft's Creative

Coding through Games and Apps (CCGA) during the Fall of 2015. Microsoft's CCGA was made available through Kentucky Department of Education's Microsoft IT academy. The content of the course used Microsoft Touch Develop coding language to teach students introductory coding concepts. Touch Develop is a block coding language. Block coding uses prewritten lines of code. Students use the prewritten code to create programs. CCGA was designed as a semester long curriculum. CCGA consisted of 12 units, with the last unit being a culminating project including a business plan to market the program they created (Appendix I).

In the spring of 2016, students were presented with content provided by CodeHS. CodeHS content focused on the programming language Java Script. Students had to take concepts learned during the first semester and apply it while writing the complete code. By the end of the 2015-16 school year, students could develop games and apps in Java Script.

Students enrolled in the Introduction to Aerospace and Aviation course used content housed on the Moodle platform. The content was provided through a partnership formed with the Institute for Aerospace Education (IAE). IAE content focused on four modules of study. The modules consisted of the foundational study of flight, flight mechanics, aeronautical engineering, and space science. Introduction to Aerospace and Aviation was the first of a four-course sequence, and it was recommended only for freshman students.

The ATI became the content and curriculum provider for schools. However, schools were responsible for enrolling students in classes, monitoring progress, and assigning grades. ATI Fellows were charged to be content specialists and to provide assistance to school facilitators and students as needed. They also provided school level facilitators with tools to evaluate student progress. This allowed students in all schools access to the material, but the schools had to ensure course fidelity and evaluate students.

**Facilitation**

As the students worked through the online curriculum, the regional ATI Fellows were available to assist. ATI Fellows had dedicated times both during and after school to answer questions and assist students. As it was determined that groups of students needed help, teachers virtually connected with students and school facilitators as a way of providing additional support. ATI Fellows also traveled to schools to work with classes and provide support to school level facilitators. Video lessons and tutorials were posted on TheHoller.org website for students to review. Finally, online professionals from Microsoft, CodeHS and IAE were available to assist if teachers needed additional support. They were accessed as an additional assistance on complex tasks. This tiered system was implemented to try to wrap supports around the students. The ATI was intentionally designed so that students were unlikely to fail because of lack of support or assistance.

**ATI implementation**

During the implementation in the Fall semester of 2015, several issues occurred. While much time and effort had been placed in planning, it was impossible to anticipate the potential issues that would arise. An important issue was making sure communication was reaching all stakeholders involved in the implementation. Because of the scale of the project, every update had to be disseminated to more than 30 schools and their personnel. Personal email, discussion forums, and threads were created to announce any change or update. Even though information was forwarded as quickly as possible, it was up to the local schools to ensure information was received. The school level facilitator was key in making sure all communication was received.

ATI Fellows were available and used Microsoft's Skype for Business to discuss and show examples of how to work through problems. Many of the problems were small and could be easily corrected, however, because of the scope it was often difficult to get notification of updates read by all personnel in a timely fashion.

An example of an unknown implementation issue resulted from the fact Microsoft's CCGA was adopted as the curriculum for the course. The curriculum was new and was not officially released until August 18, 2015. Most of the schools were already in session prior to the release date. Schools used pre-work in programming language and digital citizenship prior to the release of the content. When the content was released on the 18th, guidance had to be immediately sent to stakeholders on how to access the content. Also, because the curriculum had never been used, Microsoft has implementation issues related to their own platform. The ATI teachers had to work with various Microsoft representatives to train school personnel and address some of the minor issues in order to fully implement the system. It was not until the end of August 2015 that all schools were fully up and running using ATI course content.

Another issue that had to be resolved developed around the sharing of physical resources. The IAE curriculum required students to participate in activities such as flight simulation, wing building, and drone flight. The ATI purchased classroom sets of all materials. However, these materials had to be shared among all participating schools. The materials included flight simulators, a wind tunnel, and a drone that had to be picked up from one school and delivered to another school. ATI Fellows worked with school personnel to develop a schedule. Schools had to teach the four different modules during different times of the year. Materials would be rotated based on the supplies needed for each module. ATI Fellows and KVEC staff assisted in the rotating of necessary supplies.

At the start of September 2015, all school districts had fully functional courses. As expected, many issues were identified. ATI teachers traveled throughout the region to work with facilitators to ensure course fidelity. A follow up training was held on September 21. The meeting was designed as an update facilitator training, but also to identify any additional problems or concerns.

For the remainder of the Fall semester, schools progressed with the curriculum. In some cases, schools transitioned from Microsoft's CCGA to the content provided by CodeHS. The transition occurred as students became more comfortable with the block coding curriculum of Touch Develop and needed to move to a more traditional coding model provided CodeHS.

**ATI Transformation**

An evolving part of the ATI was the continued addition of new partners in order to fulfill the purpose of providing high level technology education to the students of the region. In the beginning, ATI was a concept with much of the planning based on the sole resources available through KVEC. However, as more entities were engaged, the scope of the ATI became much greater. This was a very positive outcome, however, it created an evolving model that changed daily. With this, the vision and mission of the ATI remained constant with only the timelines and scope of the project changed. An example of this included the addition of Morehead State University and Initiative for Aerospace Education (IAE) as partners.

The initial plan was to only offer courses in computer science in year one. Courses and pathways in additional areas would be added in years two and beyond. In June of 2015, ATI leadership met with the department chairs of the math and aerospace engineering at Morehead State University. Dr. Ben Malphrus of Morehead State University connected ATI leadership with the Initiative of Aerospace Education (IAE). A meeting was set-up and a new partnership was formed. By partnering with IAE, the ATI was able to offer Introduction to Aerospace and Aviation in year one.

The meeting with Morehead was planned as part of the goal of the ATI to partner with all local post-secondary institutions. However, the partnership with IAE was serendipitous, and was not planned. In this instance of forming partnerships, changes were positive, as things are moved much quicker and with a greater range than initially anticipated.

**Data Collected**

The Appalachian Technology Initiative launched its first class offerings in the Fall of 2015. Prior to 2015, only two school districts in the 19 district area offered courses in computer science. Lee County schools partnered with Microsoft's Teaching Education and Literacy in Schools (TEALS) program to offer computer science courses to their students. The Johnson County School District was the only other school district to offer a computer science pathway. In the field of aerospace and aviation, no school districts offered courses in the pathway.

Data were collected on student enrollment and progress in the courses. Of the 19 school districts in the KVEC service region, 15 participated with the ATI. The Introduction to Computer Science course was offered in 13 districts and the Introduction to Aerospace and Aviation course was offered in nine school districts. Student enrollment for Introduction to Computer Science was 374 for the region. An additional 72 students enrolled in Introduction to Aviation and Aerospace. Student progression varied based on location (school) and by student interest. Students also were asked to complete a questionnaire on the effectiveness of delivery and their interests in future pathways.

**Data Collection Procedures**

Appalachian Technology Initiative Fellows worked with district administrators to collect student enrollment data. School level facilitators were also responsible for collecting data on the effectiveness of the instructional delivery system as well as student recommendations as far as future course content. Students and teacher facilitators in each school were also asked to participate in a survey about the effectiveness of the ATI initiative as well as the level of engagement for students.

**Why were this capstone and related strategies selected?**

The Appalachian Technology Initiative was created to initiate systemic economic change to a region. The ATI was designed to identify emerging high tech industry and develop a k-12 program to match the needs of the future workforce. By creating a new generation of students with an opportunity to remain in the region and participate in the new economy, southeast Kentucky could change its trajectory.

After review, the initial fields of study selected were aerospace engineering and computer science. In Kentucky, aerospace manufacturing industry is the number one export in the state (Clair, 2014). Computer science jobs were expected to grow by 22% by 2020 (Partovi, 2014). However, in the 2014-15 school year, no schools in the region had aerospace programs, while only two schools offered courses in computer science. The ATI was developed to address these gaps.

For decades, the American education system has been through a series of reforms that have failed to bring economic progress to Appalachia. The educational reforms of the past decades focused on first order change, with an emphasis on reforming existing traditional content. In order to truly create systemic change in southeast Kentucky, second-order change must occur. This included providing new opportunities to the students in the region. The ATI was an ambitious program designed to create second order change in the region.

The ATI hoped to leverage expansive digital opportunities and give every student in the region access to a world-class education. It was a social injustice for students in rural America to not have the same opportunities as students in larger more affluent schools. Students in every school should have an opportunity to take courses in contents such as aerospace or computer science.

The ATI was developed with a dual purpose. First, it was created as a system to deliver high quality education opportunities to all schools, regardless of size or geographic location. Secondly, it was created to focus on future workforce development, focusing content, curriculum, and skill development on the needs of worker in the 21st century. In the words of Harbison and Meyers (1968), "education is both the seed and flower of economic development" (p. xi). The ATI not only needs to be the seed and flower, but fertilizer as well!

Education in the United States has traditionally been dominated by a one-size-fits-all approach (Christensen, Horn, & Johnson, 2008). For example, a teacher leads a group of students in a series of activities. All learning is teacher driven and takes place in a classroom with 25 to 30 students sitting at desks in rows. Based on personal observation, this model can still be seen in many classrooms across the region today. However, the world of education is changing. Gene Wilhoit, director of the National Center for Innovation in Education said, "a teacher in a classroom is a confining environment" (personal communication, April 25, 2014).

In order to meet the needs of 21st century learning environment, schools need to look at how they deliver instruction to students on a day-to-day basis. “Dramatic changes in how people use, interact with, and access information has resulted in a vastly different educational landscape infused with technology” (LaFrance & Beck, 2014, p. 162). This technology infusion makes it possible for schools to deliver instruction in a wide variety of modalities.

The ATI was designed around innovative approaches to create opportunity for all students. It also leveraged the KentuckyWired broadband initiative, the SOAR plan, to bring high speed Internet to southeast Kentucky. Also, the ATI aligns with Kentucky Valley Education Cooperative’s future ready initiative that helps support one-to-one devices for students in schools. These programs help to further breakdown the barriers of students who do not have access to technology at home. No longer can rural isolation be a barrier to educational opportunities for students. The ATI is designed to be replicable throughout the country in rural environments, and also for multiple subject areas.

The initial launch of the ATI focused on bringing about 21st century skill opportunities to all students in the region. In addition, the ATI developed a long-term strategy to provide opportunity for students who obtain these high level skills to remain in the region. Throughout the country, urban areas have developed high tech centers to attract and retain their talented youth. The larger scope of the ATI is to create centers within a rural area. The goal of the ATI was to bring world-class educational opportunities to all students in the mountains, but also to create potential economic growth for the region.

**When was the capstone implemented?**

The first courses of the ATI launched in August of 2015. However, the capstone project began much earlier with numerous implementation points along the way (Appendix A). The idea behind the creation of the Appalachian Technology Initiative began in January 2015. As part of the ARI initiative, KVEC was engaged in increasing the number students who would be prepared for careers of the emerging digital economy. This included the fields of computer science and aerospace engineering, Kentucky's number one export. The work entailed identifying careers that could make a difference in an economically depressed region. In this conversation, the idea arose that in order to leverage the SOAR KentuckyWired initiative as an economic driver, K-12 education had to transform to prepare students for the forthcoming high speed Internet. The idea for the ATI was born.

Initially, the ATI was only a computer science initiative. At the time, only 2 of the 19 school districts served by KVEC offered computer programming or other computer science pathways. Work began to create a system to offer computer science courses and pathways to all schools in the region. During the months of January and February 2015, several meetings and conversations occurred around the potential design and curriculum of the computer science initiative. This included meetings with representatives from Apple, CodeHS, Advance Kentucky, and Rural-up. All meetings were focused on the development and implementation of a regional computer science curriculum. On May 5th, 2015, the first regional meeting was held to officially launch the program (Appendix B). At this meeting, schools were informed of the initial planning and how it would be implemented in schools. Participants at the meeting included principals, teachers, central office administrators, and innovation coordinators. Schools were asked to provide preliminary information concerning the potential interest and student enrollments. The discussion expanded to the possibility of adding additional content areas.

The discussions centered as to whether the ATI should be a computer science initiative, or be expanded to incorporate other technical pathways that were not currently in schools. In fact, the ATI was not coined until the month of May. Prior to that date, it was only spoke of as a computer science initiative. As the initiative evolved, it was clear of the need to include more than computer science courses and pathways. The decision was made to create a system that brought high-level technical educational opportunities to all schools in the region. The focus would expand to include many technology-based pathways, not just computer science. With this, the ATI was coined and a logo was created. The ATI was no longer a dream, but an official plan with the intent of becoming a school to deliver high-quality technical educational opportunities in the areas of computer science, aviation, aerospace, and robotics.

In June 2015, progress was rapidly made to engage partners and find staff to implement the educational model. An application and job descriptions were created (Appendices C & D) and the number of staff members for the program was set at 6.

The initial budget meeting was held, and cost and salaries structures were put in place (Appendix E). Several meetings occurred with potential partners including Eastern Kentucky University, Morehead State University, Project Lead The Way, Rural-up, the Challenger Center, Google, Ripple-Effects, CodeHS, GSV-Lab, and the Kentucky Department of Education. The meetings were focused on several topics including, guidance on course and pathway creation, economic development related to K-12 curriculum, instructional delivery methods, funding, and access to content experts.

Also in June 2015, staff applications for the position of ATI Fellows were received. A KVEC leadership group reviewed applications and eight finalists were selected. The finalists were asked to preform a performance task activity (Appendix F). The decision to hire six staff members was made after review of performance tasks during the last week of the month.

The month of July was dedicated to staff training and course delivery implementation. Curriculum for the initial two courses of Introduction to Computer Science and Introduction to Aviation and Aerospace Engineering was identified and staff development began. ATI Fellows then attended a three-day boot camp with the Initiative for Aerospace Education and a two-day boot camp with Microsoft IT academy. The boot camps were in depth crash courses in the content and delivery structures for the courses. ATI Fellows had to then convert the models to fit an area wide approach.

Also during July, an ATI handbook was created as an overview of the initiative (Appendix G). ATI Fellows worked additional days to complete the online course development and facilitation guidelines. On August 4, 2015, school level personnel were brought to KVEC offices in Hazard, Kentucky for a one-day seminar on how the ATI would deliver content to the students (Appendix H). All schools in the region had officially begun implementation during the second week of August.

**Impact of Capstone**

In the 2014-15 school year, two of the 19 school districts in the KVEC service region offered computer science pathways. Lee County School District participated in the Microsoft TEALS program, while Johnson County had a traditional AP Computer Science path. No school districts in the KVEC region offered courses in aerospace or aviation.

In the Fall of 2015, all 19 school districts in the KVEC service region had the opportunity to offer Introduction to Computer Science and Introduction to Aviation and Aerospace. All students in grades 8 through 12 were eligible to take ATI courses. The initial classes offered in computer science and aerospace were introductory courses. They were designed as the first courses in four-course sequence. Because of this, it was recommended the courses be offered to students in 8$^{th}$ and 9$^{th}$ grade. However, schools had the option to allow students in grades 10 through 12 to enroll in the class.

The purpose of the ATI was to bring about systemic change to a traditionally depressed economic region. To do this, school content must be aligned to the career pathways of the 21$^{st}$ century economy. Students must have access to the content, and also must develop an appreciation so they have an opportunity to participate in the careers as adults. The student survey administered was designed to look at the level of student engagement and interest in the content.

Teacher surveys were designed to measure student interest, as well as to evaluate the effectiveness of the ATI model. Teachers were asked about the level of student engagement along with their overall views of the deliver model developed for the ATI.

**Data Analysis and Results – Quantitative Student Engagement Survey**

Questions for the student survey were selected from Panorama Student Survey instrument. The instrument is a free and open source survey tool developed by Panorama Education and Harvard Graduate School of Education. The survey questions have been validated through two pilot tests. The tests “confirmed that the survey has a high degree of reliability, structural validity, and convergent/discriminant validity” (Panorama Student Survey, 2015, p. 4).

The focus of the student survey questions was to determine the level of student engagement and interest in the fields of computer science and aerospace. In order to make systemic change in the region, the ATI wants to develop opportunity and create enthusiasm in these high tech fields. Questions selected were directly related to student interest, enthusiasm, and engagement.

The quantitative results of the Student Engagement Survey are reported in this section. Of the 446 students enrolled ATI courses, 220 students responded to the survey yielding a 49.33% response rate. All districts were invited to complete the survey, however not all chose to participate. The survey was an anonymous survey with no identifiable data collected. Because of this, it could not be determined what schools or which students did not participate. The total number of responses varied per question because not all respondents responded to all questions.

In Table 2 the results from question one of the survey “How excited are you about this class?” is summarized. The categories were converted to a 5 point Likert scale rating with the five questions rated; (1) Not at all excited, (2) Slightly excited, (3) Somewhat excited, (4) Quite excited, (5) Extremely excited. A total of 220 students answered the question with most students (128 respondents = 57%) indicating they were “extremely excited” (68 respondents = 31%) or “quite excited” (57 respondents = 26%). Only 25 students responded they were “not excited at all” about taking the course. The mean of the respondents for the survey question was 3.53 and the standard deviation was 1.15.

Table 2

*Question 1: How excited are you about going to this class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely excited | 5 | 68 | 31% |
| Quite excited | 4 | 57 | 26% |
| Somewhat Excited | 3 | 44 | 20% |
| Slightly excited | 2 | 26 | 12% |
| Not at all excited | 1 | 25 | 11% |

Note: N = 220, M = 3.53, SD = 1.15

In Table 3, the results from question two of the survey “How often do you get so focused on class activities that you lose track of time” is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Almost never, (2) Once in a while, (3) Sometimes, (4) Frequently, (5) Almost always. A total of 219 students answered the question with 45% students indicating they were "almost always" (33 respondents = 15%) or "frequently" (65 respondents = 30%). Only 17 students responded they were "almost never" lose track of time taking the course. The mean of the respondents for the survey question was 3.32 and the standard deviation was 0.98.

Table 3

*Question 2: How often do you get so focused on class activities that you lost track of time?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Almost always | 5 | 33 | 15% |
| Frequently | 4 | 65 | 30% |
| Sometimes | 3 | 61 | 28% |
| Once in a while | 2 | 43 | 20% |
| Almost never | 1 | 17 | 8% |

Note: N = 219, M = 3.32, SD = 0.98

In Table 4, the results from question three of the survey "In this class, how eager are you to participate" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all eager, (2) Slightly eager, (3) Somewhat eager, (4) Quite eager, (5) Extremely eager. A total of 220 students answered the question with most students (128 respondents= 58%) indicating they were "Extremely eager" (44 respondents = 20%) or "Quite eager" (84 respondents = 38%). Only 17 students (8%) responded they were “not eager at all” to participate. The mean of the respondents for the survey question was 3.53 and the standard deviation was 0.95.

Table 4

*Question 3: In this class, how eager are you to participate?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely eager | 5 | 44 | 20% |
| Quite eager | 4 | 84 | 38% |
| Somewhat eager | 3 | 54 | 25% |
| Slightly eager | 2 | 21 | 10% |
| Not eager at all | 1 | 17 | 8% |

Note: N = 220, M = 3.53, SD = 0.95

In Table 5, the results from question four of the survey “When you are not in class, how often do you talk about ideas from class” is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Almost never, (2) Once in a while, (3) Sometimes, (4) Frequently, (5) Almost always. A total of 220 students answered the question with 35% students indicating they were “almost always” (22 respondents = 10%) or “frequently” (57 respondents = 26%). The answer of “Sometimes” was selected by 58 respondents (27%). Several students (41= 19%) responded they “almost never” talked about ideas from the course. The mean of the respondents for the survey question was 2.91, and the standard deviation was 1.05.

Table 5

*Question 4: When you are not in class, how often do you talk about ideas from class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Almost always | 5 | 22 | 10% |
| Frequently | 4 | 57 | 26% |
| Sometimes | 3 | 58 | 26% |
| Once in a while | 2 | 42 | 19% |
| Almost never | 1 | 41 | 19% |

Note: N = 219, M = 2.91, SD = 1.05

In Table 6, the results from question five of the survey "Overall, how interested are you in this class?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all interested, (2) Slightly interested, (3) Somewhat interested, (4) Quite interested, (5) Extremely interested. A total of 219 students answered the question with most students (145 respondents= 66%) indicating they were "Extremely interested" (71 respondents = 32%) or "Quite interested" (74 respondents = 34%). Only 18 students (8%) responded they were "not interested at all" to participate. The mean of the respondents for the survey question was 3.75 and the standard deviation was 0.93.

Table 6

*Question 5: Overall, how interested are you in this class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely interested | 5 | 71 | 32% |
| Quite interested | 4 | 74 | 34% |
| Somewhat interested | 3 | 41 | 19% |
| Slightly interested | 2 | 15 | 7% |
| Not interested at all | 1 | 18 | 8% |

Note: N = 219, M = 3.75, SD = 0.93

In Table 7, the results from question six of the survey "How interesting do you find things you learn in your ATI class?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all interested, (2) Slightly interested, (3) Somewhat interested, (4) Quite interested, (5) Extremely interested. A total of 219 students answered the question with most students (130 respondents= 59%) indicating they were "Extremely interested" (55 respondents = 25%) or "Quite interested" (76 respondents = 35%). Only 12 students (6%) responded they were "not interested at all" to participate. The mean of the respondents for the survey question was 3.62 and the standard deviation was 0.96.

Table 7

*Question 6:How interesting do you find things you learn in your ATI class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely interested | 5 | 55 | 25% |
| Quite interested | 4 | 76 | 35% |
| Somewhat interested | 3 | 49 | 22% |
| Slightly interested | 2 | 27 | 12% |
| Not interested at all | 1 | 12 | 6% |

Note: N = 219, M = 3.62, SD = 0.96

In Table 8, the results from question seven of the survey "How often do you use ideas from ATI class in your daily life" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Almost never, (2) Once in a while, (3) Sometimes, (4) Frequently, (5) Almost always. A total of 218 students answered the question with only 27% students indicating they were "almost always" (18 respondents = 8%) or "frequently" (41 respondents = 19%) using ideas for ATI in their daily life. The answer of "Sometimes" was selected by 61 respondents (28%). Several students (54= 25%) responded they "almost never" use ideas from the course. The mean of the respondents for the survey question was 2.66 and the standard deviation was 1.08.

Table 8

*Question 7: How often do you use ideas from ATI in your daily life?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Almost always | 5 | 18 | 8% |
| Frequently | 4 | 41 | 19% |
| Sometimes | 3 | 61 | 28% |
| Once in a while | 2 | 44 | 20% |
| Almost never | 1 | 54 | 25% |

Note: N = 218, M = 2.66, SD = 1.08

In Table 9, the results from question eight of the survey “how important is it to do well in ATI class?” is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all important, (2) Slightly important, (3) Somewhat important, (4) Quite important, (5) Extremely important. A total of 217 students answered the question with most students (161 respondents= 74%) indicating it was “Extremely important” (81 respondents = 37%) or “Quite important” (80 respondents = 37%) to do well in class. Only 7 students (3%) responded at it was “not important at all” to do well. The mean of the respondents for the survey question was 3.99, and the standard deviation was 0.76.

Table 9

*Question 8: How important is it to you to do well in ATI class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely interested | 5 | 81 | 37% |
| Quite interested | 4 | 80 | 37% |
| Somewhat interested | 3 | 35 | 16% |
| Slightly interested | 2 | 14 | 6% |
| Not interested at all | 1 | 7 | 3% |

Note: N = 217, M = 3.99, SD = 0.76

In Table 10, the results from question nine of the survey "How much do you see yourself as a technology person?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all, (2) A little bit, (3) Somewhat, (4) Quite a bit, (5) A tremendous amount. A total of 217 students answered the question with most students (127 respondents= 58%) indicating they were "A tremendous amount" (51 respondents = 24%) or "Quite a bit" (76 respondents = 35%) a technology person. Only 14 students (6%) responded they were "not at all" a technology person. The mean of the respondents for the survey question was 3.54 and the standard deviation was 1.01.

Table 10

*Question 9: How much do you see yourself as a technology person?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| A tremendous amount | 5 | 51 | 24% |
| Quite a bit | 4 | 76 | 35% |
| Somewhat interested | 3 | 44 | 20% |
| A little bit | 2 | 32 | 15% |
| Not at all | 1 | 14 | 6% |

Note: N = 217, M = 3.54, SD = 1.01

In Table 11, the results from question ten of the survey "How useful do you think this class will be to you in the future?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all useful, (2) Slightly useful, (3) Somewhat useful, (4) Quite useful, (5) Extremely useful. A total of 220 students answered the question with most students (133 respondents 61%) indicating the class will be "extremely useful" (81 respondents = 37%) or "quite useful" (52 respondents = 24%) in the future. Only 12 students responded the class would be "not at all useful". The mean of the respondents for the survey question was 3.75 and the standard deviation was 1.04.

Table 11

*Question 10: How useful do you think this class will be to you in the future?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely useful | 5 | 81 | 37% |
| Quite useful | 4 | 52 | 24% |
| Somewhat useful | 3 | 50 | 23% |
| Slightly useful | 2 | 25 | 11% |
| Not at all useful | 1 | 12 | 5% |

Note: N = 220, M = 3.75, SD = 1.04

**Data Analysis and Results – Quantitative Teacher Survey**

The quantitative results of the Teacher Survey are reported in this section. All 15 districts participating with the ATI had school level facilitators complete the survey. A total of 19 facilitators responded. The total number of responses varied per question because not all respondents responded to all questions.

In Table 12, the results from question one of the teacher survey "How enthusiastic are students to take an ATI class?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all enthusiastic, (2) Slightly enthusiastic, (3) Somewhat enthusiastic, (4) Quite enthusiastic, (5) Extremely enthusiastic. A total of 19 teachers answered the question with most teachers (10 respondents= 53%) indicating they were "Extremely enthusiastic" (2 respondents = 11%) or "Quite eager" (8 respondents = 42%). No teacher reported students were "not enthusiastic at all". The mean of the respondents for the survey question was 3.47, and the standard deviation was 0.76.

Table 12

*Teacher Question 1: How enthusiastic are the students to take an ATI class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely eager | 5 | 2 | 11% |
| Quite eager | 4 | 8 | 42% |
| Somewhat eager | 3 | 6 | 32% |
| Slightly eager | 2 | 3 | 16% |
| Not eager at all | 1 | 0 | 0% |

Note: N = 19, M = 3.47, SD = 0.76

In Table 13, the results from question two of the teacher survey "For teachers who need extra support, how difficult is it for them to get the support they need?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Extremely difficult, (2) Quite difficult, (3) Somewhat difficult, (4) Slightly difficult, (5) Not at all difficult. A total of 19 teachers answered the question with most teachers (11 respondents= 58%) indicating it is "Not difficult at all " (7 respondents = 37%) or "Slightly difficult" (4 respondents = 21%). One teacher reported it was "Extremely difficult" for students to get help. The mean of the respondents for the survey question was 3.79, the median was 4, the mode was 5 and the standard deviation was 0.98.

Table 13

*Teacher Question 2: For students who need extra support, how difficult is it for them to get the support they need?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Not difficult at all | 5 | 7 | 37% |
| Slightly difficult | 4 | 4 | 21% |
| Somewhat difficult | 3 | 6 | 32% |
| Quite difficult | 2 | 1 | 5% |
| Extremely difficult | 1 | 1 | 5% |

Note: N = 19, M = 3.79, SD = 0.98

In Table 14, the results from question three of the teacher survey "How many resources do you need to adequately support your students' learning?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) A lot of resources, (2) A few more resources, (3) Several more resources, (4) Quite a few more resources, (5) A lot more resources. A total of 18 teachers answered the question with 7 teachers (39%) indicating they needed "almost no resources" (1 respondents = 5%) or "a few more resources" (6 respondents = 33%). No teacher reported they needed "A lot more resources". The mean of the respondents for the survey question was 3.17 and the standard deviation was 0.47.

Table 14

*Teacher Question 3: How many resources do you need to adequately support your students' learning?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Almost no resources | 5 | 1 | 5% |
| A few more resources | 4 | 6 | 33% |
| Several more resources | 3 | 6 | 33% |
| Quite a few more resources | 2 | 5 | 28% |
| A lot more resources | 1 | 0 | 0% |

Note: N = 18, M = 3.17, SD = 0.47

In Table 15, the results from question four of the teacher survey "How clearly do ATI leaders identify goals for teachers?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not clear at all, (2) Slightly clear, (3) Somewhat clear, (4) Quite clear, (5) Extremely clear. A total of 18 teachers answered the question with most teachers (9 respondents= 50%) indicating it is "Extremely clear " (2 respondents = 11%) or "Quite clear" (7 respondents = 39%). Two teachers reported goals were "not clear at all". The mean of the respondents for the survey question was 3.28 and the standard deviation was 0.94.

Table 15

*Teacher Question 4: How clearly do ATI leaders identify goals for teachers?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely clear | 5 | 2 | 11% |
| Quite clear | 4 | 7 | 39% |
| Somewhat clear | 3 | 5 | 28% |
| Slightly clear | 2 | 2 | 11% |
| Not clear at all | 1 | 2 | 11% |

Note: N = 18, M = 3.28, SD= 0.94

In Table 16, the results from question five of the teacher survey "How positive is the tone that ATI leaders set for the culture of the class?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all positive, (2) Slightly positive, (3) Somewhat positive, (4) Quite positive, (5) Extremely positive. A total of 18 teachers answered the question with most teachers (10 respondents= 56%) indicating the tone is "Extremely positive " (4 respondents = 22%) or "Quite positive" (6 respondents = 33%). No teacher reported tone was "not at all positive". The mean of the respondents for the survey question was 3.67 and the standard deviation was 0.81.

Table 16

*Teacher Question 5: How positive is the tone that ATI leaders set for the culture of the class?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely positive | 5 | 4 | 22% |
| Quite positive | 4 | 6 | 33% |
| Somewhat positive | 3 | 6 | 33% |
| Slightly positive | 2 | 2 | 11% |
| Not at all positive | 1 | 0 | 0% |

Note: N = 18, M = 3.67, SD = 0.81

In Table 17, the results from question six of the teacher survey “How effectively does ATI leaders communicate important information to teachers?” is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all effectively, (2) Slightly effectively, (3) Somewhat effectively, (4) Quite effectively, (5) Extremely effectively. A total of 18 teachers answered the question with most teachers (9 respondents= 50%) indicating it is “Extremely effectively ” (2 respondents = 11%) or “Quite effectively” (7 respondents = 39%). One teacher reported information was communicated “not at all effectively”. The mean of the respondents for the survey question was 3.28 and the standard deviation was 0.94.

Table 17

*Teacher Question 6: How effectively does ATI leaders communicate important information to teachers?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely effectively | 5 | 2 | 12% |
| Quite effectively | 4 | 7 | 39% |
| Somewhat effectively | 3 | 4 | 22% |
| Slightly effectively | 2 | 4 | 22% |
| Not at all effectively | 1 | 1 | 6% |

Note: N = 18, M = 3.28, SD = 0.94

In Table 18, the results from question seven of the teacher survey "How responsive are ATI leaders to your feedback?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not at all, (2) Slightly responsive, (3) Somewhat responsive, (4) Quite responsive, (5) Extremely responsive. A total of 17 teachers answered the question with most teachers (10 respondents= 59%) indicating the tone is "Extremely responsive " (2 respondents = 22%) or "Quite responsive" (8 respondents = 33%). No teacher reported ATI leadership as "not at all" responsive. The mean of the respondents for the survey question was 3.65 and the standard deviation was 0.66.

Table 18

*Teacher Question 7: How responsive are ATI leaders to your feedback?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely responsive | 5 | 2 | 12% |
| Quite responsive | 4 | 8 | 47% |
| Somewhat responsive | 3 | 6 | 35% |
| Slightly responsive | 2 | 1 | 6% |
| Not at all | 1 | 0 | 0% |

Note: N = 17, M = 3.65, SD = 0.66

In Table 19, the results from question eight of the teacher survey "How confident are you that you can help all your students learn?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not confident at all, (2) Slightly confident, (3) Somewhat confident, (4) Quite confident, (5) Extremely confident. A total of 16 teachers answered the question with 7 teachers (44%) indicating they are "Extremely confident" (3 respondents = 19%) or "Quite confident" (4 respondents = 25%) they can help their students learn. One teacher reported they were "not confident at all". The mean of the respondents for the survey question was 3.25 and the standard deviation was 1.03.

Table 19

*Teacher Question 8: How confident are you that you can help all your students learn?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely confident | 5 | 3 | 19% |
| Quite confident | 4 | 4 | 25% |
| Somewhat confident | 3 | 4 | 25% |
| Slightly confident | 2 | 4 | 25% |
| Not confident at all | 1 | 1 | 6% |

Note: N = 16, M = 3.25, SD = 1.03

In Table 20, the results from question nine of the teacher survey “How thoroughly do you feel that you know all you need to teach the content effectively?” is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not thoroughly at all, (2) Slightly thoroughly, (3) Somewhat thoroughly, (4) Quite thoroughly, (5) Extremely thoroughly. A total of 19 teachers answered the question with 8 teachers (42%) indicating they know “Extremely thoroughly” (2 respondents = 11%) or “Quite thoroughly” (6 respondents = 32%) all they need to know to teach the content effectively. Four teachers reported they did not know the content “Thoroughly at all”. The mean of the respondents for the survey question was 3.05 and the standard deviation was 1.02.

Table 20

*Teacher Question 9: How thoroughly do you feel that you know all you need to teach the content effectively?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely thoroughly | 5 | 2 | 11% |
| Quite thoroughly | 4 | 6 | 32% |
| Somewhat thoroughly | 3 | 6 | 32% |
| Slightly thoroughly | 2 | 1 | 5% |
| Not thoroughly at all | 1 | 4 | 21% |

Note: N = 19, M = 3.05, SD = 1.02

In Table 21, the results from question ten of the teacher survey "How confident are you that you can move through the material at a pace that works well for each student?" is summarized. The categories were converted to a 5 point Likert scale rating with five questions rated; (1) Not confident at all, (2) Slightly confident, (3) Somewhat confident, (4) Quite confident, (5) Extremely confident. A total of 19 teachers answered the question with 6 teachers (32%) indicating they are "Extremely confident" (1 respondents = 5%) or "Quite confident" (5 respondents = 26%) they can move students through the material at a pace that works well for each student. One teacher reported they were "not confident at all". The mean of the respondents for the survey question was 2.95 and the standard deviation was 0.82.

Table 21

*Teacher Question 10: How confident are you that you can move through the material at a pace that works well for each student?*

| | Likert Equivalent | Number and Percent Responded | |
|---|---|---|---|
| Extremely confident | 5 | 1 | 5% |
| Quite confident | 4 | 5 | 26% |
| Somewhat confident | 3 | 6 | 32% |
| Slightly confident | 2 | 6 | 32% |
| Not confident at all | 1 | 1 | 5% |

Note: N = 19, M = 2.95, SD = 0.82

**Findings**

With the implementation of the ATI during the 2015-16 school year, 13 of the 19 districts had students enrolled in a computer science course. Enrollments in the district varied from as few as four to as many 72, with a total of 374 students being enrolled in the Introduction to Computer Science course throughout the region during the Fall semester. The numbers indicated a tremendous growth in participation in computer science education throughout the region.

The number of students enrolled in Introduction to Computer Science increased to over 500 for the Spring 2016 semester. This occurred as districts on block semester and trimester schedules added additional students to the course. The additional student enrollment was added after the initial surveys were conducted.

In addition to computer science, 72 students enrolled in the aerospace and aviation program. No students had been enrolled in an aviation program the previous year. This is a major shift in the participation of students in high tech related education pathways.

Student survey data were used to measure the impact of ATI on students. According to the report, Asking Students About Teaching Report (2012), it is stated that student survey results are predictive of student achievement gains. Students know an effective classroom when they experience one (Asking Students about Teaching, 2012). The report analyzes student survey results and also finds student survey results are more effective than teacher observations and achievement measures (Asking Students about Teaching, 2012).

Career planning development is an important component of student engagement in schools (Lapan, 2004). Students engaged in career development activities are more likely to be engaged in schools. Career planfulness is a measure of depth of commitment one has about planning for his or her future (Lapan, 2004). Roberts (2008) states, “career planfulness is an important element of career choice readiness and career maturity” (p. 57).

The student survey data reflects that a majority of students are excited (59%), eager to participate (58%), and interested (66%) in course content. Also, 61% of students feel that the course will be quite or extremely useful to them in the future. When the survey data of students who are interested, eager, and excited are combined, the results showed slightly over 60% of students were very or extremely engaged. If you take into the consideration the students who are somewhat interested, eager, or excited, the data indicates approximately 80% of students were engaged.

The data reflects students involved in ATI courses have a high degree of interest and engagement. With the combined data showing almost 60% of students highly engaged and about 80% somewhat engaged, the data bodes well for the goal of the ATI to develop a systemic cultural change for future economic opportunity for the region. This is supported by the idea that students who have a high level of career planfulness will be more prepared for careers in the future (Roberts, 2008).

The Panorama Teacher Survey results provided a broad picture, and also created potential opportunity for improvement. School level facilitators reported students were overall excited about the course (50% favorable), the culture set by leadership was strong (55% favorable), and despite issues, ATI leadership was responsive to their needs (56% favorable).

Teacher data supported student survey data on the overall engagement and interest of students in ATI courses. This data supports students survey data in which students seem to have a high level of interest and are eager to participate. These findings support the idea that the ATI is creating a culture of technology in the region.

Communication was identified as an initial implementation issue. Survey results show only 47% of teachers feel favorably about communication with ATI leadership. The data also reveals that many teachers are very uncomfortable with the content in terms of pacing (33% favorable), confidence in supporting students (44% favorable), and how thorough they know the content (39% favorable).

## Limitations of the study

The idea for the Appalachian Technology Initiative was developed in early 2015. By August, the ATI was officially launched with over 400 students taking classes. Two initial courses were offered, Introduction to Computer Programming and Introduction to Aerospace and Aviation. The greatest success of the project is its very existence. The project moved from ideation to implementation in less than a year. However, due to the limited time frame since implementation there are several limitations of the study.

The goal of the ATI is to create educational opportunities that will lead to economic impact in a traditionally depressed economic region. As detailed earlier, southeast Kentucky currently includes several of the poorest counties in the United States. Through new career pathways, the hope is to create a new economy that will stem the tide of migration out of the region. These measures will not be determined until several years in the future. This is a study that will need to occur, and will need to examine if ATI goals did create a systemic change in the economy in the region. Currently, it is impossible to make any projection as to the success of the initiative as an economic driver.

The ATI continues to be an evolving initiative. The launch of the ATI should be looked at as pilot program. One of the attributes of the design was the need to be nimble and flexible in order to deliver new content and curriculum across an area the geographical size of Connecticut. The ATI serves 19 districts, each with their own characteristics. The ATI design had to be able to effectively deliver content to all schools despite differences in schedule formats, calendars, teacher certifications, and schedules. Because of this, even in the first months of the program, what was originally planned had to be changed or modified in order to meet the needs of the stakeholders. As the program evolved, it was difficult to pinpoint if the system in place one day was going to be the system in place the next, or in a years to come. The system continues to evolve, by design, but creates a limitation around what individual characteristics of the initiative are most successful.

Communication continues to be an issue. It was identified as a limiting factor on the teacher survey. It also could be a reason only 49% of students participated in the Student Engagement Survey. We have numerous ways to communicate with schools; however, it is up to individual schools and personnel to ensure communication is open both ways. Information sent to schools is often lost.

The ATI is an initiative that provides high quality resources and opportunity to schools. Each individual school must work to ensure that students and facilitators are engaged with the work. The ATI system was designed to provide multiple layers of support. However, students and staff of individual schools must take the initiative in order to ensure fidelity of the program. The size and scope of the region creates a situation where communication of what works and what does not work is not always aligned. We have reports of great success in some areas. An example includes students throughout the region who have already completed an entire years' content in a couple of months. Another success was the students at Betsy Lane High School who won a statewide Verizon App Development Contest.

Despite these successes others had issues. Examples included reports of schools and students who have struggled with the high level content. Despite efforts to reach out to the schools, help can only be provided to those that are responsive to help. The ATI model is designed to assist schools in need, but the schools and school level personnel must take the initiative to engage ATI Fellows and leadership to ensure they receive the support they need.

This lack of a consistency lends to the belief that a deeper study of the variable within each individual school may need to be examined in order to fully understand why the system works better in some schools than in others. Factors such as the quality of school leadership, school structures, or the content expertise of the school level facilitator all could play a role in the effectiveness of ATI course implementation.

Finally, the ATI was designed as a content and curriculum provider. It provided schools the tools they need to provide high-level opportunities to students. However, it does not evaluate student performance or assign grades. Again, this makes it difficult to fully understand how successful students are in each individual school.

## Reflections

### Personal Reflection

In 2012, my son came to me and asked if he could take a programming course at school. I had just accepted the position of Chief Academic Officer for Owsley County schools. I desperately wanted to provide the best educational opportunities for my child. My response to him was that I would do my best. Unfortunately, my best was not good enough. In fact, not only did I have difficulty finding him a programming course, but also I was unable to provide various courses of interest to many of our student population. Owsley County is a very small rural school district with a total student population of less than 800. Because of its size and isolated location, it is difficult to provide a wide variety of courses to the students. Most of the faculty is at capacity teaching state-required courses, and only a few electives are offered each year. Traditionally, Owsley County High School only offered one foreign language, no chemistry or calculus. It is a tremendous social injustice to the students living in the county.

In the fall of 2014, I took a position with the Kentucky Valley Educational Cooperative (KVEC) as part of their Race-To-The-Top District award. My job with KVEC was to prepare students to be 'College and Career Ready', but also to leverage K-12 education as an economic driver for the region. As I began my position, I immediately wanted to look at ways to improve the economy, but also to improve access to student educational opportunities that would allow them to be more prepared for college and career. As I looked across the region, it was very evident that Owsley County was not the only school that struggled to provide multiple opportunities and pathways for students. This is where the idea of the Appalachian Technology Initiative (ATI) began.

**Successes**

The Appalachian Technology Initiative evolved from idea to implementation in less than eight months. While it was important to move quickly in order to immediately give students the much needed opportunity in high tech education curriculum, it also meant the ATI would be have to be flown while it was being constructed. For this reason, the ATI is still a work in progress. The greatest success of the ATI is that it launched and 446 students enrolled in the courses in the Fall of 2015. This is a significant achievement since in the previous school year of 2014-15 fewer than 30 students participated in computer science courses. No students participated in aerospace courses in 2014-15. It is believed this increase in student enrollment will make a significant impact on students in the region, allowing them the opportunity to take advantage of the digital economy and be able to remain in a traditionally distressed economic region and obtain careers in high tech fields.

In the Spring semester of 2016, more than 150 additional students enrolled in Introduction to Computer Programming, bringing the total of students enrolled to over 500. This seems to validate the fact that as more schools and students are exposed to the courses, the program will grow. It is anticipated enrollment numbers for year two will be significantly larger than in year one.

Survey results also indicate a high level of student engagement in the courses. School level facilitators have indicated that they believe more students will enroll in the introductory courses in the 2016-17 school year. One instructor, Kelly Boles of

Betsy Layne High School, indicated her school expected a significant enrollment increase next year (personal communication, February 1, 2016).

Finally, an unexpected success occurred when two of the ATI Fellows were selected to become Microsoft Endorsed CCGA trainers. This honor came from the exemplary work exhibited by the ATI Fellows. The teachers were selected to attend a three-day training in Austin, Texas. The ATI Fellows are part of the first group to be trained as trainers. They will instruct teachers nationally and internationally to effectively deliver CCGA content to students.

**Growth Areas**

Despite the successes, there is a realization the ATI will continue to evolve and will undergo numerous revisions during the course of the next few months and years. Communication has been identified as a critical weakness and must improve. A plan is being developed in order to appoint an ATI liaison for each participating school district. The liaison will work directly with ATI Fellows and leadership to disseminate information and to assist facilitators in the field. This is very important for in year two it is expected the number of students enrolling in ATI courses will double. Also, new courses are being developed, including second year courses in computer programming and aerospace engineering, as well as courses in web design and robotics.

Even with the anticipation of more classes being offered and more students participating, the ATI is also looking to scale-up the initiative with the goal of adding additional school districts in coming years. It is believed the model can be highly replicable; with the hope the model can be used to serve numerous rural regions throughout the United States. Department of Education leaders from the states of North Carolina and Virginia have already been in contact and are interested in taking the model into their respective states (Appendix L).

**Next Steps**

Moving forward, the ATI is expecting a significant scale-up in year two. In computer science, two additional courses will be offered. Students will have access to a Java Script web design course as well as AP Computer Science Principles. This will give students multiple opportunities to move forward in computer science curriculum. The web design course will not only focus on the elements of web design, but will also allow students to work with communities to create web design businesses. This is designed to increase the digital footprint of communities by having more businesses with websites. It also is designed to instruct students how to be entrepreneurs and to develop their own independent web design businesses.

Course two of the aviation and aerospace pathway will also be made available. Course two is a sophomore level course. The content expands on year one, but has a greater emphasis on flight training. After year two, students must select either the aviation track supported by Eastern Kentucky University, or the aerospace track supported by Morehead State University.

The ATI will focus on aligning pathways in computer science and aerospace to existing Kentucky Department of Education recognized CTE pathways. Communication will continue to be a major focus as more school officials; including teachers, principals, and counselors will be engaged in the work. This will assist in improving communication issues, as well as continue to create the cultural shift in the region. Also, by tying future courses to existing CTE pathways, school officials will be more likely to encourage participation as the program as it can lead to more students earning college and career readiness certifications.

Finally, in order to complete the goal of the ATI initiative, work has begun to create economic opportunity in the region. Through partnerships, KVEC proposes to launch a bold expansion of its program. Innovation hubs in southeast Kentucky, developed specifically for the region, will be able to identify a method of using new digital tools to overcome regional and cultural barriers. These hubs will be designed to ensure creative environments exist which can allow participants to grow ideas and businesses from within. These hubs would be an active force and voice added to a discussion of development in the Appalachian region that directly addresses resistance to educational change and perceived stereotypes that influence potential leaders from the southeast Kentucky.

The proposed hubs would combine the assets of K-12 schools, post-secondary institutions, and the business community to create centers for economic growth. The hubs are popular in urban areas. Hubs such as the 1871 Lab in Chicago and GSVLab in Silicon Valley are havens for innovation and entrepreneurism. The innovation hubs would be centered in communities throughout southeast Kentucky and be used for education, idea development, and entrepreneurial workspace. A student just graduating with a computer science degree from Morehead State University could work at a hub in order to develop a business idea or develop an innovative product.

The purpose of the proposed network will not only be to provide high-level educational opportunities to the students of the region, but also to develop and instill an entrepreneurial spirit. The sites would create landing spots, places for our youth to grow, as opposed to having to leave the region to seek opportunity. Again, the vision of the network is to create these pools of talent to spark an Appalachian renaissance of creativity, entrepreneurism, and design.

## Capstone Project

The Appalachian Technology Initiative was created as a regional approach to breaking down barriers of student access to curriculum. Most of the rural school districts in southeast Kentucky could not provide diverse course offering to their students on their own. They only could provide a few pathways. The concept of the ATI was to bring the school districts together, and to build a network to provide courses to all students on a regional basis. While one school may not have the capacity to offer courses in a variety of contents, if schools worked together, they could leverage the capacity of all the districts to provide a much greater course and pathway variety for all students. The idea was to create a model for technology education that could be replicated to include numerous other courses and pathways.

The initial plan of the ATI was to only offer courses in computer science to all schools in the region. In fact, the ATI was not even coined ATI in the early planning meetings, it was referred to as the computer science initiative. The idea was to bring teachers from across the region together to develop and implement content in all schools. All schools would have access to the content, and as a group, they would work to provide and deliver additional courses in the future. As the plan moved forward, it was decided the computer science initiative could be much more, and so the ATI was formed.

The Appalachian Technology Initiative brings teachers from across the region together to work and to create high level technology education opportunities to all students in the region. Pathways were developed in computer science, aviation, aerospace engineering. The pathways will evolve and be complete over four years (Appendix G). In year one, introductory courses (Appendices I and J) were offered in multiple pathways. These courses were mainly targeted for students in eight, ninth and tenth grades. In successive years, courses will be added to complete the paths by year four. Students entering the program as ninth graders will have an opportunity to complete the pathway by the end of their senior year.

The delivery system of ATI was based on an all of the above strategy for providing the content. Course curriculum would be delivered on a digital platform. All students would have access to highly qualified teachers and can work with them through forums, synchronous online meetings, face-to-face meetings, and asynchronous videos. School level facilitators would work directly with students and ensure fidelity of the course. One of the features of the ATI is it is flexible by design. If students in a class are struggling, a regional ATI teacher from another school could schedule a visit to come and instruct the students. Regional teachers also create flipped classroom lessons to provide students and schools personalized supports. This was designed to eliminate many of the issues our schools face when using traditional online courses or digital course content without a facilitator. With the ATI design, students always had access to trained, highly qualified staff to support them in their learning environments.

The model of the ATI was focused on technology education curriculum; however, the design of the ATI was created to be a framework that could be replicated for any content area. An example would be foreign language. Most of the schools in our region offer only one foreign language path. The ATI model could be used to bring together school districts to create a system to offer a variety of foreign language pathways. This could also be used for other high-level or vocational fields that are not offered in the majority of school districts.

The Appalachian Technology Initiative Capstone project went from concept to implementation from early 2015 to the start of the 2015-16 school year. In the first year, 374 students enrolled in Introduction to Computer Programming and 72 students enrolled in Introduction to Aerospace and Aviation. It is projected the number of students enrolled in the ATI will expand each year as additional courses and pathways are added. It is hoped the ATI model can also be replicated to many other content fields, providing students throughout the region enhanced educational curriculum opportunities. It is also believed the ATI can be replicated in other rural areas where students do not have the same academic opportunities as in more urban and affluent regions. The ATI can be a model of how to breakdown barriers for student opportunity throughout the nation and world.

**References**

Ahola, S. (1997). Different but equal: Student expectations and the Finnish deal higher education policy. *European Journal of Education, 32*(3), 291.

Asking Students about Teaching: Student Perception and their implementation. (2012, September 1). Retrieved December 7, 2015, from http://www.metproject.org/downloads/Asking.StudentsPractitionerBrief.pdf

Aulbach, C. (1994). The committee of ten: Ghosts who still haunt us. *The English Journal, 83*(3), 16-16. doi:10.2307/820921

Barren County Public Schools (2015). *Barren Academy of virtual and expanded learning*. Retrieved from http://www.barren.kyschools.us/11/Content2/622.

Blaylock, H. & Newman, J. (2005). The impact of computer-based secondary education. *Education, 125(3),* 373-385. Retrieved from http://journals825.home.mindspring.com/csj/html

Bohan, C. (2003). Early vanguards of progressive education: The committee of ten, the committee of seven, and social education. *Journal of Curriculum and Supervision*, *19*(1), 73-94.

Bollinger, C. (2015, January). *Economic outlook*. Annual economic outlook conference. Retrieved from http://gatton.uky.edu/Content.php?PageName=NINewsStoryDetails&NewsID=71

Bost, H. (1966). A new outlook upon the problem of poverty and health in eastern Kentucky. *Am J Public Health Nations Health American Journal of Public Health and the Nations Health*, 56(4), 590-595. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1256990/pdf/amjphnation00142-0034.pdf

Brown, D. (2012). Rural districts bolster choices with online learning. *Learning and Leading with Technology*, *39*(6), 12-17. Retrieved from www.moreheadstate.edu:7564/ehost

Caudill, H. (1963). *When night comes to the cumberlands.* Boston: Little and Brown

Cavanaugh, C., Gillian, K., Kromrey, J., Hess, M., & Blomeyer, R. (2004). The effects of distance education on K-12 student outcomes: A meta-analysis. *Learning Point Associates.* Retrieved form http://www.ncrel.org/tech/distance/k12distance.pdf

Census Bureau Data (2010, December 19). *Richest counties get richer, poorest get poorer.* Retrieved from http://abcnews.go.com/Business/census-bureau-data-richest-counties-reicher-poorest/story?id=12415751

Census.gov. (2015). Retrieved July 24, 2015, from http://www.census.gov/

Christensen, C., Horn, M., & Johnson C. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York, NY: McGraw-Hill.

County Health Rankings, (2014). *How Healthy is your County?* Retrieved April 24, 2014, from http://www.countyhealthrankings.org/

Clair, C. (2014, May 11). Kentucky Exports are Flying High With Aerospace. *Lane Report*.

Clarke, L. (2012). Putting asynchronous discussions under the lens: Improving discussions through student examination. *Distance Learning*, *9*(3), 43-50.

Cuban, L. (1988). *The managerial imperative and the practice of leadership in schools*. Albany, New York: SUNY.

Daggett, W., & Gendro, S. (2014). Common core state standards initiative: Classroom implications for 2014. *International Center for Leadership in Education*, Retrieved from http://leadered.com/pdf/Common_Core_State_Standards_2014.pdf

Daun-Barnett, N., & St. John, E. P. (2012). Constrained curriculum in high schools: The changing math standards and student achievement, high school graduation and college continuation. *Education Policy Analysis Archives*, *20*(5), Retrieved from: https://wwws.moreheadstate.edu:EJ971424&site=ehost-live

DeBoer, J., Ho, A., Stump, G., & Breslow, L. (2014). Changing "course": Reconceptualizing educational variables for massive open online courses. *Educational Researcher*, *43*(2), 74-84. Retrieved from http://edr.sagepub/content/43/2/74

DeYoung, A. J. (June 01, 1995). Constructing and staffing the cultural bridge: the school as change agent in rural Appalachia. *Anthropology & Education Quarterly, 26(*2), 168-192.

Digest of Education Statistics (2013). *Number and percentage of public school students eligible for free or reduced-price lunch, by state.* Retrieved from: https://nces.ed.gov/programs/digest/d12/tables/dt12_046.asp

Elam, C. (2002). Culture, Poverty, and Education in Appalachian Kentucky. *Education and Culture,* 18(1), 10-13

Feldman, M. P. (2014). The character of innovative places: Entrepreneurial strategy, economic development, and prosperity. *Small Bus Econ Small Business Economics, 43*(1), 9-20.

Frey, C. & Osborne, M (2013). The future of employment: How susceptible are jobs to computerization. Oxford Martin School. Retrieved from http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

Gedera, D. (2014). Students' experiences of learning in a virtual classroom. *International Journal of Education and Development using Information and Communication Technology*, *10*(4), 93-101.

Greaves, T., Hayes, J., Wilson, L., Gielniak, M., & Peterson, R. (2010), Technology factor: Nine keys to student achievement and cost-effectiveness, MDR. Retrieved from http://pearsonfoundation.org/downloads/ProjectREDTheTechnolgyFactor.pdf

Harbison, F. & Myers, C. (1964). Education man power and economic growth. New York. McGraw-Hill.

Holian, L., (2014). *The northeast Tennessee college and career-ready consortium in 2013–14* (IRM-2014-U-007961). Retrieved from Insight Policy and Research website: http://www.niswongerfoundation.org/pdf/CNA Report.pdf

Iowa Department of Education, (2014). *District reorganization, dissolution, and sharing guide*. Retrieved from website: https://www.educateiowa.gov/sites/files/ed/documents/Reorg Guide 2014_0.pdf

Jefferson County Public Schools (2015). *JCPSeSchool*. Retrieved from http://www.jefferson.k12.ky.us/programs/eschool/index.html

Keefe, J. (1986). Advisement programs: Improving teacher-student relationships, school climate. *NASSP Bulletin*, *70*, 85-90. Retrieved from http://bul.sagepub/content/70/489/85

Kentucky Educational Television (2015*). KET Distance*. Retrieved from http://www.dl.ket.org/

Kim, S. (2010, December 19). *Richest counties get richer, poorest get poorer.* Retrieved from http://abcnews.go.com/Business/census-bureau-data-richest-counties-reicher-poorest/story?id=12415751

LaFrance, J., & Beck, D. (2014). Mapping the terrain: Educational leadership in K-12 virtual schools. *Educational Administration Quarterly*, *50*(1), 160-189. Retrieved from http://eaq.sagepub/content/20/1/160

Lapan, R. T. (2004). *Career development across the K–16 years: Bridging the present to satisfying and successful futures*. Alexandria, VA: American Counseling Association.

Mencken, F. C. (March 01, 2000). Federal Spending and Economic Growth in Appalachian Counties*. *Rural Sociology, 65,* 1, 126-147.

*Most likely to succeed* [Theater]. (2015). Available from http://mltsfilm.org/

Miron, G. & Urschel, J. (2012). *Understanding and improving full-time virtual schools.* National Education Policy Center. Retrieved from website: http://nepc.colorado.edu/publication/understanding-improving-virtual

Niswonger Foundation, (2014). *Northeast Tennessee college and career consortium: Project overview*. Retrieved from website: http://www.niswongerfoundation.org/partnerships/

Panorama Student Survey. (n.d.). Retrieved October 24, 2015, from https://www.panoramaed.com/panorama-student-survey

Partnership for 21st Century Skills (2011). *Framework for 21st Century Learning.* http://www.p21.org/storage/documents/1.__p21_framework_2-pager.pdf

Partovi, H. (2014). Computer Science: America's untapped opportunity. Retrieved from http://lanyrd.com/2014/fs14/sdhrkt/

Peterson, S & Slotta, J (2009). Saying yes to online learning: A first time experience teaching an online graduate course in literacy education. *Literacy Research and Instruction*, 48, 120-136

Ravi, S. (2014). *Philosophical and sociological bases of education*. Delhi, India: Prentice Hall.

Rays, B., Dingman, S., Nevels, N., & Teuscher, D. (2007). High school mathematics: State-level curriculum standards and graduation requirements. *Center for the Study of Mathematics*, Retrieved from http://mathcurriculumcenter.org

Roberts, M. J. (2008). *School to career transitions: Career awareness and CTE students*. University of Minnesota.

Rural Policy Research Initiative, (2013). *2013 soar summit: Final report to the region*. Retrieved from website: http://governor.ky.gov/Documents/SOAR-report.pdf

Schoolquest.org, (n.d.) Retrieved April 24, 2014 from https://www.schoolquest.org

Schomberg, G. & Rippeth, M. (2009). Rethinking virtual school. *Principal Leadership, 10(4).* 32-36. Retrieved from naesp.org.

Schwab, (2011). The global competitiveness report 2011-12. *World Economic Forum*. Geneva, Switzerland. Retrieved from http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf

*Shaping our appalachian region*. (2015). Retrieved from http://www.soar-ky.org/about-us/

Smink, J. (2001). Alternatives to retention. *NASSP Bulletin*, *85*(629), 3-17. Retrieved from http://bul.sagepub/content/85/629/3

Tallman, J., & Fitzgerald, M. (2005). Blended online and classroom learning environments. *Knowledge Quest*, *34*(1), 25-28.

Thomas, M.K., Ge, X., & Greene, B. A. (2011). *Fostering 21st Century Skill Development by Engaging Students in Authentic Game Design Projects in a High School Computer Programming Class.* Journal of Educational Computing Research, 44(4), 391-408.

Tucker, M. (2014) *Kentucky rising: Key indicators and subquestions*. National Center for Education and the Economy. Retrieved from website: www.ncee.org/cieb

Waks, L. (2014). *Education 2.0: The learningweb revolution and transformation of the schoo*l. Boulder, Co.: Paradigm Publishers

Weber, C., Johnson, L., & Tripp, S. (2013). Implementing differentiation: A school's journey. *Gifted Child Today*, *36*(3), 179-186. Retrieved from http://gct.sagepub/content/36/3/17

Wirth, R. (2004). Lewin/schein's change theory. Retrieved from https://moreheadstate.blackboard.com/bbcswebdav/pid-1932780-dt-content-rid-9203678_2/courses/61870.EDD806301.ON.2015SP/LewisSchien%28ChangeTheory%29.pdf

Wraga, W. G. (2009). Toward a connected core curriculum. *Educational Horizons*, *87*(2), 88-96. Retrieved from http://wwws.moreheadstate.edu:2048/login?EJ826479&site=ehost-live

Yuniar, R. (March 31, 2015). Indonesians say coding is the future: Now, How do they do it. The Wall Street Journal, http://blogs.wsj.com/indonesiarealtime/2015/03/31/indonesian-say-coding-is-the-future-now-how-do-they-do-it/

# Appendix A

Appalachian Technology Initiative
Key Event Timeline

January 2015 (idea development)
7th—College and Career Planning meeting – ATC Principals—Idea begins to develop
16th – LYNC meeting with KDE – Career pathways
20th – First meeting with Apple representatives

February
9 – Call with Rural-up – Programming in schools
11 – Career Readiness Summit – Jenny Wiley
25- Project Red meeting. Future Ready Initiative Launch

March-
12- AIC planning meeting – Economic development meeting
16 – Advance Kentucky Meeting (AP Computer Science) – SKYPE call with CodeHS – content provider for CS
20- Meetings in Frankfort- KDE and House Education Committee Chair Derrick Graham – Discussion around the possibility of CS initiative

April
7 – AIC Regional meeting. Led by Apple Executives- Public introduction of plan for CS initiative
21 – Action Research Summit
23- East Kentucky Leadership meeting- Presented CS idea in programming session
27-28 Traveled to Cupertino, Ca. Met with Apple officials, Ripple Effects and CodeHS

May
5- Held Computer Science orientation and planning meeting – School leadership
6 – Hosted CodeHS leadership
8 – Code.org training
11—SOAR summit Pikeville, KY
13 – Innovation Coordinator meeting – ATI was introduced – Staff application was distributed
14- ATI meeting in Hazard.
19-21 Traveled to Mountain View, CA. Met with Ripple Effects, Google, Digital Promise and GSV-Lab (innovation Hub)
26 – Code.org conference call

June
2 – Met with Dr. Ben Malthus Morehead State University – Conference call with Dr. Tim Smith of Initiative for Aerospace and Aviation Education (IAE)
4 – Visited PLTW school –Shelby County
8 – ATI planning meeting – KVEC Staff
9 – Traveled to Louisville, KY and met Dr. Tim Smith and IAE
10- Conference call with Rural-up
12- Met with Kris Kimmel of the Kentucky Science and Technology Center
15- Application for ATI staff deadline
16 – Conference call with Alec Wright of GSV-Lab in CA.
17- ATI finalists selected. – Performance Task assigned.
24 ATI staff performance tasks due
29 – ATI Staff selected and notified
30 – Meeting with EKU department chairs (Math, CS and Aviation)

July
6 – ATI staff orientation
7-9 – Aviation and Aerospace Staff training – Louisville
9 – Meeting with US Rep. Hal Rogers Staff- ATI role in creation of “Silicon Holler”
14 – AIC economic development meeting – Role of ATI
27-28 – Microsoft IT Bootcamp
29 – ATI Staff work day

August
4- ATI school facilitator orientation
6 – Broadband econonomic development meeting – Manchester
7 – Microsoft IT – training Shelby County
14- Meeting with KDE officials in Frankfort. All courses approved through KDE/CTE
18- All schools had begun offering courses through ATI

Appendix B

**KVEC Computer Science Initiative**
**Professional Action Network**
**Orientation and planning meeting**
**Tuesday, May 5th, 2015 – Hazard, KY KVEC Offices**

Invitees:

Innovation Coordinators
Principals (middle and high)
District Technology Coordinators
Tech/Math Teachers
Central Office Administrators
Any other partners interested in Computer Science Education in KVEC region

9am-1pm – Lunch Provided

**Agenda Tentative:**

**I.** Introductions

**II.** Vision/Mission – Computer Science Initiative

**III.** Year One
   a. Course offerings
   b. Potential Student enrollment
   c. Facilitation
   d. Delivery and monitoring
   e. Future Course Development
   f. CTE Pathways (Industry Certification)

**IV.** Year Two and beyond…
   a. Future goals
   b. Course Development
   c. CS pathways
   d. Sustainability

**V.** Additional Partners
   a. Local (SOAR, Rural-up, etc)
   b. Global (Apple, Google, Microsoft, etc.)

**VI.** Next Steps
   a. Next Meeting
   b. Summer PD (for facilitators)

# Appendix C

# Appalachian Technology Initiative

Faculty Application

## Applications Should be E-Mailed to:

**Paul Green, ATI Lead**
**paul.green@hazard.kyschools.us**

**PHONE: 606-231-8606**

**(Faxed copies will not be considered. E-mail receipt will establish deadlines)**

**APPLICATION DUE: June 15, 2015**

**Applications will be scored by an ATI selection committee. Finalists may be required to perform interview and complete performance tasks**

# Appalachian Technology Initiative

## Vision

The vision of the Appalachian Technology Initiative is to create a technological "Appalachian Renaissance" by creating a culture of creativity, innovation and design thinking in our youth. The Appalachia Technology Initiative will be THE model of rural innovation and technology education in the nation.

## Mission

With the assistance of multiple partners, a model educational program will be developed which will deliver world-class technology learning opportunities to students in Eastern Kentucky. The acquisition of these high level skills will allow our students to thrive in the global economy.

## Design

The model will be an innovative hybrid approach to learning. Kentucky Valley Educational Cooperative (KVEC) will lead the initiative by working with multiple partners to develop a comprehensive educational model. The goal of the program will be to not only teach computer skills, but to prepare students to engage in the "Future Ready" economy. The tenets of the program will revolve around the following six C's: Commitment, Creativity, Coding, Communications, Critical Thinking and Collaboration

KVEC will create a central hub (virtual center) to lead the school. This center will have similar attributes to an Area Technology Center; however, the design will have a much larger scope. A hub will be created to serve as the epicenter for K-12 computer science education in the region. The deliver model will be a hybrid approach that will include online, blended, virtual and face-to-face learning opportunities.

From the hub, ATI faculty from through out the region will develop, instruct, facilitate and support courses for our 19 school districts. KVEC will also work with several outside partners for course and curriculum develop.

Faculty will use online platforms such as TheHoller.org to deliver the content and curriculum. National, regional and local facilitators will be available to support and assist students. Both synchronous and asynchronous approaches will be used, as students will have access to facilitators and instructors through LYNC, Skype, forums, chats, blogs, etc. Classes, presentations and seminars will be recorded and archived in TheHoller.org.

The school will be driven by a project-based approach to learning. As students develop high-level skills, they will be expected to create projects and use problem solving strategies to enhance understanding. Activities will be arranged in a variety of ways to develop the six C's. Students must be able to work together and think critically to be success in the world today.

Professional development will be available to train teachers to assist students and build capacity in the region. Teachers with backgrounds in computer related fields would be recruited to assist with course development, facilitation and support in the region.

## ATI Faculty Application
## Procedures and Requirements:

Faculty and staff of the Appalachian Technology Initiative will be the primary facilitators, mentors, monitors and creators of the ATI. Teachers MUST be passionate about technology education. Faculty selected for ATI will be expected to participate in a minimum of 5 days of summer Professional Learning days (stipends awarded). Faculty will be required to attend a minimum of 4 days of professional learning during the school year (substitutes will be reimbursed). Professional learning may include opportunities with Apple, Google and Microsoft. Other professional learning will include opportunities with distance learning, course development, online facilitation, etc. Faculty will be required to be a proficient user of theholler.org. TheHoller.org will be the primary online platform for the ATI. Faculty will work to develop courses, train school level staff and work to make the ATI a model distance-learning program. Staff will work with students via distance learning technology. Skype for business and theholler.org will be online platforms to connect and work with students. ATI faculty will have a minimum of 2 office hours per week to work with students (hourly stipend). Faculty will be available to work with students and school level personal during this time.

**Requirements for considerations would include:**
**1. A complete submission of application**
**2. Commitment to attend summer Professional Learning (5 days minimum)**
**3. Commitment to attend professional learning during school year (4 day minimum)**
**4. Commitment to participate in online office hours (2 hours per week)**
**5. Commitment to participate at a Best Practice Summit (Pikeville, KY on October 28, 2015-travel and substitute paid by ARI)**
**6. Commitment to participate at the Action Research Summit (Pikeville, KY on April 27, 2016-travel and substitute paid by ARI)**

**7. Commitment to monitor/facilitate courses on WEB portal (Holler)**
**8. Commitment to champion and develop the ATI to be the MODEL distance learning model in rural America.**

| Important Dates for ATI Faculty Applicants | |
|---|---|
| June 15, 2015 | Deadline for Grant Submission |
| June 30, 2015 | Notification of Faculty Selection |
| July 27-31, 2015 (tentative) | ATI Summer Initiative |
| October 28, 2015 | Present at Promising Practice Summit<br><br>at East KY Expo Center in Pikeville |
| April 27, 2016 | Action Research Summit at East KY Expo Center in Pikeville |

## Appalachia Technology Initiative Faculty Application Form

**PERSONAL INFORMATION:**

Full Name ______________________________

Street Address

_________________________________________________________

City, State, Zip Code

_________________________________________________________

Phone Number

(____)____________________________________

School District

_________________________________________________________

School

___________________________________________________________

Teacher Certification Areas

_____________________________________________________

**POSITION/AVAILABILITY:**

Days/Hours Available (Online office)

Monday ____
Tuesday ____
Wednesday ____
Thursday ____
Friday ____
Saturday ____
Sunday ____

Office Hours Available: from _______ to ______

**EDUCATION:**

Name and Address Of School - Degree/Diploma - Graduation Date

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Skills and Qualifications: Licenses, Skills, Training, Awards

__________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**EMPLOYMENT HISTORY:**

Present Or Last Position:

Employer: ____________________________________________________________

Address:______________________________________________________________

Supervisor: ___________________________________________________________

Phone: ____________________________________

Email: _____________________________________

Position Title: ____________________________

From: ________________ To: ________________

Responsibilities: _________________________________________________________

__________________________________________________________________

**Previous Position:**

Employer: ____________________________________________________________

Address:______________________________________________________________

Supervisor: ___________________________________________________________

Position Title: ____________________________

From: ________________ To: ________________

Responsibilities: ________________________________________________________

______________________________________________________________

**References:**

Name/Title Address Phone

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

I certify that information contained in this application is true and complete. I understand that false information may be grounds for not selecting me or for immediate termination of my position at any point in the future if I am selected. I authorize the verification of any or all information listed above.

Signature_________________________________________________________________
Date

______________________________________________________________________

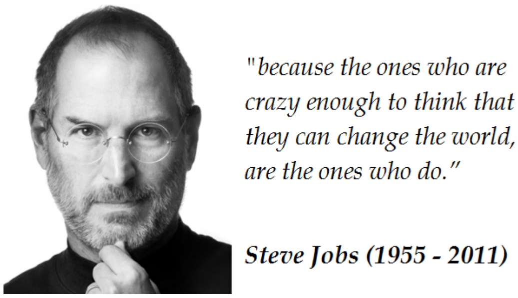
Superintendent Signature Date

______________________________________________________________________

Principal's Signature Date

______________________________________________________________________

Innovation Coordinator Date




The vision of the Appalachian Technology Initiative is to create a technological "Appalachian Renaissance" by creating a culture of creativity, innovation and design thinking in our youth. The Appalachia Technology Initiative will be THE model of rural innovation and technology education in the nation.

In 500 words or less, describe how you believe you can contribute to achieving the vision of the ATI.

# Appendix D

## ATI Regional Staff Job Description

**ATI Staff must be able to…**

**Plan**

1. Design the Instruction Program so that it is consistent with the total educational philosophy of the ATI
2. Develop, implement, and evaluate the Instruction Program's curriculum, schedule, philosophy, goals, and objectives reflecting school and state goals
3. Continue professional growth through self-directed, as well as defined professional development opportunities, which may include additional training, professional learning communities, outside research, and reading professional literature
4. Communicate with ATI administration regarding program needs and continuous improvement

**Program**

1. Possess online communication and facilitation skills
2. Provide instructional support and interventions to students
3. Implement instructional activities that contribute to a positive environment where students are actively engaged in meaningful learning experiences
4. Serve as instructors for courses in synchronous and asynchronous formats
5. Collaborate with the instructional team concerning student educational needs as requested
6. Clearly articulates deadlines, schedules, and procedures to students and parents to ensure that students complete coursework in a timely manner
7. Assist site administrator with student placement
8. Maintains contact with mentor teachers assigned by Schools
9. Assist students and parents with technical support requests relating to the course interface and student information systems
10. Uses a variety of programs and software applications, as appropriate, to complete instructional and administrative tasks
11. Participate in teacher induction training as scheduled by site administrator

**Monitor and Report**

1. Meet professional obligations through efficient work habits such as meeting deadlines, honoring schedules, coordinating resources and meetings in an effective and timely manner
2. Maintains effective and efficient recordkeeping procedures
3. Communicate directly with facilitators in schools regarding student learning, progress, and completion

4. Use formative and summative assessments in order to differentiate and improve instructional practices and strategies
5. Evaluate student performance on a regular basis and providing feedback to students and parents

# Appendix E

**ATI Budget Proposal 2015-16**

**(Based on 6 ATI Staff)**

| | | |
|---|---|---|
| IEA Content and site license (60-100 students) | | $15,000 |
| IEA Professional Learning (Louisville, July 7-9)<br>Travel, Food, mileage – 6 staff | | $3200 |
| Microsoft IT Bootcamp ( Pikeville, July 27-28)<br>Travel, food, mileage – 6 staff | | $1600 |
| Professional Learning | | |
| 5 Days in August | $100 per day (stipend) | $3000 |
| Meals | 10 days $250 per day | $2500 |
| Sub Reimbursement | 8 days $75 per day | $3600 |
| Travel | 10 days x 6 staff | $4000 |
| Facilitation – Online office hours<br>3 hrs per week – 36 weeks | | $16,200 |
| Year 2 course development<br>$2500 per class - 6 courses developed | | $15,000 |
| **Total** | | **$64,100** |

Appendix F

**Appalachian Technology Initiative**

The Appalachian Technology Initiative is truly on the cutting edge for educational delivery in the state of Kentucky. Kentucky Department of Education officials are meeting this week to determine how the ATI will be classified. This is a FIRST for the state as we are paving the way for providing high-level educational opportunities to ALL students in any part of the state.

With this… we are in uncharted territory. Our model will be under a microscope and it is imperative we create a system that works. ATI staff must be committed to finding creative solutions to the unique problems we will face moving forward.

In order to ensure the instructional delivery model of the ATI is successful, we must be creative in our approaches. Instructors will have to find ways to “reach” students using a variety of methods including, but not limited to social media, forums, chats and blogs. Teachers may need to provide specific instruction or feedback using video conferencing or recordings.

Your Performance Task:

For this task, imagine a student who is struggling in a course and needs help. Due to the online nature of the course, they have never met you personally. Identify a potential problem this student could be facing. Create a video introducing yourself and ways you could walk the student through the problem.

The video needs to be 3-8 minutes in length and can solve any problem you feel comfortable addressing. The video will need to be uploaded to Youtube. When complete… please send the link to the video to paul.green@hazard.kyschools.us

-- USDOE representatives who work with our ARI staff will judge this video. Their input will be used for the final selection of ATI staff.

Below is a link to a Screencast-o-matic and Mondopad Tutorial I created for teachers earlier. This could serve as an example or springboard for your task, but you are unlimited as long as it can be uploaded to Youtube as a final project.

https://www.youtube.com/watch?v=1F6DKpx2Fsg

http://www.screencast-o-matic.com/

# Appendix G

ATI
APPALACHIAN TECHNOLOGY
INSTITUTE

2015–2016

# Kentucky Valley Educational Cooperative

412 Roy Campbell Drive
Hazard, KY

**www.TheHoller.org**

## School Leadership

### Leadership Team

*Cooperative*:
Director: Dr. Jeff Hawkins
Associate Director: Dr. Dessie Bowling

*Initiative*:
Director: Paul Green
Asst. Director: Jennifer Carroll
Asst. Director: Andrew Castle
Asst. Director: Kelli Thompson
Asst. Director: Bernadette Carpenter

### Faculty

Kelli Boles
Doug Barnett
Matt Hudson
Stephanie Younger
John Robinson
Dave Kelton

#### *Vision Statement*

The vision of the Appalachian Technology Initiative is to create a technological "Appalachian Renaissance" by creating a culture of creativity, innovation and design thinking in our youth. The Appalachian Technology Initiative will be THE model of rural innovation and technology education in the nation.

#### *Mission Statement*

With the assistance of many partners, a model educational program will be developed which will deliver world-class technology learning opportunities to students in Eastern Kentucky. The acquisition of these high level skills will allow our students to compete in the global economy.

**Delivery Model**

The model will be an innovative hybrid approach to education. Kentucky Valley Educational Cooperative (KVEC) will lead the initiative by working with multiple partners to develop a comprehensive educational model. The goal of the program will be to not only develop high level technology skills, but to prepare students to engage in the "Future Ready" economy. The tenets of the program will revolve around the following six C's:

Commitment
Creativity
Coding
Communications
Critical Thinking
Collaboration

Students participating in the program will have an opportunity to develop a technology based capstone project that will encapsulate the work they have accomplished in the program.

KVEC will create a central hub (virtual center) to lead the school. This center will have similar attributes to an Area Technology Center; however, the design will have a much larger scope. A hub will be created to serve as the epicenter for K-12 computer science education in the region. The deliver model will be a hybrid approach that will include online, blended, virtual and face-to-face learning opportunities.

From the hub, teachers from through out the region will develop, instruct, facilitate and support courses for more than 19 school districts. KVEC will also work with several outside partners for course and curriculum develop.

The figure below outlines the tiered system of supports. Students will work directly with classroom monitors on a day-to-day basis. Regional ATI staff will serve as facilitators and supports to students and school level monitors. ATI Administrators and Professional experts will be available to support and assist to ensure success of the program.


# ATI Job Descriptions

**Facilitator Roles and Responsibilities**
-Work directly with students in their school setting
-Implement performance based model to ensure student completion and proficiency
-Utilize rubrics to assign grades and provide feedback to students
-Support students in online and blended learning environments
-Keep appropriate student records including attendance and grades
-Communicate with school and ATI leadership regarding program and student needs

**ATI Regional Staff Roles and Responsibilities**
-Serve as instructors for courses in synchronous and asynchronous formats
-Possess online communication and facilitation skills
-Provide instructional support and interventions to students
-Communicate directly with facilitators in schools regarding student learning, progress, and completion
-Communicate with ATI administration regarding program needs and continuous improvement

**ATI Administration Roles and Responsibilities**
-Support ATI Regional Staff
-ATI program development and improvement
-Develop course pathways
-Liaison between ATI Regional Staff and experts in appropriate fields

**Academics**
**Curriculum**

The Appalachian Technology Initiative is being designed to give students world-class educational opportunities. The ATI will work with the Kentucky Department of Education to offer and create educational pathways that will promote economic development in the area. The goal of the ATI is to offer courses in the following career paths:

Robotics (Year 2)

Computer Science

Aviation

Aerospace Engineering

Entrepreneurialism*

*Entrepreneurialism pathway will be combined with the other technical pathways

## Course Offerings Year One

- Introduction to Computer Programming (110201)*
- Fundamentals of Aeronautics and Aerospace (210226)
- Other courses in Microsoft IT suite

*It may be possible to embed content for Computational Thinking (110251) with this course. Schools will work with the ATI/KDE on an individual basis in order to award this credit.

## Course Offerings Year Two (anticipated)

***Computer Science***
- Introduction to Computer Programming (110201)*
- Programming Language –JAVA or C++ (110202 or 110205)
- AP Computer Science
- Other courses in Microsoft IT suite

***Aeronautics and Aerospace***

- Fundamentals of Aeronautics and Aerospace (210226)
- Aeronautics – Pilot
- Aeronautics – Mechanic
- Aeronautics - Flight control
- Aerospace Engineering

***Robotics***

- Foundations of Technology (210107)

***Entrepreneurship***

- Entrepreneurship (060185)*

* Course will include a capstone project.

***Appalachian Technology Initiative***
***Calendar for 2015-16 School Year (tentative)***

| | |
|---|---|
| **June 15** | **Staff Applications Due** |
| **July 1st** | **ATI Staff Selected** |
| **July 7-9** | **ATI IAE Training- Louisville** |
| **July 27-28** | **Microsoft IT Bootcamp- Pikeville** |
| **July 29** | **ATI Staff Training- Hazard** |
| **August 4** | **ATI/school orientation/Training (all schools must attend)** |
| **August** | **Office hours/courses begin** |
| **September 11** | **Monthly ATI staff meetings** |

# Appendix H

# Appalachian Technology Initiative
# Agenda

August 4, 2015

| Time | Item | DRI |
|---|---|---|
| 9:00 | Welcome and Introduction | Paul Green |
| 9:15 | Why ATI? – An overview | Paul Green |
| 9:45 | TheHoller.org and Microsoft IT /touch develop – Log-in | Kelly Boles |
| 10:00 | Computer Science Initiative<br>What is TouchDevelop? | Stephanie Younger |
| 10:30 | Break | |
| 10:45 | Instructional Model –CS<br>Curriculum<br>Instructional Delivery<br>Assessments | ATI Staff |
| 11:45 | Q & A – Computer Science | ATI Staff |
| Noon | Lunch | |
| 12:45 | Aerospace and Aviation (participating schools)<br>Curriculum<br>Instructional Delivery<br>Assessments<br>Supplies needed | ATI Staff |
| 1:45 | Q & A – Aerospace and Aviation | ATI Staff |

Appendix I

# Introduction to Computer Programming (110201)

## ABOUT THE COURSE

The first semester of the course is dedicated to *Creative Coding Through Games and Apps. Creative Coding through Games and Apps* uses TouchDevelop to introduce fundamental programming concepts through a series of interactive lessons that build upon ideas in previous lessons. In many lessons, students are introduced to concepts through video instruction embedded within the programming environment. After being introduced to a concept, students are guided through writing code that practices the concept. As such lessons progress, guidance is reduced, requiring students write code independently. At the conclusion of many lessons, students are directed to complete unguided projects that reinforce concepts and encourage them to be creative and to explore further.

The second semester of the course is dedicated to CodeHS's introduction to programming modules, which instruct students on how to code in JavaScript. Students will work through multiple embedded video/programming lessons to conclude the year programming a full game with JavaScript.

## NOTEBOOK

We will be using an Interactive Notebook/Journal in Computer Programming this year. You will use one composition notebook per semester, approximately. Please do NOT rip pages out of this notebook! This notebook will be used DAILY, so make sure you always have it with you! This notebook will be a record of all of the lessons, activities, etc for Computer Programming. Students are responsible for this notebook, and if the notebook is stolen or lost, the student is responsible for *immediately* replacing the notebook by purchasing a new one. A grade will be taken on the student's work in their notebook throughout each grading period.

## NATURE OF THE COURSE

Computer Programming is unique in that the course is mastery-based. Students are graded on whether a coded program operates correctly or has glitches. Students are expected to repeat or edit assignments until mastery targets have been met.

## CLASSROOM EXPECTATIONS

- You are expected to **assume responsibility for your own learning**.
- You are expected to **ask questions** to clarify your understanding.
- You are expected to **attend class and to be on time**. Attendance is vital to learning. Tardiness is both disruptive and rude to your classmates and may result in detention.
- You are expected to **actively participate** in classroom discussion and activities.
- You are expected to **bring your materials** to class everyday.
- You are expected to **respect everyone's right to learn** without distractions.
- You are expected to **follow school rules** at all times. This includes the cell phone policy .

## ABSENCES

Any time you are absent, it is your responsibility to check with peers for any new announcements. Any handouts given will be placed in the file organizer at the back of the room. If you need to make up an assignment, test, or quiz, you must schedule a time to come in and make up the work in a timely manner.

## ACADEMIC MISCONDUCT

Academic misconduct will NOT be tolerated. If the instructor believes that cheating or plagiarizing has occurred on ANY assignment, you will receive a "0." **All work that you turn in should be your OWN work and in your OWN words.**

## MATERIALS NEEDED

You will need the following items:
- 2 college-ruled composition notebooks
- Pencils
- 3 Scotch Tape Dispensers
- 1 Package Extra Large Glue Sticks
- Loose-leaf paper (and binder or folder)
- Earphones

# Course Prerequisites

Prior to taking this course, students are expected to have the following knowledge:

- Mathematics concepts commonly covered in a 7th grade algebra (or equivalent) course.

## Course Objectives

Creative Coding through Games and Apps is designed to achieve the following objectives:

- Reach a broad, diverse range of students.
- Teach the fundamentals of programming and computational thinking.
- Instill confidence in working with technology.
- Foster creativity, curiosity, and collaboration.
- Teach how computers can be used to solve real-world problems.

As a result, students will be able to do the following:

- Describe what a computer program is
- Use and implement common program control structures
- Read code in the TouchDevelop environment and describe what it does
- Create and publish TouchDevelop apps and games

For more detailed objectives, see the "Students will be able to…" column in the *Course Outline* section below.

## Student Outcomes

Students will gain hands-on experience in designing, programming, and publishing mobile apps and games that run on any platform. For more detailed learning outcomes, see the "Students will be able to…" column in the *Course Outline* section below.

## Scoring Guide (suggested values- Grades assigned by school- not ATI)

- Units 1-5 – 5% per unit (quiz grades) -- 25%
- Unit 6- Project 15%
- Units 7-11- 5% per unit (quiz grades) – 25%
- Unit 12 – Capstone 25%
- Unit 13 – CodeHS Javascript 10%

## Course Outline

*Creative Coding through Games and Apps* is comprised of 13 units broken into 50-minute lessons to deliver up to 150 hours of academic instruction. The course is designed to be flexible by allowing versions of the course to be taught in 18 or 36 weeks. The following outlines learning objectives for each lesson of the full 18-week course.

**Basic Javascript and Graphics:** Introduces the basics of JavaScript, including variables, user input, control structures, functions with parameters and return values, and basic graphics, how to send messages to objects. ➢ variables ➢ user input ➢ booleans ➢ logical and comparison operators ➢ general for loops and loop and a half ➢ random numbers ➢ functions and parameters ➢ functions and return values ➢ local variables and scope

**Animation and Games:** Watch graphics come to life! Teaches how to make objects move around the screen and how to let the user interact with programs using the mouse. At the end of this section, students will program their own video game. ➢ timers ➢ mouse events ➢ key events

**Basic Data Structures:** Introduces lists/arrays, maps/objects, sets, and grids. These are the essential basic data structures that any program will use. ➢ introduction to lists and arrays ➢ array length and looping through arrays ➢ finding and removing an element in a list ➢ introduction to objects/maps, sets, and grids

**Game Design Components:** Walk through the creation of the classic Helicopter game one step at a time. ➢ side to side movement ➢ acceleration and deceleration gravity ➢ platform movement ➢ compound objects

**Functions and Parameters Practice:** Functions are the critical building block of any program. To be able to use functions, you want to make sure you fully understand parameters, return values, and how to create your own functions. That is what this practice module is for.

**Karel Puzzles:** A set of all the trickiest Karel puzzles allows students to further problem solving skills without the emphasis on syntax.

**More graphics and Animation:** Practice Javascript by creating fun graphics programs.

**Extra Console:** Practice Javascript through a bunch of fun console programs.

# ATI Delivery Model
# Staff

**Overview**

- Touch Develop and CodeHS will be platforms
  - Touch Develop will not be released until August 18.
  - Schools will need to supplement curriculum with Hour of Code and Birth of Bot
    - https://www.touchdevelop.com/hourofcode2
  - CodeHS content will extend TouchDevelop curriculum in second semester.

- TheHoller.org will serve as social learning network.
  - Teachers/students need to log into TheHoller.org each day for updates/announcements
  - All questions will be posted on TheHoller.org. ATI will respond to all inquiries within 24 hours of posting.
  - Student pacing will vary, however, recommended pacing will be posted to theHoller weekly.

## SIGNATURES

We have read the above syllabus and we understand the expectations and policies for Introduction to Computer Programming at BLHS. We understand that success in this course demands consistent effort both during and after school hours. We also understand this success can only be achieved through diligence in attending class, completing assignments and making up work in a timely manner, and obtaining teacher/peer assistance when needed.

Student: ______________________________
Date: ________________________________

Parent: _______________________________ Date: ________________________________

Appendix J

ATI
APPALACHIAN TECHNOLOGY
INSTITUTE

**FUNDAMENTALS OF AERONAUTICS AND AEROSPACE (210226)**
**COURSE SYLLABUS**

| | | | |
|---|---|---|---|
| **School Year:** | **2015-2016** | **H.S. Credits:** | 1 |
| **School Name:** | | **Program:** | **AERONAUTICS & AEROSPACE** |
| **KY Tech Course Name:** | Introduction to Aerospace | **Teacher:** | |

**Appalachian Technology Initiative**

| **Course Number(s)** | **ATI Course Name** |
|---|---|
| 210226 | Introduction to Aerospace |

**Prerequisite(s): None**

## Course Description

The course covers the exploration of aerospace including, flight/aeronautics, aircraft maintenance, aeronautical engineering, and space. Students will learn about the forces that affect controlled flight, investigate properties of lift, and explore flight through a flight simulator. Students will also learn about aerospace standard materials, aviation safety, aircraft and wing design, and elements of a space mission resource system

## Materials Used

- Flight Sim X
- Saltec Yoke w/ Three Throttle Level
- Saltec Rudder Pedals
- Magnetic Compass
- Toy Aircraft
- Quad Copter
- Tuskegee Airmen Movie
- Tronix Kit 1: Fundamental Concepts "Electronics f
- Soldering Iron
- Solder
- Scour Pad
- Needle Nose Pliers
- Flat Side Wire Cutters
- Wire Strippers

- Raw Materials to Build Wind Tunnel
- Vernier Dual Force Load Sensors
- Vernier Anemometer
- Logger Pro Software
- Balsa Wood from Hobby Lobby
- Flight of the Phoenix Movie (Jimmy Stewart)
- Apollo 13 Movie
- October Sky Movie
- Tool Box
- Hot Glue Gun
- Hot Glue Sticks
- Roll of White Butcher Paper
- Model Rocket Launch Kit
- Alpha II Rocket Kitt
- Rocket Engines

**Objectives**

- Demonstrate an understanding of the history and development of aviation and space transportation.
- Describe the aviation/aerospace environment.
- Describe and demonstrate an understanding of the forces that affect flight.
- Describe and demonstrate an understanding of lift through Bernoulli's Principle and Newton's Third Law of Motion.
- Describe and demonstrate an understanding of the principles of flight.
- Describe and demonstrate how flight simulators are used for training.
- Demonstration flight maneuvers in a simulator: straight and level, turns, and climbs and descents.
- Demonstrate technical knowledge of computer control as it is related to aviation/aerospace projects.
- Describe and demonstrate an understanding of the materials that are used in aircraft design/development.
- Describe and demonstrate an understanding of airfoils and their use in aviation.
- Describe and demonstrate an understanding of rocketry/satellite technology and its application in space environments.
- Describe and demonstrate an understanding of the process for deploying space assets through mission operation models.
- Explore the role of civilian spacecraft in the exploration and colonization of space.
- Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies.
- Demonstrate language arts knowledge and skills.
- Demonstrate mathematics knowledge and skills.
- Demonstrate science knowledge and skills.

- Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- Solve problems using critical thinking skills, creativity and innovation.

**Grading**

*Courses with grades of less than a "C" will not count toward a certificate or be eligible for dual credit.

**Course Outline**

# Foundations in Flight and Aeronautics

Welcome to the world of flight/aeronautics. There are many things to learn. All students in the Air+Space Academy learn the basics of flight/aeronautics but some of your will go deeper. If you choose to pursue a career pathway in flight/aeronautics, unmanned aerial systems, or aviation operations and management, you will have the opportunity to fly in Air+Space Academy flight camps and eventually you can earn your Private Pilot's Certificate. In this course, you will experience the following

- FAA Documents and Regulations
- Forces and Motion
- Aerodynamics
- The Flight Simulator
- Takeoff and Basic Flight Maneuvers
- Many other connections to aviation

- Decision to Study AerospaceAssignment
- STEAM Connection to AerospaceAssignment
- Airplane Flying HandbookAssignment
- Pilot's Handbook of Aeronautical KnowledgeAssignment
- 4 Forces and Flight - View Forces in FSXAssignment
- Introduction to the Flight SimulatorAssignment
- Rate of Climb - Aerospace Connection to Algebra and GeometryAssignment
- AV8RS - Free Membership to AOPAAssignment

- The WindsockAssignment
- The AirportAssignment
- The Traffic PatternAssignment
- Airplane Flying Handbook - Chapter 1Assignment
- Pilot's Handbook of Aeronautical Knowledge - Chapter 2Assignment
- Flight Sim - Taxi to TakeoffAssignment
- Airplane Flying Handbook - Chapter 3 Basic Flight ManeuversAssignment
- Flight Sim: Flying Straight and LevelAssignment
- Aerodynamics: Forces of MotionAssignment
- AOPA - Flight Training Magazine (Ariel Twedo)Assignment
- Turns - How does an airplane turn?Assignment
- Airplane Flying Handbook - TurnsAssignment
- Flight Sim: Level TurnsAssignment
- Airplane Flying Handbook 2: Preflight Inspection and Required DocumentsAssignment
- Pilot's Handbook of Aeronautical Knowledge 2.2: InstrumentsAssignment
- Electric RC AircraftAssignment
- Flight Sim: A Manuevers ProfileAssignment
- Research Your Favorite AircraftAssignment
- Tuskegee AirmenAssignment
- Tuskegee Airmen MovieAssignment
- Paper Airplane EventAssignment

# Foundations in Aircraft Maintenance

In this section, you will be engaging aircraft maintenance technology. AMTs restore, inspect, and repair aircraft. Their work is to keep the pilots and passengers safe. AMTs have great responsibility! In this section, you will be learning about the following:

- FAA Documents and Regulations
- AMT Handbook and AC 43-13
- Hardware in Aircraft

- Safety Wire
- Riveting
- Many other AMT concepts!

- Aviation Maintenance Technician Handbook OverviewAssignment
- AC No: 43.13-2B OverviewAssignment
- Aerospace/Aircraft Hardware StandardsAssignment
- AMT 11 - Safety, Ground Operations and Servicing (Part 1)Assignment
- AMT 1 - Mathematics in AviationAssignment
- Safety, Ground Operations and Servicing (Part 2)Assignment
- Aircraft Maintenance Technician - Lab 1Assignment
- Aviation Maintenance Technician - Lab 2Assignment
- 1903 and Innovation in AviationAssignment
- Safety Wire for AircraftAssignment
- Video - Safety WireAssignment
- AMT 2 - Aircraft DrawingsAssignment
- AMT 4 - Weight and BalanceAssignment
- AMT 3 - Physics in AviationAssignment
- AMT 5 - Aircraft Materials Processes and HardwareAssignment
- AMT 6 - Aircraft Cleaning and Corrosion ControlAssignment
- Corrosion Control - Powerpoint PresentationAssignment
- AMT 8 - Inspection TechniquesAssignment
- AMT 9 - HandtoolsAssignment
- The Galloping Ghost and the Reno Air RacesAssignment
- P51-Galloping Ghost Incident at the Reno Air RacesFile
- Flight Training Magazine - Inspection PlatesAssignment
- AMT 13 - The Aircraft Mechanic CertificateAssignment

# Foundations of Aeronautical Engineering

In this section, you will be exploring the world of aeronautical engineering. Aeronautical engineers solve problems for applications that travel through a fluid (air/water). They design anything from boats to cars as well as aircraft.

Your focus will be to design, build, and test (lift/drag) an airfoil (wing) in your wind tunnel. You can even design your own wing and participate in the Air+Space Academy's Wing Design Competition.

- Engineering: What is it?Assignment
- Flight Training Magazine - How the modern fuselage was designed?Assignment
- Engineering ProcessAssignment
- Wind Tunnel and ToolsAssignment
- Aerodynamics Module 1Assignment
- Aircraft Stability and Control Module 1Assignment
- Aerodynamics Module 2Assignment
- Aircraft Stability/Control Module 2Assignment
- Wind Tunnel and Tools Lab 1Assignment
- The WingAssignment
- Wing Design Challenge 1 - The ModelAssignment
- Units of MeasurementAssignment
- Aspect Ratio and Reynolds NumberAssignment
- Lift FormulaAssignment
- Drag - Induced and ParasiticAssignment
- Unmanned Aerial Systems (UAS)Assignment
- The Future of Aeronautical EngineeringAssignment
- Aeronautical Engineering - Preparation and CareersAssignment
- Debrief - Flight of the PhoenixAssignment

# Foundations of Space Science

In this section, you will be exploring space science. Not only will you be building and deploying a rocket, you will also be creating your own rover, the Jiggybot. You will be learning about mission operations, space systems, digital electronics and more.

If you choose to continue in the pathway, you can earn dual college credit in Space Systems Engineering from Morehead State University where you can build a nano-satellite called the PocketQube.

- Space DefinedAssignment
- RocketryAssignment
- Physics of RocketryAssignment
- ESTES RocketsAssignment
- Space - Exploring our Solar SystemAssignment
- Satellite - Space Systems EngineeringAssignment
- October Sky Movie and DebriefAssignment
- ESTES Rocket BuildAssignment
- Comparing Rocket Boys to Your RocketsAssignment
- Mission Operation SystemsAssignment
- Rocket Launch - Setting Up the MissionAssignment
- Rocketry LabAssignment
- Space in Our Lives Knows and DosAssignment
- CubeSat Launch From Space StationAssignment
- Articles - Space In Our LivesFolder
- Lab 1 JiggyBotFolder
- Link to your JiggyBot and other cool space toys here!URL
- Unit 1 Space In Our Lives Curriculum MapFile
- Chapter 1 Space In Our Lives Note guideFile
- Chapter 1 Space In Our Lives Think and CommunicateFile
- Chapter 1 Space In Our Lives Think and CommunicateAssignment
- MSU SSE 120 Video Lesson 1: Introduction to the CubeSatURL
- Metric MishapsFolder
- Mars Climate Orbiter - A $$$$ Metric MishapURL
- Edge of Space MovieURL
- Mission Ice FlowsFile
- Earth from SpaceURL

- FireFlyURL
- Apollo 13 Movie and Debrief

**<u>Accommodations for Individuals with Disabilities and Equal Employment Opportunities (EEO)</u>**

The Education Cabinet, the Department for Workforce Investment and the Office of Career and Technical Education does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in educational services and/or employment. The Education Cabinet provides, upon request, reasonable accommodations including auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all services, programs and activities. To request materials in an alternative format, contact the Civil Rights Compliance Coordinator in OCTE or Norb Ryan at NorbJ.Ryan@ky.gov. Persons with hearing-and speech- impairments can contact the agency by sing the Kentucky Relay Service, a toll-free telecommunication device for the deaf (TDD). For voice to TDD, call 1-800—648-6057. For TDD to voice, call 1-800-648-6056.

The Office of Career and Technical Education does not discriminate on the basis of race, color, national origin, sex, disability, age, marital status, or religion in admission to education programs, activities, and employment practices in accordance with Title VI of the Civil Rights Act of 1964, Title VII of the Civil Rights Act of 1964, Title IX of the Educational Amendments of 1972, Section 504 of the Rehabilitation Act of 1973 (revised 1992), and the Americans with Disabilities Act of 1990 and shall provide, upon request by a qualified disabled individual, reasonable accommodations including auxiliary aids and services necessary to afford individuals with a disability an equal opportunity to participate.

For more information, contact Mr. William Denton, Office of Career and Technical Education, 20th Floor CPT, Frankfort, Kentucky 40601, (502) 564-4286. Mr. Denton can also be reached through his e-mail address: WilliamJ.Denton@ky.gov.

________________________________ __________
Student Signature Date

________________________________ __________
Parent/Guardian Signature Date

Appendix K

# Microsoft certification made easier by KDE pilot program

Posted on 08 December 2015. Tags: computer science, Kentucky Valley Educational Cooperative, Marion County, Microsoft IT Academy, technology


*Categorized* / **Features**

Dylan Tungate, a technology instructional assistant for Marion County Schools, looks on as Zach Nalley works on a Microsoft IT Academy course in Anita Milburn's information technology class at Marion County Area Technology Center. Photo by Mike Marsee, Nov. 4, 2015

By Mike Marsee michael.marsee@education.ky.gov

Workers who know the ins and outs of the most frequently used technology have an edge. Kentucky schools have found more than one way to give their students that advantage.

Students are learning to master Microsoft programs through a Kentucky Department of Education pilot program that provides access to the Microsoft IT Academy. There is room for more schools to take advantage of funding that can be used to purchase memberships in the IT Academy and vouchers for student exams.

**Kentucky's Pilot Program**

The KDE program began at the start of this school year after the Kentucky General Assembly designated funding to offer the Microsoft IT Academy to every high school and area technology center (ATC) in the state. The academy offers a technology curriculum that can be used to help students learn IT skills they will need in the workforce.

"So many of our industries and businesses are asking for our students to have those skills in computing," said Laura Raganas, the IT Academy program manager with KDE's Office of Knowledge, Information and Data Services. "It does give our students a little leg up."

The legislature provided $800,000 to offer the program to 287 high schools and area technology centers. Raganas said 258 schools have signed up so far.

"We were really excited to be able to implement it this year," said Tara Tatum, a business education teacher at Marion County High School. "Because of funding in the past, I haven't been able to do that."

Microsoft Office Specialist (MOS) certifications at the core level are available in Excel, Word, PowerPoint and Access. These certifications can count toward students' college- and career-readiness certification, and some of them — such as Excel — offer a gateway to advanced IT skills that are highly desired by industry employers.

"I tell students every day that it's not the most exciting class you're going to have, but it's going to be beneficial to you because you're going to leave with the MOS certification, and that's valued in the world of work," Tatum said.

There are 22 career pathways in which the Microsoft programs can be used to directly support the college and career readiness preparation of Kentucky students.

"Information Technology and Business Education programs are certainly benefitting from the supports of the IT Academy" said Marissa Hancock, academic program manager with the Office of Career and Technical Education at KDE. "The IT

Academy has enabled equal access to instructional support tools for teachers and certification vouchers for students."

Each school enrolled in the pilot program has its own certified testing center for students. The cost of the test is paid for with vouchers provided through the KDE program.

**Marion County Sees Value**

Both Marion County High and the adjacent Marion County ATC began offering Microsoft IT Academy courses after Dylan Tungate, a technology instructional assistant for Marion County Schools, and Anita Milburn, an information technology instructor at Marion County ATC, attended a KDE training in August that attracted about 200 educators.

"We basically said, 'This is something that we want to provide to our students," Tungate said. "We shared resources with both (schools) and we just took off."

Milburn said the academy allowed Marion County ATC to update its software from Microsoft Office 2010 to the 2013 version and allowed some returning students who already had introductory classes to get certified quickly.

"I tell students how important it is to have it on their resume," Milburn said. And I've told them, too, what it would cost them if they took each one of those exams individually. Some of them have over $500 in certification vouchers, so that's a big bonus."

Tatum said Tungate, who graduated from Marion County High only two years ago, has been a valuable resource and a good example for students. He earned MOS certifications in 2014 and is working for the school district while attending Campbellsville University.

"Seeing and hearing what he's done with all his certifications, it's definitely eye-opening for them," Tatum said.

**Eastern Kentucky Gets Cooperative**

Twelve eastern Kentucky schools that might not have been able to offer the course "Creative Coding Through Games and Apps" on their own are doing so through the IT Academy and a program offered by the Kentucky Valley Educational Cooperative.

"We were talking about things we need to do within our region to try to create opportunities for our students, and one of the things that was very glaring was that there was a lack of opportunities in computer science for our kids," said Paul Green, who coordinates the KVEC program.

The IT Academy is helping to fulfill the mission of the Appalachian Technology Initiative, an instructional model Green created as part of his work with KVEC's Appalachian Renaissance Initiative, which helps bring technology education opportunities to students in a traditionally isolated region.

KVEC is using six teachers to offer the Creative Coding Through Games and Apps course in 12 schools, which have a total of 374 middle and high school students taking introduction to computer programming courses. They are sharing resources to serve schools that couldn't otherwise offer those courses.

Green said funding was made available for certified teachers to travel to the schools on an as-needed basis, while online tutorials developed by the certified teachers allow the students to do much of the work independently. The students are supported by facilitators in each school.

"It's that facilitator that really makes or breaks the program," Green said. "It's up to that facilitator to be the go-between."

Green's model has attracted the attention of officials at Microsoft, which is considering it as something it can promote in other states, Raganas said.

"They're just doing a fantastic job," Raganas said. "Some of the schools KVEC serves are very small schools, and they don't have a business teacher on site or a computer science teacher on site."

Green said he recently talked with educators in North Carolina and Virginia about his coding program.

"We think it's a replicable model," Green said. "We've got a budget of $30,000 or $40,000 and we're reaching 374 kids for less than a teacher's salary, so that's pretty significant."

He said he thinks the program will expand next year, with another 300 to 400 students enrolling in the introductory course and pathways being started for students who have completed it. He also is working with the computer science department at Eastern Kentucky University to get help in designing content and access to upper-level students who can serve as tutors.

Green said adjustments will be made next year, but he said this was a big step from having only two districts – Johnson and Lee counties – in a 19-district area offering any kind of computer science instruction.

“This is a rural area that traditionally hasn’t had these opportunities, and we’re tying it back to economic development,” Green said, noting the push to create fiber-optic communities in eastern Kentucky. “If we don’t have kids that have these skills and can do these things, then it’s not going to make an impact.”

Raganas said changes will be made at the state level, but she said the program has gained a great deal of momentum in recent months and should continue to grow thanks to the push from the General Assembly.

“Our legislature has done what our schools and teachers have wanted to but haven’t been able to because of budget,” she said. “We are doing a great job in trying to match the wants and needs of industry with the wants and needs of our students, and it’s definitely gained a lot of momentum in the last couple of months.”

**MORE INFO ...**

Laura Raganas laura.raganas@education.ky.gov
Marissa Hancock marissa.hancock@eudcation.ky.gov
Anita Milburn anita.milburn@marion.kyschools.us
Tara Tatum tara.tatum@marion.kyschools.us
Dylan Tungate dylan.tungate@marion.kyschools.us
Paul Green paul.green@hazard.kyschools.us

**This post was written by:**

Mike Marsee - who has written 341 posts on Kentucky Teacher.

# VITA

Paul David Green

## EDUCATION

| | |
|---|---|
| May, 1996 | Bachelor of Arts<br>Eastern Kentucky University<br>Richmond, Kentucky |
| June, 1997 | Master of Arts<br>Union College<br>Barbourville, Kentucky |
| Pending | Doctor of Education<br>Morehead State University<br>Morehead, Kentucky |

## PROFESSIONAL EXPERIENCES

| | |
|---|---|
| October, 2014 | ARC Leadership/Consultant<br>Kentucky Valley Educational Cooperative<br>Hazard, Kentucky |
| July, 2008 | School/District Administrator<br>Owsley County Schools<br>Booneville, Kentucky |
| July, 2005 | School Principal<br>Lee County Schools<br>Beattyville, Kentucky |
| August, 1997 | History Teacher<br>Owsley County Schools<br>Booneville, Kentucky |