

A stylized, light blue tree graphic with many leaves, positioned on the left side of the cover.

Appalachia Rising

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ANALYSIS & SOLUTIONS



Appalachia Rising

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Approved by:

September 2015

A handwritten signature in black ink, appearing to read 'Stacey Jordan', with a long horizontal line extending to the right.

Stacey Jordan, Vice President
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Abstract

Middle Appalachia—defined in this report as the Appalachian portions of Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia—is an impoverished area that has been economically dependent on the coal industry for generations. Its schools face unique challenges in ensuring the college and career readiness of students, given that college had been neither needed nor desired in the past, and careers outside the coal industry are limited. Yet no review of education conditions and needs specific to the region has been conducted since 1983. This report responds to the need for such a synthesis, expressed by educators, policymakers, and other stakeholders to CNA Education in the course of more than a decade of work in Appalachia, including through Regional Educational Laboratory (REL) Appalachia. It is the product of a systematic review of published data and research about education in middle Appalachia from 1995 to 2015. Special attention is paid to issues that reflect national and regional priorities: college and career readiness, educator effectiveness, access to and quality of curriculum and instruction, systemic capacity, and health and wellness factors. The majority of the literature identified was small-scale qualitative research, such as case studies involving interviews. A common theme was the importance of Appalachian culture in education improvement initiatives—specifically, its attitudes toward education, attachment to family and place, commitment to the region, and responses to external mandates. Overall, the review suggests that education opportunities and outcomes in middle Appalachia are improving. Directions for future research that would build on past improvement efforts, analyze their long-term impact, and continue to investigate improvement initiatives are highlighted.

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Executive Summary

Education issues in Appalachia are embedded in a culture where schools are respected institutions, relationships are highly valued, and residents have a desire to remain in the region and contribute to its development (Daniels, 2014; Harmon, 2001; Wright, 2012). At the same time, geographic isolation, high rates of poverty, and depressed economies have long presented unique challenges for its educators (Elam, 2002).

These challenges have been particularly daunting in the areas that we define as “middle Appalachia”—a mostly contiguous portion of Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia in the heart of the Appalachian Mountains. Middle Appalachia is predominantly rural, with all six states ranking in the top half of states deemed by rural education experts as having uniquely rural needs that should be considered by policymakers (Johnson, Showalter, & Lester, 2014). Further, it is a region characterized by a deep sense of place, isolationism, and independence. It also has had a disproportionate dependence on a single, rapidly declining industry—coal. This area in the heart of Appalachia has been characterized as representing “the place of poverty in the United States’ consciousness” (Obermiller & Couto, 2004, p. 249).

While reports in the past decade have highlighted education issues in rural America and in the larger Appalachian region, no summary of research or education conditions specific to middle Appalachia has been conducted since 1983. This report responds to the need for such a synthesis, expressed by education leaders, policymakers, researchers, and other stakeholders to CNA Education in the course of more than a decade of work in Appalachia, including through our operating of Regional Educational Laboratory (REL) Appalachia.

The report is the product of a systematic review of published data and research from 1995 to 2015 about education conditions and challenges in middle Appalachia, primarily K–12. It discusses five education topics of national priority—**college and career readiness, educator effectiveness, access to high quality curriculum and instruction, systemic capacity, and health and wellness**—and situates them in the local context of middle Appalachia. The national focus on college and career readiness for all students presents a particular challenge in a region where, in the past, college was neither needed nor desired and careers outside the coal industry are limited.

The report also highlights topics on which additional research is needed, either because there is a limited knowledge base or because promising practices merit additional investigation.

Methods

We conducted an extensive literature search for journal articles, reports, and dissertations about education in middle Appalachia from 1995 to present. To supplement the literature, we also collected quantitative data specific to middle Appalachia, when available, from a variety of sources, including the U.S. Department of Education and state education agencies, to provide comparisons within or outside the region.

Findings

This search identified more than 275 studies relevant to education in middle Appalachia over the past 20 years. The majority of the literature involved small-scale or qualitative research, such as case studies and interviews. A common theme across topics was the importance of Appalachian culture in education improvement initiatives—specifically, its attitudes toward education, attachment to family and place, commitment to the region, and responses to external mandates.

The Middle Appalachia region

Compared with the rest of the United States: The student population in middle Appalachia is, in general, poorer, less ethnically diverse, and has a higher proportion of special education students. Employment indicators show a lower percentage of adults in the workforce in the region. And among the employed, a higher percentage work in extraction industries and a lower percentage in professions that require a college degree.

College and career readiness

National reports showed that the six middle Appalachia states are focusing on students' college and career readiness, and numerous initiatives are under way in the region with that goal. Research suggested improved high school outcomes, in that high school graduation rates across middle Appalachia meet or exceed national rates. In addition, while data are limited, ACT scores in middle Appalachia appear comparable to scores in other parts of those states, and promising practices are helping to increase participation and success in Advanced Placement.

At the same time, career readiness may be problematic. There is potential misalignment between high school career and technical education programs and career opportunities. Further, college completion in middle Appalachia lags behind other regions of the country, perhaps related to an ongoing reliance on occupations that do not require college degrees. Complex attitudes toward higher education, limited college-going experience among adults, and the desire to remain close to home both during and after college also contribute to this phenomenon. Students who do attend college indicate a desire to return to and improve their home communities.

Together, these studies suggest that unique supports may be needed for students from middle Appalachia to enroll and persist in college, including social and community supports, as well as curricula grounded in local issues to increase relevance and support students' desires to contribute to the betterment of home communities.

Educator effectiveness

State policies in middle Appalachia reflect the national emphasis on educator quality and effectiveness, particularly as it relates to implementing rigorous academic standards. Numerous sources identified it as a key topic of concern in middle Appalachia. The concern stems from the difficulty of attracting and retaining school leaders and teachers to geographically remote school districts, coupled with concern that principal and teacher candidates native to the region may have had inadequate preparation to teach to rigorous standards. Further, a shortage of teachers in the fields of special education, mathematics, and science often results in out-of-field teaching. Such findings suggest that educator preservice and inservice programs should attend to recruiting and providing rigorous preparation and professional development to teachers in hard-to-staff content and program areas.

At the same time, the research indicated that the role of educator in middle Appalachia is a respected position to which many aspire because it enables them to enjoy a viable career at home. As a result, attrition of educators is less an issue than overall quality—how to ensure that local educators are delivering high-quality leadership and instruction. The literature indicated recognition that the region must “grow its own,” and numerous initiatives to increase the knowledge and skills of the region's educators have been implemented, often with external support. No research emerged that examined the long-term impact of these initiatives.

Another theme is the challenge faced by educators in middle Appalachia in teaching to externally generated, rigorous academic standards and definitions of effectiveness that may not resonate with all local residents. The literature indicated that local definitions of educator effectiveness go beyond academics to include the ability to build trusting relationships and support students in overcoming barriers to learning. Some research suggested that educators view parent and student attitudes as

barriers to academic achievement. The literature advocated teacher preparation programs that focus on the rural Appalachian context, incorporating strategies for embedding standards in place-based pedagogies and working to counter deficit views of Appalachian students and parents.

Curriculum and instruction

While the literature on curriculum and instruction in middle Appalachia does not yet address implementation of the Common Core State Standards, it did reflect a national focus on mathematics and science instruction and online/blended learning. Much of the literature was devoted to math and science education, growing out of federally funded initiatives such as the Appalachian Rural Systemic Initiative (ARSI). The literature that emerged from these initiatives emphasizes the need to increase educator effectiveness in teaching to challenging standards, preparing students for high-tech careers, using technology to increase access to high-quality instructional materials, and engaging students and the community through locally relevant pedagogies.

While some of the research advocated integrating place-based education with math and science education, the two ideas do not appear to be well-integrated in the actual improvement efforts. Initiatives appear to derive from national, standards-based movements, with a perfunctory nod toward community engagement. Meanwhile, the literature on place-based education projects seldom explicated how these projects connected to student learning goals. One critical caveat is that most of the research described approaches to curriculum and instruction, with limited information about the effectiveness of such approaches.

A relatively small body of research documented the increasing use of technology to improve access to high-quality curriculum and instruction. Studies to date have found that simply building technology infrastructure does not automatically lead to improved teaching and learning, but few studies describe actual implementation and impact of technology initiatives. An emerging theme in the literature is the need to attend to student diversity in this region once considered to be extremely homogeneous and monocultural.

Systemic capacity

Literature on school improvement in middle Appalachia emphasized the need to build capacity at several levels of the system. Research indicated that middle Appalachia school districts have been the recipient of numerous systemic reform efforts, often spurred by national or state trends or programs aimed at raising academic standards for all students, equalizing funding, and democratizing school governance. Three, interrelated themes emerged from this literature: improving

resource infrastructure; forming regional partnerships; and implementing systemic improvement initiatives. Research suggests that systemic improvement initiatives have provided much needed fiscal and material resources for education improvement, increased the diversity of stakeholder involvement, and helped equalize education expectations and opportunities for all children. Not surprisingly, those aspects of the reform that were most appreciated were those that stakeholders viewed as meeting local needs.

State and regional colleges and universities have played an especially pivotal role in systemic improvement efforts, while engaging the broader community was a universal challenge. In particular, integrating the national focus on college and career readiness, especially when driven by external change agents, into a culture that values family, place, common sense, the mountain culture, and staying close to home presents a challenge to educators.

Health and wellness

Educators in middle Appalachia increasingly are concerned about health and wellness factors—in particular childhood obesity and substance abuse—and how these factors impact schools. We found little research connecting the role of schools to health and wellness in middle Appalachia, though data confirm that middle Appalachia has some of the highest rates of obesity and substance abuse in the United States.

Limited research suggested a strong link between parent and student health behaviors, indicating that schools might do well to offer programs for the extended family. Studies also suggested that such programs should focus on interpersonal relationships, rely on relevant facts, and be presented in terms of self-improvement rather than cast a negative light on family and student behaviors and values.

Implications for policy and practice

- **College and career readiness** efforts should be closely aligned with current and future career opportunities, as well as community development needs in the region. Such efforts should be connected to student learning goals so that students simultaneously develop high-level knowledge and skills while learning to apply knowledge and solve problems in their home communities.
- **Educator preservice and inservice programs** should focus on ramping up teacher content knowledge and pedagogical skills, particularly in mathematics and science; recruiting local teacher candidates in hard-to-staff content and program areas; and cultural context and culturally relevant pedagogies.

- **Curriculum and instruction** in middle Appalachia might be made more challenging, relevant, and engaging through the integration of place-based approaches with the teaching of rigorous academic standards.
- **Systemic capacity** can be enhanced by building on partnerships and lessons learned from prior initiatives. Particular consideration should be given to involving parents and community leaders to ensure relevance and buy-in.
- **Health and wellness** issues are emerging in the region around childhood obesity and substance abuse. Educators will need guidance on effective programs for addressing these problems. Community partnerships will be important, given families' strong roles in modeling health behaviors.

Directions for future research

Research conducted over the past 20 years has laid the groundwork for future studies that will expand on prior research. In general, much research exists that describes the general context for education in middle Appalachia. Additional research is needed to document implementation and outcomes of current education improvement efforts so that educators and policymakers can more fully understand what works and what doesn't, with disaggregation of data for Appalachian regions and specific student groups.

In particular, more research is needed on (1) programs supporting students from Appalachia in enrolling and persisting in college; (2) career and technical education programs; (3) improving teacher and leader effectiveness through recruitment, development, and state improvement initiatives; (4) implementation, impact, and sustainability of curriculum and instruction improvement initiatives, particularly those that integrate the teaching of national standards with locally relevant pedagogies; (5) the use of technology to improve access to quality curricula and materials; (6) characteristics of effective, sustainable community partnerships to improve education; and (7) addressing health and wellness issues.

Conclusions

Middle Appalachia mirrors the rest of the country in the current focus on college and career readiness, including an emphasis on more rigorous academic standards. Local initiatives are emerging that seek to reconcile attachment to place and geographic isolation, both common rural characteristics, by developing local capacity to teach to rigorous standards and generate innovative career pathways for youth. At the same

time, persistent poverty results in ongoing and new challenges for educators to inspire and prepare youth for a future different from that of their parents.

Many promising practices, spurred by federal, state, regional, and local investment, are under way that merit further investigation to determine their effectiveness in improving student achievement and to understand how these practices fit with the regional culture. Overall, the findings suggest that middle Appalachia is closing the education and economic gaps with other parts of the country, but much work and research remain necessary to provide equitable opportunities to all students.

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Glossary

ACCLAIM	Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics
AMSP	Appalachian Math and Science Partnership
AP	Advanced Placement
ARC	Appalachian Regional Commission
ARSI	Appalachian Rural Systemic Initiative
ATEC	Appalachia Technology in Education Consortium
CCD	Common Core of Data
CCR	college and career readiness
CCSS	Common Core State Standards
CTE	career and technical education
EDGE	Earn a Degree–Graduate Early (WV)
FRL	free or reduced-price lunch
i3	Investing in Innovation Fund
IB	International Baccalaureate
IEP	individualized education plan
KERA	Kentucky Education Reform Act of 1990
KVEC	Kentucky Valley Educational Cooperative
NAEP	National Assessment of Educational Progress
NCEE	National Center for Education Evaluation and Regional Assistance
NCES	National Center for Education Statistics
NCLB	No Child Left Behind Act
NSF	National Science Foundation
PEP	Principals Excellence Program (KY)
RAC	Regional Advisory Committee
RCCI	Rural Community College Initiative
REL	Regional Educational Laboratory
RMEP	Rural Math Excel Partnership
RTTT	Race to the Top
SBDM	school-based decisionmaking
SOAR	Shaping Our Appalachian Region
STEM	science/technology/engineering/math
SY	school year

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Introduction

Education issues in Appalachia are embedded in a culture where school is a respected institution, relationships are highly valued, and residents desire to remain in the region and contribute to its development (Daniels, 2014; Harmon, 2001; Wright, 2012). At the same time, geographic isolation, high rates of poverty, and depressed economies have long presented unique challenges for its educators (Elam, 2012).

These challenges have been particularly daunting in the three subregions in the heart of Appalachia designated by the Appalachian Regional Commission (ARC) as North Central, Central, and South Central Appalachia. Of the 90 Appalachian counties designated in 2015 by the ARC “distressed,” 75 percent are located in these three subregions.¹ The Central subregion, in particular—which encompasses 53 counties in eastern Kentucky and mostly contiguous counties in Tennessee, Virginia, and West Virginia—is said to represent “the place of poverty in the United States’ consciousness” (Obermiller & Couto, 2004, p. 249).

In recent years, education reform has been driven by the notion that college-level skills are needed to prepare students to succeed in an increasingly globalized economy (Barnett & Stamm, 2010; Higher Learning Commission, 2013; Hofmann, 2012). President Obama has made increasing college completion rates a priority, and the Common Core State Standards were written with the explicit goal of ensuring college and career readiness for all students (Berger et al., 2013; Carrell & Sacerdote, 2013; Dougherty & Fleming, 2012).

The new focus on college and career readiness for all students presents a particular challenge in this region, where college had been neither needed nor desired in the past and high-paying careers outside the coal industry are limited. While researchers have recently examined challenges faced by schools in rural America (Arnold,

¹ The ARC’s economic status designations are derived from comparing each county in the nation with national averages on three economic indicators: three-year average unemployment rates, per capita market income, and poverty rates. Then, based on that comparison, the ARC classifies each Appalachian county with one of five economic status designations. The lowest classification, *distressed*, is applied to counties that rank in the bottom 10 percent of counties nationwide. See <http://www.arc.gov/distressedcounties>.

Newman, Gaddy, & Dean, 2005; Johnson et al., 2014; Johnson & Strange, 2009) and in the larger Appalachian region (Pollard & Jacobsen, 2011, 2014), no comprehensive review of data and research on education conditions and needs specific to middle Appalachia could be located since DeYoung’s 1983 article “The Status of Formal Education in Central Appalachia.”

The education division of CNA—a nonprofit research organization—undertook such a review in Summer 2015, in response to the need expressed to us by educators, policymakers, and other stakeholders in the course of more than a decade of work in Appalachia, including through Regional Educational Laboratory (REL) Appalachia.² While our initial intent was to focus on Central Appalachia, we expanded the review to include the two additional subregions—referring collectively to the three as “middle Appalachia” throughout this report.

The review focuses on five topics CNA identified as particularly salient to college and career readiness of the region’s youth:

1. College and career aspirations, opportunities, and outcomes
2. Educator effectiveness
3. Curriculum and instructional access and quality
4. Systemic capacity
5. The emerging issue of health and wellness

The report begins with a description of the methodology for conducting the review, followed by an overview of the middle Appalachia region. The remainder of the review is organized around each of the five topics listed above, each chapter including a review of data and current research on the topic, followed by discussion and implications for future research on the region.

Our hope is that this review will provide policymakers, practitioners, and researchers with critical information to understand and begin to address education challenges unique to middle Appalachia through research or data-informed initiatives.

² CNA Education operates REL Appalachia for the U.S. Department of Education. For more on that and other CNA work in Appalachia, see Appendix A.

Methodology

This report about education conditions and needs specific to middle Appalachia is based on a thorough literature search CNA performed in summer 2015. The search focused on data and research on the five topics listed in the Introduction from 1995 to 2015 in order to capture information salient to current school improvement issues in the region.

Our search for research on education conditions in middle Appalachia began with seven Boolean searches conducted using EBSCOhost for articles published between 1995 and 2015. The initial search used the terms “*education* and *central* and *Appalachia*.” Subsequent searches used the terms “*education* and *Appalachia*” plus the name of each of the six states with counties in middle Appalachia: Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia. Together, these seven searches identified 182 unique articles that focused on the five target topics.

In addition, we reviewed relevant reports on the ARC website. We also searched archives of the *Journal of Appalachian Studies* from 1995 to 2015, as well as the education section of that journal’s annual bibliography of research in Appalachia for the same time period.

As sources were reviewed, additional relevant studies were identified and reviewed through snowballing, though resource limitations prevented pursuing this strategy beyond a small number of reports.

Quantitative data on population, demographic characteristics, education statistics, and cultural indicators relative to the five topical focus areas were taken from reports compiling U.S. Census data located during the initial search (Obermiller & Couto, 2004; Pollard & Jacobsen, 2011, 2014); data reports from the Appalachian Regional Commission (ARC);³ and U.S. Department of Education, National Center for Education Statistics, Common Core of Data.

³ See <http://www.arc.gov/>. Established by an act of Congress in 1965, the ARC is a regional economic development agency that represents a partnership of federal, state, and local governments. It funds projects to promote economic development across Appalachia and collects data relevant to the region.

In total, 279 unique items were identified from the searches conducted above.

Promising education improvement initiatives in middle Appalachia were identified during the literature search. We also obtained such information from REL Appalachia staff and consultants and CNA Education research staff working on projects in middle Appalachia.

Finally, we organized the items and initiatives into topic areas. These topics were identified by synthesizing and prioritizing needs identified through CNA's work in the region through the Regional Educational Laboratory (REL) Appalachia and other research projects, the U.S. Department of Education, Regional Advisory Committee (2011) for the Appalachia Region, focus areas for the Shaping Our Appalachian Region (SOAR) Initiative,⁴ and a relatively recent review of rural education research (Arnold et al., 2005). While this last source did not focus on Appalachia, many of the education challenges in the region are related to its rural nature.

⁴ <http://www.soar-ky.org/>

The Middle Appalachia Region

The aim of this data and research review is to illuminate key education issues that are influential in equipping youth in middle Appalachia with the knowledge and skills needed to pursue college and careers in the 21st century.

Our initial intent was to focus on the subregion identified by the Appalachian Regional Commission as Central Appalachia, but the review was expanded to include two additional subregions identified by the ARC as encompassing the central portion of the Appalachian region: North Central and South Central. For simplicity, we will refer to this expanded, three-subregion area as “middle Appalachia.”

We highlight the middle Appalachian region because of cultural and education similarities among the three subregions.

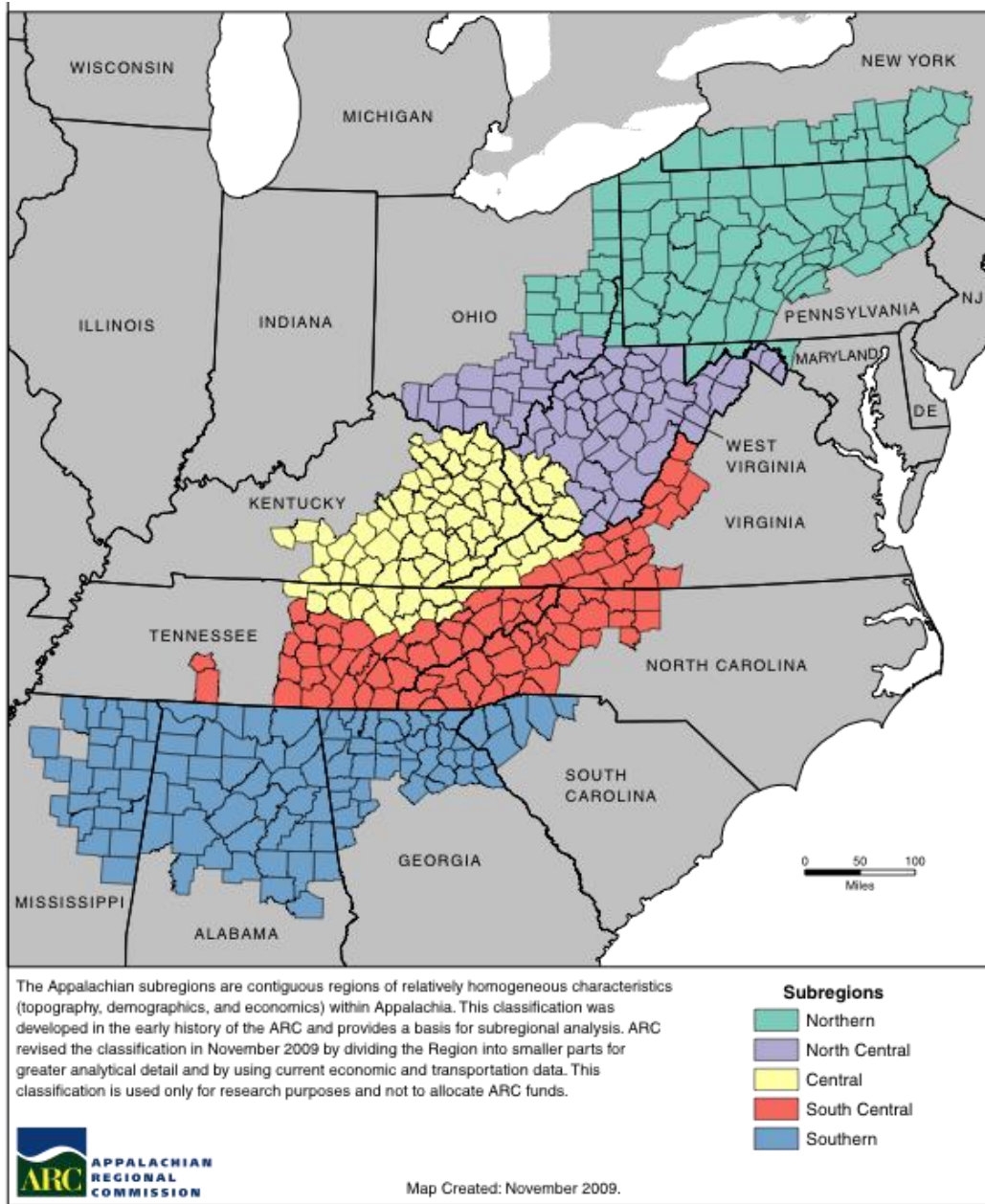
Geographic boundaries

The ARC defines Appalachia as a 205,000-square-mile region that follows the spine of the Appalachian Mountains, encompassing 410 counties in 13 states.⁵ Prior to 2009, the ARC divided the region into three subregions, each considered to be relatively homogenous in terms of its topography, demographics, and economics: Northern, Central, and Southern Appalachia. In 2009, the ARC divided the region into smaller parts “for greater analytical detail,” effectively dividing the former Northern subregion into Northern and North Central, and the Southern subregion into Southern and South Central. The Central subregion remained largely unchanged. (See Figure 1 on page 6.)

The middle Appalachia region that is the focus of this report encompasses 238 Appalachian counties or independent cities—comprising 371 school districts—in Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia.

⁵ http://www.arc.gov/appalachian_region/TheAppalachianRegion.asp

Figure 1. Subregions of Appalachia



Source: Appalachian Regional Commission,
http://www.arc.gov/research/MapsofAppalachia.asp?MAP_ID=31.

Population demographics

Population characteristics

The three central subregions of Appalachia vary in their demographic and socioeconomic characteristics, yet generally have more in common with one another than with Northern and Southern Appalachia or with the United States as a whole (see Appendix B, Table 7).

According to U.S. Census data, somewhat more than 9 million people lived in middle Appalachia in 2010, or approximately 3 percent of the U.S. population. As the U.S. population has increased in the last decade (9.7 percent), the rates of increase in North Central and Central Appalachia have lagged behind the national rate, with the population in Central Appalachia remaining almost static at 1.6 percent.

The population across middle Appalachia is primarily White: 85.5 percent White in the South Central subregion and more than 90 percent in Central and North Central—compared with only 63.7 percent White nationwide. This monoracial/monoethnic population contributes to cultural homogeneity in the region. South Central Appalachia has a larger population and higher population density and racial diversity than the Central and North Central subregions, but still is generally more similar to them than to the U.S. population as a whole.

The median household income is lower in middle Appalachia than the national average. Central Appalachia in particular has a median household income some \$20,000, or 38 percent, lower.

Student characteristics

The demographic composition of the student population in middle Appalachia (Appendix B, Table 8 and Table 9) mirrors that of the general population (Table 7).

Most students in the three subregions, more than 78 percent for each, are White—compared with 51 percent for the United States as a whole. The percentage of children living in poverty in middle Appalachia exceeds the rate nationwide. Further, the percentage of students eligible for free or reduced-price lunch (FRL) exceeds the national average, 55.2 percent versus 46 percent, respectively. The Central Appalachia subregion has the highest poverty (32.0 percent) and FRL (58.9 percent) rates among the three.

Two additional subgroups that are typically of concern for schools—English learner students and students with disabilities—are disproportionately represented in middle Appalachia. The percentage of English learner students is very low across the

three subregions relative to the United States as a whole (2.1 percent versus 8.5 percent). Middle Appalachia's rate of children with disabilities exceeds the national rate (5.2 percent versus 4.0 percent). It also has a higher rate of students with individualized education plans (IEPs).

Economic characteristics

The Appalachian region as a whole historically has been dependent on mining, forestry, agriculture, and chemical and heavy industries, although manufacturing and professional service industries have become more prominent in recent years.⁶ As of 2010, the industries with the highest employment in middle Appalachia are similar to those in the United States as a whole (Appendix B, Table 10): state and local government; food, hotel, and entertainment; health and social services; and retail trade.

Nevertheless, there are some notable differences in the middle Appalachian labor market. Middle Appalachia continues to rely more on agriculture and natural resources (including farming, forestry, coal, gas, mining, and other) than elsewhere. This is especially true for Central Appalachia, where coal, gas, and related industries account for 4.8 percent of the labor market, or approximately 38,000 jobs. In contrast, there is a considerably lower percentage of jobs in many industries that require college degrees—including education and information services; professional or technical services; and finance, insurance, and real estate—in middle Appalachia than nationally.

The employment and unemployment rates in middle Appalachia are comparable to those in other parts of Appalachia and nationally, although Central Appalachia has the lowest employment and highest unemployment rates (Table 1). As a whole, middle Appalachia has a lower percentage of adults in the labor force. This means that a higher percentage of adults have left the labor force altogether and thus are not captured in the employment and unemployment rates.

⁶ http://www.arc.gov/appalachian_region/TheAppalachianRegion.asp

Table 1. Employment Data, Ages 25–64 (2008–2012)

Region	Population	Persons in Labor Force (%)	Employment Rate (% of Labor Force)	Unemployment Rate (% of Labor Force)
United States	163,664,576	78.1	92.3	7.7
Appalachian region	13,274,525	73.6	92.3	7.7
Middle Appalachia	4,782,881	70.1	92.1	7.9
North Central Appalachia	1,284,229	70.2	92.8	7.2
Central Appalachia	1,030,314	60.3	91.4	8.6
South Central Appalachia	2,468,338	74.1	92.0	8.0

Source: Pollard & Jacobsen (2014).

Middle Appalachia context

The overall culture and education context of middle Appalachia is complex, with many subtleties and local variations. We discuss these issues in depth throughout the report. However, there are general themes that unite the area and serve as a backdrop to education practices.

The isolation created by the mountainous terrain has resulted in limited in-migration and a strong reliance on family and community support systems, as well as attachment and commitment to the region (Ali & Saunders, 2006; Browne-Ferrigno & Allen, 2006; Elam, 2012). The geography of the region has led to an economy that historically relied on coal and other extraction industries, none of which requires high levels of formal schooling. The boom-or-bust nature of these industries, coupled with lack of alternate job opportunities, has kept income levels relatively low across the region (Pollard & Jacobson, 2014).

These geographic and contextual factors likely contributed to the development of a culture strongly focused on family, community, and egalitarianism, in contrast to cosmopolitan values that emphasize formal education and career success and wealth (Howley, Harmon, & Leopold, 1997). As will be evident in the sections that follow, these cultural factors have exerted a profound influence on the education system of middle Appalachia.

College and Career Readiness

The current national focus on ensuring the college and career readiness (CCR) of all students has become a key driver of education efforts in states, including those of middle Appalachia. In this section, we examine what is known about various aspects of college and career readiness in the region.

National and state context

As noted previously, CCR has driven education reform efforts nationwide in recent years. Reflecting national trends, the six states that encompass middle Appalachia all have taken significant steps in promoting CCR for their high school graduates. These steps include policies, programs, and initiatives across K-12 and its higher education partners.

In 2014, the Education Commission of the States published an analysis of CCR policies for all 50 states (Glancy et al., 2014). The analysis discussed key CCR policies and practices in K-12 and higher education, with an emphasis on standards, assessments, and accountability. Table 2 summarizes the analysis for the six middle Appalachia states.

Table 2. State-Level College and Career Readiness Policy in Middle Appalachia

Policy	KY	NC	OH	TN	VA	WV
Requires that schools offer Advanced Placement, International Baccalaureate, and/or dual enrollment	•	•	•		•	•
Has adopted CCR assessments	•	•	•	•	•	•
Graduation requirements align with college admission requirements	•					•
Includes CCR measures in school accountability	•	•	•	•	•	
Has statewide college admission policies	•	•				•
Has statewide college remedial and course-placement policies	•	•	•	•	•	•

Policy	KY	NC	OH	TN	VA	WV
Has three out of four college transfer policies ^a	•		•	•		•
Has comprehensive higher education accountability policies		•	•	•		
Adopted a CCR definition	•		•	•	•	•
Produces high school feedback reports for recent graduates	•	•	•	•	•	

Source: Glancy et al. (2014).

^a. Transfer policies are (1) transferable core of lower-division course, (2) common course numbering, (3) guaranteed transfer of associate's degree, and (4) credit by assessment.

According to Glancy et al. (2014), Kentucky has emerged as a national leader in its approach to promoting CCR. Legislation in 2009 known as Senate Bill 1 led the Kentucky Department of Education and Council on Postsecondary Education to create a Unified Strategy for College and Career Readiness that outlined key goals, timelines, responsibilities, and outcomes related to planning a system that promotes CCR for its students. North Carolina has successfully incorporated a range of CCR indicators into its accountability system, including ACT, SAT, and college remediation rates. Ohio has established statewide standards and benchmarks that students must meet to enter credit-bearing courses in college, along with extensive statewide policies on remedial coursework for students who fail to meet the benchmarks.

Tennessee has an explicit CCR definition connected to ACT and other assessments and has used the definition to align K-12 and postsecondary course standards and curriculum. Virginia, while not a Common Core State Standards state, has developed rigorous standards with an aligned assessment system. Further, Virginia has developed “capstone courses” for grade 12 students who have met basic proficiency or graduation standards but have not met college readiness benchmarks. West Virginia requires schools to offer a minimum of four Advanced Placement (AP) or International Baccalaureate (IB) courses, while also requiring consortia of schools and colleges to offer West Virginia EDGE, which provides college credits for career and technical education programs.

In order to support the states' CCR efforts, the U.S. Department of Education has awarded several federal grants to state and local departments of education. The six states with school districts in middle Appalachia have received a total of nine Race to the Top grants with combined value of more than \$1.5 billion, where programs may be directed statewide or locally; and 17 Investing in Innovation Fund (i3) grants worth more than \$220 million. Agencies in middle Appalachia specifically have received five i3 grants totaling \$30 million, all of which focus on college and career readiness (Appendix B, Table 11 and Table 12).

With this national and state emphasis on college and career readiness as a backdrop, the remainder of this section examines the research on CCR in middle Appalachia over the past 20 years.

Major themes

We located a small body of research focused on college and career readiness in middle Appalachia. Roughly half of the sources were qualitative studies that used interviews and surveys to describe perceptions about education. These studies provided rich data on how culture and attitude intersect with the state and national CCR agenda. Another third of the sources provided quantitative, descriptive analyses of student achievement or workforce data that serve as early indicators of the results of the CCR movement. Five sources described career and technical education programs—an important area of research in a region that lacks a strong college-going culture.

Two major themes—college readiness and post-high school attitudes and aspirations—emerged from this body of literature, each with various subthemes, as detailed below.

College readiness

Scant research on college readiness was found that focused on middle Appalachia specifically. As was true when DeYoung conducted his 1983 review of formal schooling in Central Appalachia, assessment instruments and the prevalence of their use differ across states, making it problematic, at best, to represent student achievement in middle Appalachia as a region and/or to compare achievement in middle Appalachia versus the United States as a whole. While all six states participate in the National Assessment of Educational Progress (NAEP),⁷ only a sample of students participates in each state, and data are reported for the state as a whole, not by district.

Therefore, rather than examine achievement within each state (the approach taken by DeYoung), we examine available data and research on high school graduation rate, ACT scores, and Advanced Placement participation. These measures have limitations, but they are the cleanest currently available to compare college readiness across states.

⁷ See <http://nces.ed.gov/nationsreportcard/about/statepartic.aspx#rm>.

Graduation rate

The most basic indicator of college readiness is the high school graduation rate. As Table 3 indicates, students in middle Appalachia and its subregions graduated at rates at or above the national average in 2008/09. For historical context, Ziliak (2007) observed that high school graduation rates in middle Appalachia increased by around 20 percentage points between 1979 and 1999—from 40 percent to 62 percent in Appalachian Kentucky, from 60 to 78 percent in Appalachian Ohio, and from 56 to 75 percent in Appalachian West Virginia. Further, Ziliak (2007) noted that the gap in poverty rates between Appalachia and the nation narrowed over those two decades in tandem with the improved graduation rates.

Table 3. Graduation Rate (SY 2008/09)

Region	Averaged Freshman Graduation Rate (Median)
United States	76.5%
Middle Appalachia	79.2%
North Central Appalachia	81.0%
Central Appalachia	76.5%
South Central Appalachia	78.5%

Source: U.S. Department of Education, National Center for Education Statistics (2010).

A study by Black, McKinnish, and Sanders (2005) using historical economic and education data provided evidence that recent high graduation rates observed for middle Appalachia may be partially related to the recession of the late 2000s, including a steep decrease in coal-related employment. The authors used regression models to study the relationship between wages and high school enrollment during the coal boom of the 1970s and subsequent bust in the 1980s in coal-rich counties in Kentucky and Pennsylvania. They found that high school enrollment decreased with the availability of high-wage jobs for low-skill workers during the coal boom, and that enrollment increased during the coal bust, when wages decreased for high school dropouts. They estimated that a 10 percent increase in wages for low-skill workers could decrease high school enrollment by 5 to 7 percent.

Despite gains in graduation rates, research identified several challenges to improving rates even further. Based on surveys and interviews in Kentucky and West Virginia, researchers identified the following obstacles: poverty, high mobility rates, lack of parental involvement, grade retention policies, and a lack of role models who value education (Lyttle-Burns, 2011; Meehan, Cowley, Chadwick, & Whittaker, 2001). In particular, Lyttle-Burns (2011) noted that some families in the region were satisfied to sustain themselves at least in part through government assistance, suggesting to

students that high school graduation or additional education is not necessary for the desired standard of living.

ACT and Advanced Placement

More advanced measures of college and career readiness than graduation rate are available, to varying degrees, for middle Appalachia. Many states now use ACT or SAT scores as indicators of college and career readiness. However, the percentage of students who participate in each test varies across states, and we did not identify data specific to Appalachian subregions.

Two recent studies that described ACT scores in middle Appalachia portions of Kentucky and Tennessee (where the ACT is mandatory) suggested that students in these sections of middle Appalachia were performing as well, or nearly so, as their non-Appalachian peers (Mokher, 2014; Mokher, Lee, & Sun, 2015). Analysis of ACT data from 24 Central Appalachian school districts in Kentucky revealed that the percentage of students who met the Kentucky college readiness benchmarks in reading was nearly the same as the state average (43.5 versus 44.0 percent, respectively). Fewer students in the Central Appalachian districts, however, met the state's math college readiness benchmarks than in the state as a whole (36.4 percent versus 41.2 percent, respectively) (Mokher, 2014). In Tennessee, Mokher, Lee, and Sun (2015) examined ACT scores for 30 middle Appalachian high schools in northeast Tennessee that are part of a consortium to improve college and career readiness through a federal i3 grant. The mean composite ACT scores in these high schools were nearly identical to the statewide average ACT scores of 19.5 and 19.8 in 2013 and 2014, respectively (ACT, 2014).

Another indicator of college readiness is the number of students participating in AP courses and passing AP exams. Nationwide, Gagnon and Mattingly (2015) found that 47 percent of rural districts had no students taking AP courses. Further, remote, small rural districts were 10 times less likely to offer AP courses than were larger rural districts. We identified only one study about AP courses specific to middle Appalachia. In the same 30 high schools in northeast Tennessee mentioned above, Mokher, Lee, and Sun (2015) found that approximately 25 percent of students enrolled in at least one AP course before graduation, with approximately 40 percent of these students earning a score of at least 3 out of 5 (i.e., "passing") on at least one AP exam.

The authors reported small, positive impacts of the consortium program being evaluated on composite ACT, AP participation, and AP exam performance relative to a set of matched comparison schools. However, these results may not be typical of middle Appalachia, as the study schools have invested significant resources in increasing AP participation and performance with the i3 grant funding.

ost-high school attitudes and aspirations

The largest amount of post-high school research—in fact, the largest amount of CCR-related research in general for middle Appalachia—focused on attitudes about and aspirations toward higher education and subsequent careers. This research included planning for higher education and challenges associated with pursuing higher education. These studies primarily have been small in scale and used interviews and surveys.

Research we reviewed showed a complex set of beliefs about higher education and subsequent careers in middle Appalachia, sometimes with conflicting results. While high school graduation rates now match or exceed national rates, the postsecondary education attainment of the adult population in middle Appalachia, particularly in the Central Appalachia subregion, continues to lag behind that of other parts of Appalachia or the United States as a whole (Table 4). One in five adults in Central Appalachia lacks a high school diploma, and lower percentages of adults have college degrees across middle Appalachia than in the rest of the country.

Table 4. Education Attainment, Ages 25–64 (2008–2012)

Region	Population	Less Than High School Diploma (%)	High School Grad (%)	Associate's Degree (%)	Bachelor's Degree or More (%)
United States	163,664,576	12.3	48.9	8.5	30.2
Appalachian region	13,290,719	12.7	55.2	8.9	23.2
Middle Appalachia	4,782,881	14.7	56.9	8.1	20.3
North Central Appalachia	1,284,229	12.1	60.2	7.8	19.8
Central Appalachia	1,030,314	20.6	59.1	7.0	13.3
South Central Appalachia	2,468,338	13.6	54.3	8.7	23.4

Source: Pollard & Jacobsen (2014).

Note: Pollard & Jacobsen (2014) report a five-year estimate from the American Community Survey, rather than a snapshot from a single year.

Ziliak (2007) suggested that the large gap in college completion rates between Appalachia and the nation overall may explain the relatively low median income levels in Appalachia. Ziliak (2007) further suggested that intensive investments in human capital are needed to improve high school and college completion rates and create a “workforce more capable of effectively exploiting modern technologies ... that fuel economic growth and development” (p. 3).

Four subthemes were prominent in this body of literature on post-high school attitudes and aspirations: (1) parental education and attitudes; (2) attachment to place and family; (3) college aspirations and persistence; and (4) career aspirations and opportunities. Many of these intersect, making it difficult and perhaps incorrect to fully separate them, but we do so here for purposes of discussion.

Parental education and attitudes

A number of studies focused on the low percentage of adults in the region with college degrees and the consequent impact on students' college aspirations and planning (Ali & Saunders, 2006; Bryan & Simmons, 2009; Lyttle-Burns, 2011; Meehan et al., 2001; Wilson & Gore, 2009; Wright, 2012).

Some research suggested that the low percentage of adults in middle Appalachia with college degrees provides youths with few role models and little support for pursuing higher education. For example, in a survey of 91 college students from Appalachian Ohio and Kentucky, Wallace and Diekroger (2000) found that students had received discouraging messages about higher education, both before enrolling and when talking with family and friends while attending college. Females reported more negative reactions than males did from friends and family about pursuing a college education, though both genders reported negative reactions. These reactions included accusations of "acting better" than people who did not go to college, as well as being ignored when discussing college experiences.

Further, Browne-Ferrigno and Allen (2006) suggested that many middle Appalachia citizens who were brought up in working class environments do not value higher levels of schooling. Hendrickson (2012) found that parents regularly encouraged students to forgo college and follow them into industry. Lyttle-Burns (2011) reported that some students were satisfied with their families' standard of living, even when sustained through government assistance; these students therefore determined that further education was not necessary.

Beyond lack of encouragement, the lack of college attainment by family members may result in students having limited access to college information from parents who either do not or cannot help make education decisions (Bryan & Simmons, 2009; Hlinka, Mobelini, & Giltner, 2015; Lyttle-Burns, 2011). This is a particular problem because many students rely primarily on parents for information about college (Meehan et al., 2001). Ali and Saunders (2006) noted that overreliance on parents might disadvantage students as they sought to gain admission to college. They suggested that school counselors should involve parents in career planning, as well as offer students workshops on applying to college that included how to maximize support from significant others. This suggestion is supported by Hendrickson's (2012) finding that encouragement from school staff to pursue college education influences students' decisions.

At the same time, a few studies suggested that even when parents did not attend college themselves, parental support for higher education influenced student aspirations (Hlinka et al., 2015). In surveys of grade 7 students in West Virginia, Meehan et al. (2001) found that a majority of students saw value in postsecondary education. Further, three-fourths of survey respondents intended to go to college and thought their parents wanted them to go. Perhaps most encouraging, Ali and Saunders (2006) found that aspirations to attend college were associated more strongly with perceptions of parental support for academic pursuits than with parents' own education levels and occupational status.

Attachment to place and family

A second subtheme was that of strong connections to family, community, and place, which is valued as much or more than is education attainment, upward mobility, or outmigration (Bryan & Simmons, 2009; Howley, Harmon, & Leopold, 1997; Wilson & Gore, 2009). This attachment to place is explained, in part, by the geographic isolation that has resulted in a strong reliance on family and community. Howley et al. (1997) suggested that education aspirations in middle Appalachia were driven more by traditional values that emphasize sense of place and “the good life,” than by cosmopolitan values that emphasize “the happy life” built on economically driven outcomes.

One result of this environment is that Appalachian youth may be less inclined than are their non-Appalachian peers to pursue and/or persist at postsecondary institutions, especially those institutions located at a distance from home (Bryan & Simmons, 2009; Howley et al., 1997; Wilson & Gore, 2009). Wright (2012), in interviewing 30 community college students in eastern Kentucky, reported that many students chose the local community college over a four-year university because it allowed them to stay at home and to continue working at an established place of employment. Other reasons included lower tuition, reduced rent, and the perception of the community college as a safe choice that offered a gradual initiation to college work and life.

Bryan and Simmons' (2009) interviews with 10 first-generation college students in Appalachian Kentucky revealed a strong sense of close-knit families and communities. Students reported feeling pressure to succeed not only for themselves, but for the benefit of their families and communities. However, the sense of connection to family also created conflicting feelings about the separation resulting from going away to college. Several interviewees reported establishing separate identities at home and at school to hide conflicting behaviors or beliefs.

Perhaps supporting other research regarding the influence of family and community opinions on students' college decisions, Wallace and Diekroger (2000) found that Appalachian students who attend college rely more on their own opinions and values than on those of others. The findings suggest that these students may be more

willing than their non-college-going peers to break away from strong family and community ties, or at least stretch the ties, to pursue a college degree.

College aspirations and persistence

A small body of literature considered supports needed to help students from middle Appalachia to enroll and persist in college. Ali and Saunders (2006), observing that many rural Appalachian students drop out of college, suggested that classes in high school should go beyond helping students enroll in postsecondary education. They posited that preparation should include information about the realities of college life and the obstacles students are likely to face at the postsecondary level. Similarly, Bryan and Simmons (2009) reported that students credited early intervention programs at their high school and in college with their successful transition. These programs included campus visits, ACT preparation, and an on-campus summer bridge program with dedicated transition office and staff.

Two studies described programs aimed at encouraging students from middle Appalachia to enroll in college. Edwards (2007) described a Radford University program in western Virginia that seeks to encourage “college-able, but not college-bound” students to pursue higher education. Radford students serve as mentors to high school students, while teachers at participating high schools teach lessons about middle Appalachia culture. Between 2002 and 2007, 65 percent of participating high school students enrolled in some form of higher education (Edwards, 2007). In addition, the college mentors reported changes in their views of Appalachia, with several pursuing Appalachian Studies in graduate school.

In eastern Kentucky, the Robinson Scholars Program identifies scholarship recipients as early as grade 8. The program awards scholarships covering the full costs of up to five years of college to first-generation college students. Additionally, the program addresses the needs of student participants while they complete high school, and assists in the transition to college life (Carter & Robinson, 2002).

Wilson and Gore (2009) posited that because Appalachian students value connections to place and people of origin, a higher sense of connectedness at the university would benefit these students. Their surveys found that students from Appalachia reported significantly better academic performance when they also felt connected to the university. The authors suggested that students may benefit from support programs such as college learning communities. In addition, Wallace and Diekroger (2000) suggested that colleges might take advantage of a strong internal drive shown by students from Appalachian regions when providing support.

Interestingly, the poverty that is so often associated with middle Appalachia did not emerge in the literature as a primary obstacle to college attendance or persistence. Wright’s (2012) interviews suggested that lower costs were motivators for attending a community college, but lack of funding was not an explicit reason. Similarly, only a

few interviewees in Bryan and Simmons' study (2009) reported that poverty directly affected their education, though they stated that the overall regional poverty had an impact on their K-12 education experiences. However, both of these studies sampled students who already were enrolled in college, not students who elected not to attend college.

Meanwhile, Lyttle-Burns (2011) did identify poverty as a key barrier to completing high school. Further, Wallace and Diekroger (2000) found that 50 percent of students surveyed reported that family, friends, and others expected them to have jobs, which interfered with completing college assignments.

Career aspirations and opportunities

Wright's 2012 interview-based study of 30 community college students in Kentucky found that students generally pursued careers that would enable them to remain in the region—contrary to the image of advanced education as a way out of an economically struggling environment. Wright (2012) noted that students discussed applying their postsecondary education toward “transformative ends” within their home communities (p. 7). For instance, one student hoped to use an arts degree to help the community become an arts mecca; another hoped to use an agricultural degree to replant farm lands recovered from abandoned mines. Similarly, Daniels (2014) described graduate students' motivations for remaining in the region after graduate school, with a specific emphasis on love of people and place. Further, Hlinka, Mobelini, and Giltner (2015), in interviews with high school and community college students, found a strong desire to remain in the region after pursuing higher education.

Wright (2012) concluded that Appalachian colleges might focus on place-based education for students who wished to use their education to transform rural communities. She characterized such a mission as investing “in those who choose to stay” rather than concentrating resources “on those who achieve to leave” (p. 10).

In contrast, Bryan and Simmons (2009), in interviewing 10 Appalachian college students in Kentucky, found that three students had no intention of returning home, while four could not return home due to lack of career opportunities but would if one presented itself. Only three students, those in medical fields, planned to return home immediately after college.

Regarding perceptions of career opportunities, Wright (2012) interviewed 30 students at Southeast Kentucky Community and Technical College. These students perceived mining and work in the medical field as the highest-paying job opportunities in the region. Those interested in other industries believed they would have to leave the region. Some sentiment was expressed that the local community was most suitable for retirees, due to lack of career options for young people.

Two studies examined the alignment between K-12 career and technical education (CTE) programs and actual and projected workforce needs in middle Appalachia areas of Tennessee and Kentucky (Hargis, 2011; Mokher, 2011). Both studies observed that K-12 CTE programs in middle Appalachia may be overemphasizing some program areas in lower demand, while underemphasizing others with better prospects, though many localized differences exist.

Mokher (2011) compared the percentage of students enrolled in various CTE program areas with the percentage of employees in high-wage, high-demand occupations in Tennessee. She found that a higher percentage of students participated in agriculture and health science programs relative to the local employment needs, while a lower percentage of students participated in business technology and family/consumer sciences relative to local employment needs. Further, localized differences in program-employment misalignment existed based on available CTE program options. For example, the percentage of CTE students who concentrated in trade/industrial programs relative to the percentage of employees in these fields varied based on geography within middle Appalachian portions of Tennessee (Mokher, 2011).

Similarly, Hargis (2011) compared projected job openings with the number of students participating in CTE programs. That study found that Appalachian Kentucky schools may be producing too many students focused on automotive technology, construction carpentry, electricity, health science, horticulture, information technology, machine tooling, and welding, at the expense of higher-demand fields including accounting and finance, industrial maintenance, office technology, and wood manufacturing.

Summary

Research about college and career readiness in middle Appalachia over the past 20 years is weighted most heavily toward qualitative studies of attitudes and beliefs about postsecondary education. A smaller set of studies focuses on quantitative indicators of education achievement and career opportunities. Relatively few studies focus on implementation and outcomes of CCR initiatives in the region.

Research sharing quantitative indicators of CCR in middle Appalachia provides reason for optimism. High school graduation rates are improving such that they meet or exceed national graduation rates. In addition, while data are quite limited, research suggests that high school students in middle Appalachia score comparably on ACT exams to other students in their states. Still, more analysis is needed that disaggregates state-level data sources and reports to school district, county, or regional levels to allow deeper insight into CCR indicators in middle Appalachia.

At the same time, college completion in middle Appalachia continues to lag behind other regions of the country. Research indicates that complex attitudes toward higher education may contribute to this phenomenon. While some studies suggest that families and students value college attendance and that students desire to use their college education to improve the region, other cultural factors supersede higher education pursuits. Place-based, traditional values shared by many middle Appalachia residents may define standards of living and quality of life differently than the mainstream education culture does. The desire to remain close to home, combined with lingering effects of an economy that has not required higher education, deter college enrollment and persistence. The low regional rate of college attainment provides fewer role models and information sources for students who may desire to attend college; consequently, high school graduation often is the highest education attainment.

Students who wish to pursue higher education must balance these conditions, attitudes, and their own desire to stay close to home. Research suggests that colleges should tune into and build on these values by providing additional supports and offering place-based approaches to learning that would be relevant for students and provide pathways for using their education to improve their home communities.

Limited research is available on career and technical programs in the region. More research is needed on the apparent misalignment between CTE programs and career opportunities, particularly program evaluation of current CTE programs and research that would illuminate effective practices. Similarly, there is a dearth of research on the various CCR efforts in the region. Program evaluations are under way on initiatives such as those funded by federal Race to the Top and i3 grants. Our hope is that these evaluations and related research will illuminate how these initiatives are tailored to the unique needs of the region, as well as their impact both on target students and on education in middle Appalachia.

In addition, future research should build on the current body of work that describes college transition programs aimed at middle Appalachia students to also examine the impact of such programs. Further, much of the existing research focuses on students who are currently in college. It would be beneficial to conduct research with college-aged individuals who did not pursue college, to better understand decisions, barriers, and necessary supports.

Educator Effectiveness

National and state context

The effectiveness of school teachers and administrators has been a key focus of national reform efforts in recent years, driven by federal initiatives such as the Race to the Top and the School Improvement Grants programs, as well as No Child Left Behind Act provisions (Hallgren, James-Burdumy, & Perez-Johnson, 2014; Learning Point Associates, 2007). Each of these programs has included requirements for ensuring students are taught by highly qualified and/or effective teachers in well-managed schools.

The Race to the Top program, in particular, initiated a wave of teacher evaluation reform across the country (McGuinn, 2012). These new systems emphasize the use of multiple measures, including student achievement, to inform staff development, compensation, promotion, tenure, certification, and removal of ineffective teachers (Hallgren et al., 2014). While only four states with school districts in middle Appalachia received Race to the Top grants (Kentucky, North Carolina, Ohio, and Tennessee), all six states have instituted new teacher evaluation systems.

Recruiting effective educators is another area of heightened concern both nationally and within middle Appalachia, as school leaders and teachers are expected to possess the knowledge, skills, and capacity to teach to rigorous academic standards and prepare students for careers in an increasingly globalized and high-tech economy (American Youth Policy Forum, 2010; Arnold et al., 2005; U.S. Department of Education, 2011). The policy database of the Education Commission of the States⁸ indicates that states with school districts in middle Appalachia have enacted legislation in recent years to support the recruitment and retention of highly effective educators.

The effectiveness of school administrators is of particular concern as schools nationwide are held accountable for improving achievement for all students, and

⁸ The state-by-state policy database may be accessed at http://www.ecs.org/html/stateterritories/state_policy_developments.htm.

principals are expected to serve as instructional leaders in implementing rigorous standards to prepare students for college and careers (Finkel, 2012; Nicholson, Harris-John, & Schimmel, 2005). Below, we share major themes around educator effectiveness in the literature on middle Appalachia.

Major themes

The nearly 30 articles that provided information for this section were primarily qualitative and/or descriptive in nature. These sources identified educator effectiveness as a key topic of concern in rural schools in general and in middle Appalachia in particular (Harmon, 2001; Henderson, 2001; Waters, Howley, & Schultz, 2008). The concern stems from the difficulty of attracting school leaders and teachers to geographically remote school districts, coupled with concern that teacher candidates native to the region may have been inadequately educated themselves (Henderson, 2001). A shortage of teachers in the fields of special education, mathematics, and science, in particular, often results in out-of-field teaching (Henderson, 2001; Waters et al., 2008). Similarly, Appalachian districts are challenged to prepare and recruit effective education leaders (Browne-Ferrigno & Maynard, 2005).

Perhaps because new educator evaluation systems in the middle Appalachian states are a relatively recent development, our search produced no studies that examined the implementation and impact of these systems in middle Appalachia. Instead, major themes that emerged from the review of literature on the topic of educator effectiveness were (1) teacher preparation and qualifications; (2) teacher recruitment and retention; (3) teacher effectiveness; (4) administrator recruitment and retention; (5) administrator effectiveness; and (6) educator attitudes toward parents.

Teacher preparation and qualifications

Two sources we located addressed the issue of teacher preparation for rural schools in general or schools in middle Appalachia in particular. Theobald's (2002) reflective essay, based on his past research on rural education, argued that universities in rural areas have a moral obligation to specialize in rural teacher preparation. According to Theobald, rural-focused teacher preparation programs would equip teachers to help students overcome "cultural obstacles" that interfere with their aspirations while also expanding definitions of what constitutes success, so that students do not equate success with urban life. Fieldwork in rural schools would be a key component of such teacher preparation programs.

More importantly, Theobald asserted that teacher preparation programs should help teachers prepare lessons grounded in community circumstances, such as

mathematics lessons focused on local disposable income, life sciences lessons focused on local flora and fauna, and studies of local history. Theobald believed that teacher preparation programs geared to rural circumstances would result in better preparation of students to understand and address conditions in their local communities.

Along similar lines, Winter (2013) suggested that teacher preparation programs serving students from Appalachia must address negative Appalachian stereotypes so that teachers from the region develop a positive Appalachian identity that would transfer to their students. Winter derived this position from a survey of teacher candidates in an Appalachian university, which found that prospective teachers from the region recognized and condemned stereotypical views of Appalachians, yet focused on negative attributes when describing their future Appalachian students.

No recent studies were located that shared indicators on teacher qualifications specifically for middle Appalachia school districts. However, a study by Blank, Langesen, Laird, Toye, and de Mello (2004) provided estimates by state of the percentage of highly qualified teachers in various subject areas in 2000. While the analysis did not distinguish Appalachian from non-Appalachian districts, it showed that all six states with school districts in middle Appalachia ranked in the bottom half of states for percentage of science teachers in grades 7-12 with certification and major in the field. Four of the six states ranked in the bottom half of states on the same statistic for mathematics teachers. No similar pattern occurred for teachers of English or social studies.

Papers emerging from the Appalachian Rural Systemic Initiative (ARSI) and the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) identified out-of-field teaching in mathematics and science as an area in need of further research in rural and Appalachian schools (Henderson, 2001; Waters et al., 2008).

Teacher recruitment and retention

Recruiting and retaining effective teachers has long been a problem for rural school districts due to social and cultural isolation, lower pay, and the requirement to teach multiple subjects (American Youth Policy Forum, 2010; Arnold et al., 2005; Harmon, 2001). One might expect these problems to be magnified in the mountains of middle Appalachia, particularly in remote locations without easy access to more metropolitan areas.

Recent studies on teacher recruitment and retention in middle Appalachia, however, provided evidence that teaching is a valued career selected by many there, in part, because it allowed them to remain in their home communities. For instance, an American Youth Policy Forum (2010) visit to a middle Appalachia district in North

Carolina found that many teachers in rural schools were native to the area, having moved away and then made a deliberate choice to return. DeYoung's (1995b) study of a rural West Virginia school district found that obtaining a school system job was a strategy used by well-connected and high-achieving students to obtain work and remain in the local community. Many such teachers accepted substandard pay and were willing to teach multiple subjects in exchange for being able to remain near home.

A study of teacher attrition in Appalachian Kentucky school districts between 1986 and 2005 painted a mixed picture of teacher retention in the region (Cowen, Butler, Fowles, Streams, & Toma, 2012). The study found that only 10 percent of teachers who began their careers in Appalachian districts switched to a new district over their careers, and that there were no major differences in teacher mobility between Appalachian and non-Appalachian districts in Kentucky. At the same time, among teachers across the state who transferred to another district, transfers out of Appalachia were more prevalent than transfers into Appalachia were. The authors concluded that Appalachia provided a "comparably isolated, fixed labor market," in that Appalachian teachers were unlikely to leave their initial districts, but that when transfers occurred, they tended to be out of rather than into Appalachia (Cowen et al., 2012, p. 437).

While the above studies suggest that the teacher labor market in middle Appalachia is relatively stable, there is evidence of teacher shortages in certain fields. In particular, teacher shortages in mathematics, science, and special education are reported to be an issue in rural schools in general and in Appalachian schools in particular (Harmon, 2001; Henderson, 2001; McLaren & Rutland, 2013; Waters et al., 2008). A qualitative study of 21 Ohio principals' approaches to mathematics reform reported that principals of remote Appalachian schools in the study had difficulty finding qualified mathematics teachers (Larson & Howley, 2006).

Two sources described programs designed to address teacher shortages. The Appalachian Model Teacher Consortium was a partnership of rural Grayson County schools, Wytheville Community College, and Radford University in Appalachian Virginia. Developed to keep local youth in the community and provide a cadre of well-qualified teachers, high school students could earn credits toward an associate's degree at Wytheville, then transfer into Radford's teacher education program. Student teaching occurred in Grayson County Public Schools, and students then were eligible for employment there (Proffit, Sale, Alexander, & Andrews, 2002).

A program at Morehead State University in eastern Kentucky addressed a chronic shortage of qualified early childhood special education teachers in the region. The program assisted teachers in publicly funded preschools in obtaining a new, state-mandated certification. The certification program featured a variety of course delivery methods for teachers who resided at a distance from the university, including six online courses, one face-to-face course, six blended courses, three

weekend workshops, and two field trips. Students completed practicum hours in their own classrooms, but were assigned a mentor teacher and faculty practicum supervisor for consultation, support, and modeling (McLaren & Rutland, 2013).

Teacher effectiveness

While studies specific to teacher effectiveness in middle Appalachia were scarce in our search, a small number of studies had emerged from the National Science Foundation (NSF)-funded Appalachian Math and Science Partnership project (AMSP). Comprising nine institutions of higher education and 51 districts in Kentucky, Tennessee, and Virginia, the project sought to strengthen and reform education in math and science in preK through grade 12 classrooms from 2002 to 2014.⁹

In general, these studies did not address issues unique to Appalachia, and findings mirrored those of national studies regarding teacher effectiveness in mathematics and science instruction. The studies reported that a large percentage of elementary and middle school teachers demonstrated a lack of conceptual understanding of foundational science concepts prior to professional development activities designed to increase understanding (Krall, Christopher, & Atwood, 2009; Krall, Lott, & Wymer, 2009; Krall, Straley, & Shafer, 2009). These results mirrored findings from the nationwide Math and Science Partnership project as a whole.¹⁰ The authors of the above studies suggested that this lack of understanding might result from teacher preparation programs in the Central Appalachian region that, they believed, required candidates to complete a series of lecture-style, survey science courses emphasizing breadth over depth (Krall et al., 2009a).

Two case studies describing nonacademic roles played by teachers in middle Appalachia suggested that definitions of teacher effectiveness in the region might go beyond effective classroom instruction. A case study of a rural, West Virginia school district examined what it meant to be effective in a poor, Appalachian school district. Teachers in Braxton County, West Virginia, played a “compensatory” role in an attempt to offset what they perceived as cultural disadvantages associated with poverty and isolation (DeYoung, 1995b). Teachers provided winter clothing, planned field trips to local malls and movie theaters as a reward for attendance and academic performance, and were involved heavily in before- and after-school activities—all on the rationale that school was the only place where children could engage in social activities. Similarly, a case study in an eastern Kentucky school implementing comprehensive state reform found that teachers worked diligently to include and

⁹ See <http://appalachian.mspnet.org/>.

¹⁰ See http://mspkmd.net/index.php?page=01_2b.

challenge all students and to help them overcome barriers to learning (Kannapel, Aagaard, Coe, & Reeves, 2000).

Administrator recruitment and retention

We located only one study that pertained to the recruitment and retention of school administrative leaders. A study on superintendent turnover in Kentucky public school districts over 1998–2008 found virtually no difference in rates in Appalachian versus non-Appalachian school districts. In addition, the study did not show patterns strong or consistent enough to suggest systematic differences in turnover between rural and nonrural school districts (Johnson, Huffman, Madden, & Shope, 2011).

A study of the Principals Excellence Program (PEP)—a partnership between Pike County Schools and the University of Kentucky to expand the candidate pool for future vacancies and prepare principals to serve as instructional leaders—shared some findings regarding recruitment. PEP participants identified several challenges to recruiting and retaining principals (and teachers) in the district, including the need to grow their own because aspiring principals desired to remain close to family. They noted that educators were reluctant to drive or relocate to remote schools.

Participants also reported that geographic isolation contributed to different belief systems in different parts of the county. In particular, community expectations about who the principal is and what the principal does may lead a local school-based decisionmaking (SBDM) council (which in Kentucky has authority to hire principals) to “protect itself” and reject outsiders for the job (Brown-Ferrigno & Allen, 2006, p. 7).

Administrator effectiveness

As is true nationwide, principals in middle Appalachia are expected to serve as instructional leaders in implementing rigorous standards to prepare students for college and careers (Finkel, 2012; Nicholson et al., 2005). Because of geographic isolation, districts in middle Appalachia must often grow their own leaders to rise to the challenge of helping students meet rigorous academic standards in ways that align with the local context (Browne-Ferrigno & Allen, 2006).

At the same time, studies suggested that the roles, responsibilities, and expectations of education leaders in rural areas such as middle Appalachia differ from those in urban and suburban locales, and these factors must be taken into account when considering effectiveness of administrators (Harmon, 2001; Johnson et al., 2011). For instance, Jones and Howley (2009; as cited in Johnson et al., 2011, p. 1) reported that superintendents in rural districts spend more time on tasks associated with day-to-

day district operations than on tasks associated with long-range improvements and strategic initiatives.

Harmon (2001) asserted that administrators in rural school districts must possess a unique skill set that enables them to build positive relationships in rural communities where the school is a respected institution. Harmon noted that rural school administrators' relationships tend to focus more on people than on "business." He further asserted that successful leaders in rural school districts are skilled at building trust and finding ways to incorporate the strengths of the community into the curriculum.

Howley, Howley, and Larson's (1999) survey of principals in Ohio and West Virginia reported that rural West Virginia principals felt pressure to balance external demands with local interests. DeYoung (1995a) reported that a West Virginia superintendent earned community respect by ensuring that the board of education (the county's largest employer) always made its payroll, never raised property taxes, and avoided the corruption and fiscal irregularities that plagued many other districts in the state. The superintendent reported that working with parents around district athletic programs was one of his most difficult jobs, and parents rarely asked about instructional programs (DeYoung, 1995a; 1995b).

A case study of implementation of statewide, standards-based reform in an eastern Kentucky school district, however, reported that parents appreciated the principal's efforts to provide a more rigorous academic program for students. The principal was the daughter of a coal miner and a first-generation college student, who vowed to make a difference with Appalachian students and actively searched for programs and strategies to help all students achieve at high levels. Parents appreciated the higher level of schoolwork, with some parents choosing the school over a nearby independent elementary school (Kannapel et al., 2000).

While the above studies suggest that education leaders in middle Appalachia contend with a number of culture- and community-specific issues, other studies indicated that they also must navigate the same, external pressures of principals in other locales to increase academic rigor and performance, moving beyond traditional managerial roles to become instructional leaders. This challenge may be especially acute in middle Appalachia, where "recruiting and retaining the next generation of school leaders is a real and long-term challenge" (Browne-Ferrigno & Maynard, 2005, p. 6).

Three studies we located reported on the Principals Excellence Program, implemented from 2002 to 2005, to reframe the principalship from school manager to instructional leader. PEP offered an intensive, seminar- and field-based training program to 15 aspiring Pike County (Kentucky) principals each year, designed to develop a professional community of principals who would support one another in

becoming change agents in the district (Browne-Ferrigno & Allen, 2006; Browne-Ferrigno & Maynard, 2005; U.S. Department of Education, 2004).

While no rigorous study reported program outcomes, district administrators reported that PEP created a strong principal candidate pool, resulting in 18 of the district's 24 schools being led by PEP participants, who were changing administrative practice. Participants reported that the program helped them become more effective instructional leaders, delegate authority, be more reflective, and understand the importance of cooperation among schools in the district, as well as fostered collaboration with other rural school leaders.

The success of the program was attributed to the partnership between Pike County Schools and the University of Kentucky, seed funding for the program, integration of its curriculum with authentic tasks from participants' experience, and consistent monitoring of the program within the district. Participants particularly appreciated the opportunity to visit other schools in eastern Kentucky to learn how they addressed common challenges in the region. Stakeholders emphasized that the district could not have implemented the PEP program without additional funding and collaboration with the university (Browne-Ferrigno & Allen, 2006; Browne-Ferrigno & Maynard, 2005; U.S. Department of Education, 2004).

Educator attitudes

A common theme in the literature on educator effectiveness in middle Appalachia was educators' perspectives on the parents and students they serve. The literature suggested that many educators in Appalachian schools perceive that parents do not value academic pursuits, and that educators must compensate for these attitudes in some manner. For instance, Pike County, Kentucky, administrators involved in the Principals Excellence Program perceived that a deeply embedded cultural attitude that minimized the value of formal education made it difficult for education leaders to promote a "success for all" mentality (Browne-Ferrigno & Maynard, 2005).

DeYoung (1995a) reported that a West Virginia superintendent believed that students' academic performance was only marginally important to most parents, and that it was up to the school to raise expectations and change the life trajectories for the district's youth. Similarly, Larson and Howley (2006) reported that principals in Appalachian Ohio districts were more inclined than those in non-Appalachian Ohio districts to blame parents or the values of local communities for students' difficulties with mathematics. These principals characterized parents' attitudes as irrational and based on fear and/or ignorance.

Two studies remarked on stereotypes held by Appalachian educators about their students. A study of the NSF's Rural Systemic Initiative in Appalachia noted the challenge of changing attitudes about student capabilities in tight-knit rural

communities where “prejudices can be solidified against whole families” and “children arrive for their first day of school already marked as underachievers” (Boyer, 2006, p. 37). Such views mirrored those of the Appalachian teacher candidates in Winter’s (2013) study, who described their prospective students as having several negative traits including poverty, bad home life, low achievement, and parents who do not value education.

These studies, taken together, suggest that some educators in middle Appalachian school districts may set themselves apart from students and families, carrying into classrooms and school offices negative stereotypes of student capabilities and parental attitudes. At the same time, other studies described the commitment of these educators to helping students overcome an impoverished background and understand the importance of obtaining an education.

Summary

The literature on educator effectiveness suggests that teachers and administrators in middle Appalachian schools operate in a unique cultural context that requires skills and roles that differ from their urban and suburban counterparts. At the same time, Appalachian educators operate in the same national context as their nonrural peers and must, therefore, create instructional environments that address rigorous academic standards for which they are held accountable.

Studies we reviewed suggest a tension between the pressures of national and state standards and local culture and values, yet do not address the issue directly. The studies reported above tend to focus on local context issues, or on issues emanating from standards-based education initiatives, but seldom consider how the two interact. Future research might take a more integrated approach.

For instance, research suggests that the educator workforce in the region is relatively stable, largely because educators wish to remain in their local communities and are committed to local schools. At the same time, there is a need to develop local leaders and teachers who can teach to more challenging standards in ways that are relevant to students. More development of and research on “grow your own” programs to foster effective teachers and leaders in middle Appalachia is much needed. Such research should examine current teacher preparation programs to provide information on current approaches and their alignment to national, state, and local expectations and needs, including not only instructional leadership skills needed to teach to high standards, but knowledge, skills, and dispositions that help educators understand and engage with parents and students in Appalachian communities.

Research also suggests a need to address teacher shortages in mathematics, science, and special education. Studies of current efforts to address these shortages could

include examining similar programs around the country that could be adapted to the Appalachian context.

Finally, all states in middle Appalachia are implementing new teacher evaluation systems, yet these systems are new enough that we found no studies examining their implementation and impact. As such studies are developed, sorting out findings for Appalachian versus non-Appalachian districts would be a valuable contribution to the literature.

Curriculum and Instruction

National and state context

As is true nationwide, curriculum and instruction in middle Appalachian school districts is shaped by the Common Core State Standards (CCSS), which states began adopting in 2010. Five of the six states with school districts in middle Appalachia adopted the CCSS (Virginia is the exception), although states renamed them to incorporate state names or slogans. While the CCSS have been challenged in numerous states nationwide, as of this report Kentucky, Tennessee, and West Virginia remain committed to their implementation, although Tennessee in 2014 enacted legislation affirming local control over education standards. Both North Carolina and Ohio are reviewing the CCSS and may replace them. Virginia developed its own standards and, following side-by-side review versus the CCSS, issued a statement asserting that the two sets of standards are comparable in content and rigor (Henderson, Peterson, & West, 2015; Salazar & Christie, 2014).

Alongside the CCSS is an increased national emphasis on STEM subjects—science, technology, engineering, and mathematics—on the rationale that schools need to ramp up instruction in these areas to prepare workers for an increasingly high-tech, 21st-century economy (Morrison & Bartlett, 2009).¹¹ Similarly, online/blended learning has grown over the past 20 years as states seek to increase students' access to a wide range of courses (Watson, Pape, Murin, Gemin, & Vashaw, 2014). Online/blended learning holds particular promise for rural schools, which often lack sufficient teachers or resources to offer a wide range of courses (Harmon & Blanton, 1997).

All six states with school districts in middle Appalachia offer online learning options through various means. A recent state-by-state review of digital learning (Watson et al., 2014) rated digital learning options in North Carolina, Ohio, and Virginia as “Good,” while Kentucky, Tennessee, and West Virginia were rated as “Fair.” According to that review, virtual school course enrollments across the six states in SY 2013/14 ranged from around 3,000 in Tennessee to more than 100,000 in North Carolina.

¹¹ See also Education Commission of the States commentary on STEM subjects at <http://www.ecs.org/html/issue.asp?issueid=253&subissueid=0>.

Major themes

The majority of the more than 30 sources referenced in this section of the review are conference papers or descriptive essays describing promising initiatives or projects or reflecting on issues relative to curriculum and instruction in middle Appalachia. Perhaps because of the relatively recent implementation of the Common Core State Standards, no studies were located that focused on their implementation in the region. The literature does express, however, a long-standing concern among rural researchers that curriculum and instruction in Appalachian schools, regardless of the particular standards in place, should be relevant to the local context. Reflecting the national STEM emphasis, a body of literature surfaced on mathematics and science initiatives in the region. A smaller set of studies focused on the use of technology.

Five major themes emerged from the literature on curriculum and instruction in middle Appalachia: (1) relevance to Appalachian context; (2) mathematics and science education; (3) community engagement; (4) use of technology; and (5) diversity considerations in the classroom.

Relevant curriculum and instruction

A predominant theme in the rural education literature, including that focused on middle Appalachia, is the importance of curriculum and instruction that is relevant and appropriate for students in the rural, Appalachian context. Rural education researchers have long advocated for an approach known as *place-based learning* or *place-situated curricula* that grounds curriculum and instruction in local cultures, environments, and traditions (Haight & Gonzalez-Espada, 2009; Haleman & DeYoung, 2000; Johnson, Thompson, & Naugle, 2009; The Rural School and Community Trust, 2014). Proponents argue that place-based learning experiences make learning more relevant and engaging for students; connects schools to their communities for mutual benefit; and builds responsible citizenship by helping students see the connection between academic pursuits and community welfare.

The literature on middle Appalachia provided examples of place-based learning incorporated into various content areas, including science, history, literature, journalism, and the arts. Haleman and DeYoung (2000) reflected on the experiences of middle Appalachian schools that embraced place-situated curricula supported by The Rural School and Community Trust. Highlighted projects included integrating local history into the curriculum by documenting stories from community elders; traditional music programs using local musicians and emphasizing the importance of local musical traditions and heritage; school-community forums facilitated by high school students to develop and implement community development projects; archaeology and nature studies in nearby parks or forests; and studies of

environmental degradation. The authors reflected that these place-based projects had mutual benefits for schools and the communities in which they were situated, including forging intimate school-community connections; integrating curricula through theme-based projects; spurring dialogue and action around community revitalization efforts; developing student awareness of local history, economy, and environmental issues; and engaging students.

Haight and Gonzalez-Espada (2009) and Watson (2014) each described a place-based science program. The *Reading the River* project, implemented in the early 2000s by Northern Kentucky University and Morehead State University, sought to increase the confidence and knowledge of science teachers in using inquiry-based teaching and integrating content knowledge by conducting field-based investigations on the Licking River watershed in eastern Kentucky. Pre- and post-tests showed statistically significant improvements in teachers' confidence in using hands-on instructional technologies, inquiry-based teaching strategies, and community resources and in conducting field investigations (Haight & Gonzalez-Espada, 2009). In addition, teachers reported that their students were more aware of their environment and the effects the community had on local creeks and rivers. Watson (2014) shared reflections from case studies of two environmental education day camps in Appalachian Ohio that helped children explore the relationship between local resource extraction and environmental degradation. Watson made two observations: that camp organizers did not adequately take into account barriers to program goals presented by the low socioeconomic level of some participants (e.g., lack of transportation to camp, inappropriate clothing/shoes) and that camp organizers had to negotiate sensitive issues as they attempted to educate children without casting a negative light on the local mining heritage.

Johnson et al. (2009) proposed augmenting the place-based learning model with "research-based, responsive practices," defined as practices that acknowledged the research literature but also attended to the characteristics or conditions of a particular place (p. 181). The authors asserted that "research-based practices" are problematic for rural schools because these "best practices" tend to originate in suburban and urban schools.

A study by Gore and Wilburn (2010) provided insight into how place-based learning might go beyond curricular content to encompass pedagogical practices consistent with the cultural values of a particular place. The authors noted that Appalachian inhabitants emphasize collectivistic values such as strong kinship ties, sense of community, avoidance of conflict, keeping outsiders at a distance, and attachment to place. The authors conducted two surveys of first college and then middle and high school students that examined the association between cultural individualism and academic individualism, and cultural collectivism and academic collectivism, for Appalachian and non-Appalachian students. A key finding was that among students who reported behaviors at school that were associated with collectivistic values,

Appalachian students had higher GPAs than did non-Appalachian students. The authors suggested that learning for students from Appalachia might be enhanced if schools used collectivist learning models such as learning communities, group projects, and curricula that encouraged social connections over individual expression.

Waitt (2006) noted that the literature to which students are exposed in classrooms often is set in urban areas and revolves around the experiences of middle-class protagonists, whose lives may be quite dissimilar to those of Appalachian students, many of whom reside in rural areas and come from economically struggling families. The author went on to suggest appropriate literature for language arts classes in Appalachian high schools, grouping the literature around three key ideas (conformity and rebellion, class conflict, and multiculturalism) that would help students understand the region's political, social, and economic position as it relates to the local and national context.

Taken together, these studies suggest the potential of place-based learning to increase curricular relevance, promote pedagogical practices consistent with local values, and foster strong school-community connections for mutual benefit. At the same time, the field would benefit from taking to heart Johnson et al.'s (2009) recommendation to augment place-based learning with research-based, responsive practices that would combine the quest for identifying and scaling up "best practices" with the goal of providing curriculum and instruction that is attentive to the characteristics of a particular place.

Such an approach would involve more systematic, participatory research on place-based learning models that involve diverse stakeholders in identifying project goals and outcomes, identifying conditions and supports needed to implement the projects, documenting actual outcomes, reflecting on lessons learned for improving the effectiveness of place-based learning models, and considering how effective models can become integrated into the fabric of learning in schools in middle Appalachia over the long-term.

Mathematics and science education

The literature on curriculum and instruction issues in Appalachia was skewed toward mathematics and science because of research that emerged from several federally funded initiatives focused on improving mathematics and science education in Appalachia (Appendix B, Table 13).

Much of this work was initiated with the Appalachian Rural Systemic Initiative (ARSI), funded from 1995 through 2005, to improve the performance of K–12 students in the Appalachian region by strengthening the knowledge and skills of local teachers (Henderson, 2001). Key features of ARSI were resource collaboratives housed at each

university, teacher partners to serve as change agents at the school level, teacher professional development focused on standards-based instruction, and community partnerships (Harmon & Blanton, 1997; Henderson, 2001; Inverness Research Associates, n.d.). According to the Year 10 report (ARSI, 2006), subsequent projects in the region (listed in Table 13) had their roots in ARSI.

While the initiatives listed in Table 13 likely produced a number of evaluation reports, few of them emerged through our search process. The literature our search did generate originated primarily from ARSI, plus one article from the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM). For the most part, articles located through our search were descriptions of the initiatives, lessons learned, or essays on larger issues that emerged from the work.

Key issues identified as important for improving mathematics and science education and/or research in rural schools in general, or Appalachian schools in particular, were:

- Taking a systemic approach that involved changes in institutional roles and relationships, affecting classroom instruction, policymaking, community involvement, and attention to postsecondary transitions (Harmon & Blanton, 1997)
- Holding Appalachian students to the same high standards as students in other regions, with attention to involving local communities in standards setting (Harmon, 2001; Harmon & Blanton, 1997)
- Developing vision and capacity among education leaders to implement standards-based mathematics and science instruction (Harmon, 2001; Harmon & Blanton, 1997; Henderson, 2001)
- Recruiting and retaining high-quality educators, particularly in mathematics, science, and special education (Harmon, 2001)
- Improving teachers' understanding of the content and their pedagogical content knowledge to engage students with mathematical and scientific thinking and reasoning, a particular challenge in Appalachia due to teacher isolation, poor preparation, and out-of-field teaching (Harmon, 2001; Harmon & Blanton, 1997; Henderson, 2001; Lemke, 2001; McKnight, 2001; Yager, 2001)
- Making effective use of technology to support teaching, learning, and professional practice (Lemke, 2001)
- Ensuring the relevance of mathematics and science standards and instruction by considering the interaction of the context and content of schooling (Henderson, 2001; Howley, 2001)

- Increasing access to expertise, instructional resources, professional development, and networking, particularly through the use of technology (Harmon, 2001; Harmon & Blanton, 1997; Henderson, 2001; Lemke, 2001)
- Engaging the community (Harmon, 2001; Harmon & Blanton, 1997; Henderson, 2001; Lemke, 2001; Yager, 2001)
- Raising the skill level of workers and leaders so they could compete for the high-skill jobs required in a globalized economy (Harmon, 2001)

Relatively few studies reported student achievement outcomes of the above efforts, and those that did focused on a small number of school districts or did not provide comparisons. For instance, Boyer (2006) shared results of a study of 2003 mathematics achievement in two Virginia school divisions participating in ARSI and one non-ARSI school division with similar demographics. The study found that more than 70 percent of students in ARSI divisions were “passing” (on unidentified measures) compared with 55 percent in the non-ARSI division. The ARSI Year 10 report (2006) described improved mathematics and science achievement on state tests in nearly all participating districts but provided no comparison with non-ARSI schools against which to judge these improvements.

Some rural and Appalachia scholars took a more deeply contextual view of what is needed to improve curriculum and instruction in mathematics, science, and other areas. Waters et al. (2008) and Johnson et al. (2009) argued that “best practices” must be contextualized within particular places and cultures. As noted previously, Johnson et al. advocated for research-based responsive practices that acknowledged research findings but also attended to the specific characteristics and conditions of a particular place. Similarly, Waters et al. suggested that research on mathematics education in rural settings should focus on the extent to which mathematics content and instructional approaches were embedded in and consonant with the needs of rural schools.

A relatively new initiative in the region for which no research is yet available is the Rural Math Excel Partnership (RMEP) between the U.S. Department of Education and Virginia Advanced Study Strategies (VASS). RMEP is a U.S. Department of Education Investing in Innovation Fund (i3) Development project, funded in 2012–2016, that includes six rural school divisions in southern Virginia, among them two in the middle Appalachia region (Henry County and Martinsville City). The initiative focuses on preparing teachers, engaging parents, and involving the community. Its ultimate goal is to develop a model of shared responsibility that supports success of middle

and high school students in foundational math courses as preparation for pursuing at least a postsecondary technician-level credential in STEM careers (VASS, 2015).¹²

Community engagement

Pervasive in the literature on education in middle Appalachia is the concept of engaging the community with school improvement. The sources varied in terms of the nature of the community engagement called for, from simple partnerships to in-depth examination of the beliefs and experiences of rural students and adults with regard to particular subject matter concepts.

A key theme in that literature, reflecting the “it takes a village” philosophy, was the notion that improvements in the content and pedagogy of schooling in Appalachia were possible only if the entire community engaged with the work. Regional colleges and universities, in particular, could and did play pivotal roles by partnering with Appalachian school districts to provide resources and support for instructional improvements—as illustrated by the mathematics and science initiatives described in the preceding section. Regional postsecondary institutions also had partnered with local communities to address local issues, as described in the literature on place-based education projects (Johnson et al., 2009).

In addition, several mathematics and science education initiatives—particularly the NSF-funded systemic initiatives—included a component to engage parents and the community in the work (Harmon & Smith, 2012; Henderson, 2001). The extent to which these efforts succeeded in their engagement efforts was lightly reported in the literature identified in our search. One report that was produced after the first five years of ARSI implementation identified community engagement as one of the project’s greatest challenges, noting that other components of the initiative took precedence and that the role of community engagement facilitator, intended to be filled by a community member, often was played by an educator (Inverness Research Associates, n.d.).

Other researchers noted the importance of considering the cultural values and behaviors of parents and other adults in the community relative to mathematics and science concepts and issues. Waters et al. (2008), for instance, suggested that researchers should consider the relationship between rural parents’ values and mathematics reform. Watson (2014) pointed out that environmental education efforts must consider the historical, economic, and cultural role that extraction industries such as coal had played in the region—and take care not to cast this history in a negative light.

¹² See also RMEP website: <http://www.rmepva.com/>.

In summary, available literature suggested that involving the community in mathematics and science education reform might serve a number of purposes, including building on local mathematics and science knowledge and values, obtaining buy-in for improvements, and ensuring sustainability of curricular and instructional improvements.

Technology

A key topic of rural education research was ensuring access to a range of curricular options, instructional resources, and connections to the larger world through the use of technology. A survey of rural education research (not confined to Appalachia) identified a number of studies focused on the use of technology to offer comprehensive instructional programs (Arnold et al., 2005). Numerous scholars looking at education in middle Appalachia highlighted the promise of technology as a tool to increase access to a broad range of resources and opportunities for students (American Youth Policy Forum, 2010; Haleman & DeYoung, 2000; Harmon, 2001).

The Federal Communications Commission's (FCC) E-rate program, designed to connect the nation's schools and libraries to broadband, has had a nationwide impact that has undoubtedly included middle Appalachia. The FCC reports that classroom Internet access has grown from 14 percent nationwide when E-rate was established in 1996 to nearly 100 percent today.¹³ At the same time, an early study of E-rate applications (Puma, Chaplin, & Pape, 2000) found that larger schools and districts were more likely to apply for E-rate discounts and to receive higher average funding per student, suggesting that size affected the capacity to take advantage of the program—which could be a factor for rural Appalachian districts.

In spite of the recent emphasis on and resources for improving instructional access through technology, we located relatively few studies that examined the implementation and impact of these efforts in middle Appalachia. While the ARSI initiative included the use of technology as a fundamental strategy to improve access to high-quality instructional resources, available research gave scant attention to its technology component (Harmon & Blanton, 1997; Henderson, 2001; Inverness Research Associates, n.d.). Some lessons learned from ARSI about technology use were reported, however, including that building a technology infrastructure, by itself, does not improve teaching and learning. The goal must be improving curriculum and instruction, using technology as a tool and providing the necessary conditions to

¹³ <https://www.fcc.gov/e-rate-update>

support the effective use of technology toward this goal (Inverness Research Associates, n.d.; Lemke, 2001).

Waters et al. (2008) called for research specifically on how access to technology affected the improvement of mathematics education in rural areas. This suggestion is well-taken in light of the infusion of technology in the region through numerous initiatives over the past 20 years. For instance, the Niswonger Foundation, which focuses on improving education in northeastern Tennessee, received a federal Investing in Innovation Fund grant in 2010 to improve the college and career readiness and success of students in 30 high schools in the region. Its primary strategy is to increase the number of rigorous courses offered at each high school, including through distance and online learning.¹⁴

Similarly, the Kentucky Valley Educational Cooperative, in eastern Kentucky, received a federal Race to the Top grant in 2014 to support its Appalachian Renaissance Initiative (ARI) in 17 school districts. A key feature of ARI is to expand students' course access by equipping all schools with distance learning capabilities and videoconferencing systems. ARI also created a social media site called "The Holler" for linking students, educators, and other stakeholders both within and outside the region (Casey, 2014).¹⁵

Research and evaluation of the Niswonger and ARI initiatives are under way; but additional research is needed on the impact of the infusion of technology on curriculum, instruction, and access.

Diversity considerations in the classroom

The area encompassed by middle Appalachia—the Central Appalachia subregion in particular—often is considered relatively homogeneous racially and culturally due to its largely White, low-income population (Pollard & Jacobsen, 2014). There is also a pervasive stereotype, even among many educators in the region, that Appalachian students are low academic achievers (Boyer, 2006; Winter, 2013). These perceptions may make educators insensitive to the diverse needs of students within their schools and classrooms.

Emerging themes in the literature concerned the need for educators in middle Appalachia to be sensitive, in particular, to issues of gender, gender identity, and academic giftedness. One that emerged from the 2001 ARSI conference was the need

¹⁴ See <http://www.niswongerfoundation.org/partnerships/>.

¹⁵ See also <http://www.theholler.org/hollers/appalachian-renaissance-initiative/>.

to examine whether there were gender differences in mathematics and science education unique to rural schools (Henderson, 2001). Haight and Gonzalez-Espada (2009) noted that one of the outcomes of the *Reading the River* project was increased teacher confidence in addressing gender and minority inequity in science instruction. Appalachian author Silas House (2014) called for education to play a role in promoting acceptance of students who are lesbian, gay, bisexual, or transgendered. He described as a myth that Appalachia is more tolerant than the rest of the country of “quare” folk, and expressed the view that some young Appalachians felt compelled to leave the area in search of a more welcoming environment as a consequence.

Other scholars note the need to offer instructional programs for academically talented students in middle Appalachia. One study explored how talented students in an isolated Appalachian school district experienced school mathematics (Howley, Pendarvis, & Gholson, 2005). Key findings included these: (1) Services for gifted students were limited to a weekly half-day program at a central resource center. (2) Participating students were likely to live close to the town because those in more remote locations were less inclined to make the long bus trip to the center. (3) Students tended to view mathematics as a set of procedures with numbers rather than a way of expressing ideas, relationships, and patterns. (4) Students believed knowledge of mathematics had practical value and would help them secure good jobs. (5) Students reported that mathematics in the gifted program was more challenging and made more extensive and meaningful use of computers to engage in mathematics learning. (6) Students indicated that their parents were highly supportive of their efforts to learn math. The authors reported that there was little evidence that these rural gifted children were provided with opportunities to connect mathematics with problem solving in local communities. Instead, mathematics was viewed by the students as calculations and problems done in the context of school mathematics.

Waters et al. (2008) also considered issues around the mathematically talented rural student. They suggested that research should consider the adult experience of mathematically talented students, including what shaped their aspirations, how their life trajectories differed from their counterparts’ in nonrural schools, what influenced these young adults to return to their home communities, and the advantages and disadvantages these students faced in college.

Similar research questions might be applied to students who are gifted in other academic areas.

Summary

The body of research generated over the last 20 years on curriculum and instruction issues in middle Appalachia is primarily descriptive and/or reflective in nature. The literature provides examples of place-based approaches, and calls for continued emphasis on embedding curriculum and instruction in the local context in order to increase their relevance and engage families and the larger community with schools. Literature emerging from National Science Foundation-funded projects describes efforts over the past 20 years to upgrade the quality of instruction in mathematics and science, but there is scant research on the long-term impact of these initiatives on teaching and learning in the region.

Rural education scholars have continued to call for approaches to curriculum and instruction that consider local knowledge and values and engage schools with community partners, and recent initiatives have included community engagement components. To date, however, research on these initiatives primarily describes the community engagement component without analyzing its implementation and outcomes.

Another area in need of extensive research is the use of technology to improve teaching and learning. As with community engagement, technology has been a key feature of improvement initiatives over the past 20 years, but little research was found describing the ways in which technology is being used and its impact on teaching and learning.

A small number of studies identify issues around how curriculum and instruction in middle Appalachia should attend to diverse student characteristics in the classroom. This is a relatively new perspective that contrasts with traditional views of middle Appalachia as a homogeneous region, home to a particular type of student.

Much needed in the literature on mathematics and science improvement efforts in middle Appalachia is an analysis of the many initiatives that have been implemented there. Such research would examine the various strategies and programs that were implemented; identify the organizations, institutions, school districts, and perhaps even project leaders involved; synthesize impacts and lessons learned across the projects; and consider sustainability of the various initiatives.

Finally, research is needed on the implementation and impact of the Common Core State Standards in middle Appalachia school districts. Focus areas for such research might include principal leadership for implementation; developing teacher capacity to teach to rigorous standards; place-based approaches to teaching to the standards; and local awareness, reactions, and engagement with Common Core implementation.

Systemic Capacity

National and state context

Literature on school improvement in middle Appalachia over the past 20 years emphasizes the necessity of building the capacity not just of individual teachers, principals, and schools, but of entire *systems* to support and sustain improvement. The U.S. Department of Education's Regional Advisory Committee (2011) for the Appalachian region notes that in order for *all* students to meet challenging academic standards, the entire system must support improvements. Components of that support include establishing strong operating frameworks, dealing with funding issues and competing priorities, partnering with higher education, using data to inform decisionmaking, supporting school-level autonomy, and preparing for emerging student populations (e.g., English learners).

The notion of systemic change, a school reform mantra nationwide since the 1990s, is predicated on the belief that comprehensive school improvement anywhere in the country—not just in rural and/or Appalachian schools—requires reforming the entire system to support instructional improvement (Hurst, Tan, Meek, & Sellers, 2003). This line of thinking emerged nationally from the work of Smith and O'Day (1991), who argued that states should identify goals that all students must meet, develop a coherent system of instructional guidance, and give schools the resources and autonomy to create an environment conducive to student achievement of the state-identified goals.

This movement took hold in middle Appalachia states through comprehensive reform efforts such as the Kentucky Education Reform Act of 1990 and Tennessee's Education Improvement Act of 1992, which supported the implementation of new state standards through major reforms in school governance, curriculum and instruction, assessment and accountability, and finance (Pankratz & Petrosko, 2000; Smith, Detch, & Morgan, 2004). Other states in the region supported similar reforms (Hurst et al., 2003).

The National Science Foundation's Rural Systemic Initiative (RSI) was based on the notion that the unique characteristics of rural schools create a particular need to develop systemic capacity. The initiative sought to improve math and science achievement in rural regions by promoting challenging math and science courses,

improving teachers' knowledge and skills, and providing classroom resources. At the same time, the initiative assumed that rural communities must be engaged with the improvement efforts because of a close school-community connection. The initiative sought to build on the strength of rural communities by stressing the development of community-wide partnerships that shaped mathematics and science improvement to the local context (Boyer, 2006; Harmon & Blanton, 1997).

Developing systemic capacity in middle Appalachia, then, refers to efforts to build the capacity of the entire system to support improvements in teaching and learning. Research on this topic suggests that such improvements often have been driven by external forces such as the standards-based reform movement.

Major themes

The literature we found on systemic capacity in middle Appalachia cuts across several topics within this report; some systemic reform efforts, such as ARSI, were discussed in detail in prior sections. This section draws on some 30 studies that focus broadly on systemic reform and capacity. Three, interrelated themes emerged from the literature: (1) resource infrastructure; (2) regional partnerships; and (3) systemic school improvement efforts.

Resource infrastructure

Districts in rural areas face a unique set of infrastructure challenges related to poverty, isolation, low population density, and other factors that affect their ability to develop the necessary infrastructure to support school improvement. According to the National Center for Education Statistics (NCES) locale designations,¹⁶ 58 percent of school districts in middle Appalachia are rural, compared with 44 percent for the nation as a whole. As noted earlier in this report, the median household income (Table 7) is lower and the percentage of children living in poverty (Table 9) is higher in middle Appalachia than in other parts of Appalachia and in the United States as a whole. In addition, as shown in Table 5 (below), districts in middle Appalachia spend less per student than do districts in other parts of the country, with South Central Appalachia spending the least per student of the three subregions. Pupil-teacher

¹⁶ NCES uses the U.S. Census Bureau definition of rural, which is any area that is not classified as urban. Urban areas are defined by the Census as “encompass[ing] at least 2,500 people, at least 1,500 of which reside outside institutional group quarters”; see <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>.

ratios in middle Appalachia, however, are similar to or lower than the ratio nationwide.

Table 5. District Expenditure and Pupil-Teacher Ratio (SYs 2010/2011, 2012/13)

Region	Per Pupil Expenditure (SY 2010/11) (Median)	Pupil-Teacher Ratio (SY 2012/13) (Median)
United States	\$12,908	15.6
Middle Appalachia	\$10,270	15.0
North Central Appalachia	\$11,604	15.2
Central Appalachia	\$10,338	15.4
South Central Appalachia	\$9,140	14.4

Source: National Center for Education Statistics, Common Core of Data.

These overall poverty levels, coupled with reduced spending for education, create challenges for school districts in helping students reach rigorous standards that ensure college and career readiness.

We located few studies that addressed the issue of resource infrastructure challenges in the era of college and career readiness. However, two case studies, both conducted in Appalachian Kentucky in the 1990s, highlighted the importance of additional funding to implement systemic improvements. Participants in the Principals Excellence Program in Pike County commented that the district could not have initiated the program without federal funding and collaboration with the University of Kentucky (Brown-Ferrigno & Allen, 2006). A case study of the implementation of comprehensive state reform in an eastern Kentucky school district in the 1990s reported that the district had instituted some reforms prior to the state legislation, but that the influx of state dollars with passage of the reform law in 1990 enabled the district to raise teacher salaries and invest in teacher professional development, new materials, and technology. In addition, the state funded a family resource center and extended school program that enabled the district to address students' social, emotional, and academic needs (Kannapel et al., 2000).

Regional partnerships

Literature over the past 20 years suggests that community and education leaders in middle Appalachia recognize the necessity of bringing the knowledge, resources, and expertise of all stakeholders in the region to bear on improving education opportunities and outcomes for Appalachian students. One approach that has a long history in the region is forming partnerships across regions, districts, and sectors—a strategy advocated in the American Youth Policy Forum report (2010).

Colleges and universities in middle Appalachia have played a particularly pivotal role in many improvement initiatives there. Examples such as the Principal Excellence Program in eastern Kentucky (Browne-Ferrigno & Allen, 2006; Browne-Ferrigno & Maynard, 2005; U.S. Department of Education, 2004) abound in previous sections of this report. National Science Foundation–funded initiatives to improve mathematics and science education in the region have been headquartered at universities across all six states and brought the expertise of university faculty to bear on teacher professional development (ARSI, 2006; Harmon & Blanton, 1997; Harmon & Smith, 2012; Henderson, 2001; Inverness Research, 2008). In addition, there have been smaller-scale partnerships between single universities and school districts around place-based education initiatives (Haight & Gonzalez-Espada, 2009; Johnson et al., 2009).

The literature also describes place-based projects for students at the postsecondary level. Appalachian Teaching Project (ATP), launched in 2001 by the Appalachian Regional Commission (ARC), is a place-based research initiative that engages undergraduate and graduate students at regional universities in Appalachia in classroom and field research designed to “build on community assets to shape a positive future for Appalachia” (Sampson & Herrin, 2007). The collection of essays in a special issue of *Appalachia Journal* edited by Sampson and Herrin described projects implemented through the ATP. Examples included a partnership between community college students and local residents to use the arts to address problems with prescription drug abuse (Gipe, 2007); a university–high school mentoring program designed to encourage students to pursue higher education (Edwards, 2007); oral history projects (Beaver, 2007; Puckett, 2007); and community workshops facilitated by college students to identify and address local community issues (Ezzell, 2007).

A Ford Foundation–funded program, the Rural Community College Initiative (RCCI), sought to expand education opportunities for the rural poor and stimulate economic development in some of the most economically distressed areas of the nation from 1994 to 2007 (Baldwin, 2001; Salant & Kane, 2007).¹⁷ Seven middle Appalachian community colleges across three states participated in the RCCI. The initiative convened a small but diverse group of business, government, and education representatives to examine data, create a long-term vision for the community, and develop an action plan. From 2002 to 2007, community colleges partnered with land-grant universities to scale up practices from early in the initiative, with varying levels of success (Baldwin, 2001; Salant & Kane, 2007).

¹⁷ See also Southern Rural Development Center for information from 2002 to 2007; <http://srdc.msstate.edu/rcci/>.

Other partnerships under way in the region broaden the K-12/postsecondary partnership to include additional stakeholder groups—although no research is yet available on these initiatives. For instance, the Kentucky Valley Educational Cooperative (KVEC) won a federal Race to the Top award in 2013 to support the Appalachian Renaissance Initiative mentioned in the **Curriculum and Instruction** section. The ARI was developed through a partnership of 17 KVEC districts, five postsecondary institutions in or near the region, and a number of community and state-level organizations. Its activities include extensive professional development for administrators and teacher leaders, support from national mentors, college and career readiness initiatives and supports, student agency activities, and parent/caregiver initiatives—all of which are supported by investments in state-of-the-art technology.¹⁸

The Shaping Our Appalachian Region (SOAR) initiative, launched in 2013, is a bipartisan collaboration aimed at expanding and diversifying the economy of Appalachian Kentucky.¹⁹ At the time of this report, the initiative is chaired by U.S. Representative Hal Rogers and Governor Steve Beshear; board members include representatives from business and industry, nonprofit groups, and higher education. SOAR organizes public meetings and workgroups with representation from a variety of stakeholder groups that are charged with developing strategies and recommendations in areas such as education and retraining, health, agriculture, business recruitment, and tourism. The education and retraining workgroup developed 17 recommendations grouped into three themes: (1) equipping the workforce with skills to support a revitalized region; (2) connecting education and training to the workplace and increasing access to education; and (3) ensuring effective education and regional leadership (Rural Policy Research Institute, 2014).

Systemic school improvement efforts

A small body of research emerged that focused on the implementation of systemic education improvement initiatives in middle Appalachia that were driven by federal or state policy or funding, and typically reflected national goals for raising the level of academic standards and rigor in the schools.

As noted above, the Rural Systemic Initiative through which the Appalachian Rural Systemic Initiative (ARSI) was funded was based on the idea that a community infrastructure would need to be developed to provide the vision, capacity, and resources to sustain mathematics and science improvements (Harmon & Blanton,

¹⁸ <http://www.kentuckyvalley.org/#!ari/c1aqp>

¹⁹ www.soar-ky.org/

1997; Inverness Research, n.d.).²⁰ ARSI sought to develop this infrastructure through resource collaboratives at area universities, teacher partners and district leadership teams to serve as change agents, professional development to build teacher knowledge and skills, catalyst schools in each district to serve as models, technology to increase access to high-quality resources, and community engagement teams (ARSI, 2006; Harmon & Blanton, 1997; Henderson, 2001; Henderson & Royster, 2000; Inverness Research, n.d.).

Reported outcomes included engagement with 46 of 66 RSI-eligible counties, delivery of more than 56,000 hours of professional development to more than 2,000 teachers, training of 51 teacher partners, implementation of science and mathematics curricula aligned with state standards, increased mathematics and science graduation requirements, increased resources for math and science instruction, collaboration with partners, and improved mathematics and science performance in nearly all ARSI districts (ARSI, 2006).

One paper critiqued ARSI as “top-down, routinized reform” due to ARSI program improvement reviews conducted by expert teams, and also charged that there was nothing *rural* about the initiative (Bickel, Tomasek, & Eagle, 2000). A rebuttal to this study by ARSI’s principal investigators (Henderson & Royster, 2000) maintained that ARSI was a bottom-up reform initiative that rested on teacher partners and resource collaboratives, with the program improvement review part of a multi-dimensional process for reaching ARSI goals. They further asserted that ARSI was uniquely rural because of its focus on rural, low-income schools, as well as the various components described above to build capacity in the region.

These same authors who criticized ARSI (Bickel, Howley, & Maynard, 2003) took issue with another school improvement effort initiated at the national level to benefit disadvantaged students—the No Child Left Behind Act (NCLB). They asserted that the NCLB goal of closing achievement gaps between disadvantaged students and their peers through rigorous accountability measures was based on a flawed premise. They characterized the notion that schools have it within their power to close achievement gaps as an “emphatic dismissal of the intrusiveness of the context of schooling, whether poor and Appalachian or otherwise” (p. 322). To test this assumption the authors conducted multi-level, repeated measures analysis of the relationship between standardized reading achievement data and a number of independent contextual variables for elementary students in two Appalachian counties in West Virginia between 1992 and 1996. Results indicated that social class, neighborhood quality, and day care participation influenced achievement. The authors concluded that NCLB underestimated the importance and complexity of contextual factors and

²⁰ See also archived website at <http://www.nsf.gov/nsf/nsfpubs/nsf9733/nsf9733.htm#goal>.

hence, “offers nothing to victims of persistent poverty and pernicious stereotyping in Appalachia or elsewhere” (Bickel et al., 2003, p. 338).

Another body of research on systemic reform initiatives in middle Appalachia focused on implementation of the Kentucky Education Reform Act of 1990 (KERA). This reform legislation occurred as a result of a state lawsuit declaring the entire system of schooling unconstitutional. The legislature responded by rewriting education laws in the areas of curriculum, governance, and finance. The curriculum provisions established challenging goals that all students should reach, established school-based decisionmaking (SBDM) councils at each school to make decisions about helping students achieve the goals, implemented a high-stakes accountability system to hold schools accountable for student achievement, and included a number of supports to help overcome barriers to learning including a preschool program, nongraded primary program, family resource and youth services, and extended school services. The governance provisions sought to professionalize governance, including by eliminating the patronage and nepotism that had plagued many Appalachian districts. The finance section, a boon to poor districts statewide, increased and equalized funding for students (Pankratz & Petrosko, 2000).

Appalachian districts welcomed several components of the KERA reform; notably, the increased and equalized funding (Kannapel et al., 2000). In addition, certain reform provisions helped schools overcome long-standing power structures that favored local power elites. Porter’s (1996) case study of an Appalachian high school found that the SBDM provisions helped change local power structures previously dominated by White, male administrators and school board members. In addition, the emphasis on high achievement for all students held promise for a more inclusive sense of collective responsibility in a district dominated by a local education elite who looked out for their own friends, kin, and peers.

Similarly, case studies in three different elementary schools across Eastern Kentucky documented situations in which principals and school staff dedicated to helping their students overcome barriers and reach high levels of achievement took advantage of KERA features to create cultures that focused on helping all students reach their potential (Kannapel, 2007; Kannapel et al., 2000). For instance, the principal in one of these schools commented that without KERA’s goals and accountability measures, the school “would not ever have gone anywhere ... not because we didn’t love our kids, we just didn’t look at it” (Kannapel, 2007). In another school, the KERA provision allowing principals (rather than the superintendent and school board) to hire teachers had facilitated the development of a top-notch staff, as the principal resisted pressure to hire community members who needed jobs but were not well-suited to the work (Kannapel, 2007).

While the above findings illustrate that externally generated systemic efforts can be beneficial for schools in middle Appalachia, the literature also suggested some ambivalence and even resistance to state-imposed reform. McHaffie’s (1998) analysis

of education spending in an Appalachian Kentucky school district found that in spite of state policies to equalize and increase funding, political maneuvers at the county level kept property tax assessments low for powerful coal companies, thus reducing the funds available for schools. Porter (1996) reported that local stakeholders resisted external definitions of what their priorities and policies should be and resented the accountability measures that implied that local districts could not govern themselves without greater state accountability. There also were concerns that the emphasis on high academic achievement devalued local knowledge, common sense, and the mountain culture. Porter concluded that reform efforts would ultimately fail if local stakeholders were not involved in defining their own problems and priorities.

Summary

The literature on systemic reform efforts in middle Appalachia points to the complexity of education improvement in the region. It suggests general agreement that improvements must occur through partnerships that develop the capacity of the entire system to improve. However, the balance between externally and internally generated initiatives, between global and local values, is a delicate one.

Studies of systemic reform initiatives in the region suggest that many local educators and community members welcome outside resources for improvement, expert support from regional universities, and state policies that upset existing power structures and equalized decisionmaking power and opportunities for all children to be successful. At the same time, the research reported in earlier sections of this report highlights the challenge of integrating the national focus on college and career readiness for all students into a culture that values family, place, common sense, the mountain culture, and staying close to home. It also highlights the challenge of fully engaging the community with the work of school improvement, particularly when the impetus for reform comes from external sources.

Absent from this body of research is an analysis of the sustainability of the various reform initiatives in the region, as well as a comparison of outcomes in districts that have been involved in the various initiatives versus those that have not. An interesting line of research for the future would be to document and analyze the progress of districts that have been involved in various systemic improvement initiatives over the last 20 years. Such research might track the extent to which capacity and an institutional memory have been developed in these districts such that ongoing improvement efforts build on past initiatives. Particular attention should go to the sustainability of achievement gains, regional partnerships, and community engagement efforts.

Emerging Issue: Health and Wellness

In CNA's own work with educators in middle Appalachia, multiple stakeholders have suggested that the health and wellness of students and students' families is a growing problem confronting schools. They are concerned specifically about high rates of childhood obesity and increasing rates of substance abuse. While research on health and wellness issues in middle Appalachia is beginning to emerge, little connection has yet been made to the role of schools in addressing them. Still, in this section of the report, we provide a brief overview in anticipation that schools in the region will increasingly be called upon to address health and wellness issues that affect the students and families they serve. We focus here on two major themes: childhood obesity and substance abuse.

Childhood obesity

Obesity is a growing concern in Appalachia and across the United States. According to the Centers for Disease Control and Prevention's (CDC) National Health and Nutrition Examination Survey, childhood obesity rates have increased dramatically. Between 1965 and 2008, they doubled for preschool-age children (from 5 to 10.4 percent), tripled for high school-age children (from 6.1 to 18.1 percent), and increased five-fold for elementary school-age children (from 4 to 19.6 percent) (Ogden & Carroll, 2010).

Children living in rural and Appalachian communities are at high risk for obesity (Ickes & Slagle, 2013). As shown in Table 6 (below), middle Appalachia states rank in the top half nationwide in adult and childhood obesity rates (Levi, Vinter, St. Laurent, & Segal, 2010).

The high obesity rates in middle Appalachian states are a concern because research has shown relationships among obesity, general fitness, and academic performance. A 2005 review of nine published studies found consistent, negative associations between children's overweight or obese conditions and cognitive, behavioral, and achievement measures (Taras & Potts-Datema, 2005). Further, the CDC found that high school students who are physically active at least 60 minutes a day, five days a week, earned higher grades than students who were not active (CDC, 2009). However, the relationship between obesity and school performance is complex and may not be causal. A study in West Virginia found that the specific relationship between obesity

and achievement disappeared when researchers controlled for other general fitness measures (Cottrell, Northrup, & Wittberg, 2007).

Table 6. Statewide Adult and Childhood Obesity Rates in Middle Appalachia States (2009)

State	Adult Obesity Rate		Childhood Obesity Rate	
	%	Rank	%	Rank
Kentucky	30.5	7	21.0	3
North Carolina	29.4	10	18.6	11
Ohio	29.0	13	18.5	12
Tennessee	31.6	2	20.6	6
Virginia	25.5	32	15.2	23
West Virginia	31.3	4	18.9	10

Source: Levi et al. (2010).

Further, a 2010 CDC review of 50 studies of school-based physical activity found positive associations between that activity and academic performance. The studies showed physical education, recess, physical activity in the classroom, and extracurricular physical activity to be associated with a variety of academic outcomes: attention, concentration, memory, verbal ability, attendance, time on task, homework completion, test scores, and grades (CDC, 2010). Together, these findings suggest that schools might play a role in offering nutrition and fitness education and activities for entire families, which would serve the dual purpose of engaging families with schools.

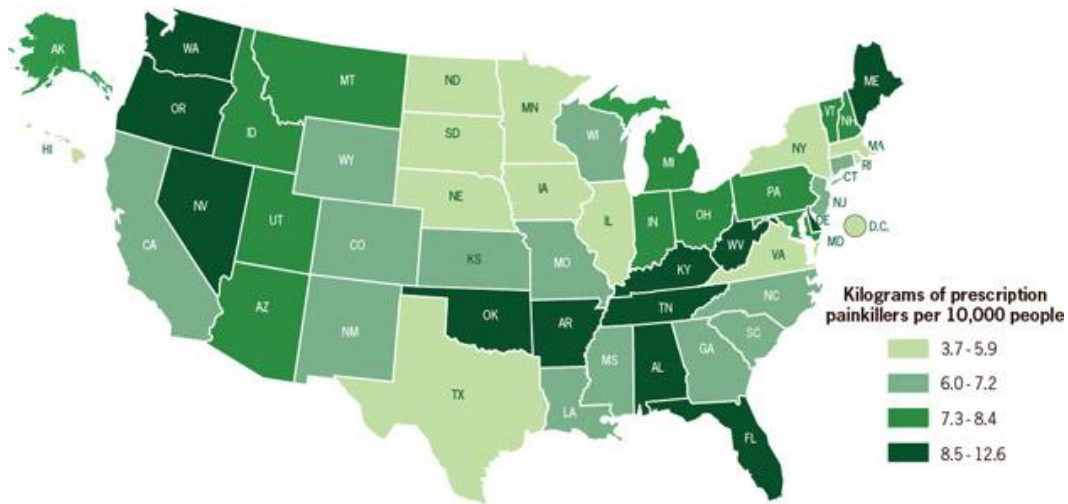
While we found no studies on school-based health and wellness programs in middle Appalachia specifically, Kruger et al. (2012) conducted focus groups that explored barriers to and facilitators of physical activity in the region. Appalachian barriers included lack of fitness facilities, extensive distances to reach facilities, and extensive distances required to reach destinations in general, which leaves less time for physical activity. Focus group participants suggested that fitness programs might be more appealing if (1) partnered with existing organizations such as schools and cooperative extension services and (2) designed with the needs of the extended family in mind so that adults can bring children.

Substance abuse

Use and abuse of drugs are growing problems in the United States and Appalachia, in particular prescription painkillers (CDC, 2011a, 2011b). Between 2002 and 2006, West Virginia experienced a 550 percent increase in prescription drug overdose deaths (CDC, 2007). In 2008, West Virginia also had the second highest prescription drug overdose death rate in the nation at 25.8 deaths per 100,000 people; Kentucky

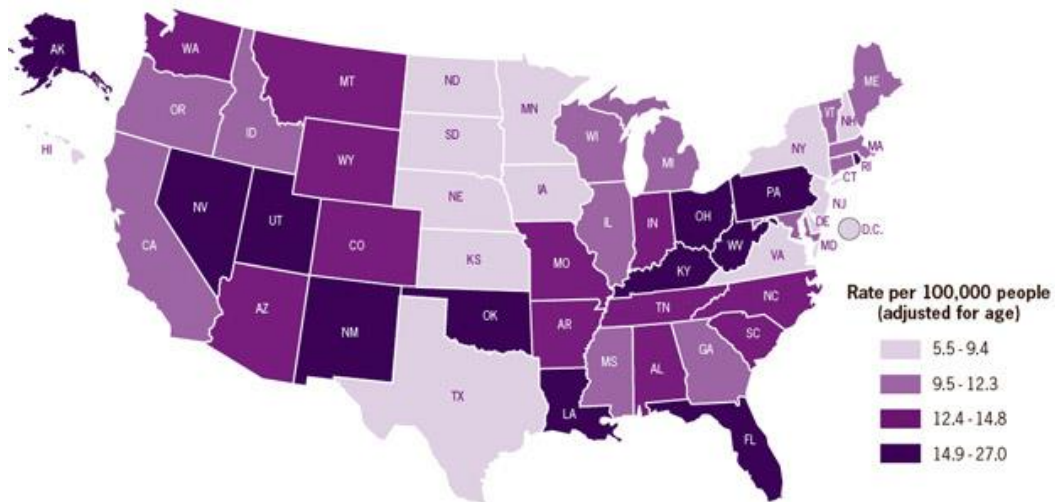
was sixth with 17.9 deaths per 100,000 people (CDC, 2011b). Also, low-income residents of Appalachian Kentucky use more narcotic pain relievers per capita than residents from other parts of the state (Chubinski, Walsh, Sallee, & Rademacher, 2014). (See Figure 2 and Figure 3.)

Figure 2. Prescription Painkillers Sold by State per 10,000 People (2010)



Source: <http://www.cdc.gov/vitalsigns/painkilleroverdoses/infographic.html>.

Figure 3. Drug Overdose Death Rates by State per 100,000 People (2008)



Source: <http://www.cdc.gov/vitalsigns/painkilleroverdoses/infographic.html>.

Leukefeld et al. (2007) conducted interviews in Appalachian Kentucky with 70 community leaders, educators, health care providers, and law enforcement officials on prescription drug use. They identified four factors that contributed to the prescription drug epidemic in their community: (1) availability of drugs from doctors; (2) peer and family influence; (3) use as a coping strategy; and (4) cultural acceptance.

In addition to drug use, the use of tobacco is higher in Appalachia than in the rest of the United States, and alcohol abuse is prevalent (Meyer, Toborg, Denham, & Mande, 2008). One study in Appalachian Ohio reported that adolescent men view the use of smokeless tobacco as “a rite of passage in the development of masculine identity” (Nemeth et al., 2012, p. 1208).

While CNA researchers working in middle Appalachia have heard anecdotal reports from educators that substance abuse has been growing among students, we located very little research addressing this issue. A series of focus groups on preventive health conducted between 1997 and 2002 in 24 Appalachian counties and one independent city in 10 states included focus groups with adolescents (Denham, Meyer, Toborg, & Mande, 2004). In agreement with research suggesting the strong sense of family in middle Appalachia, findings from all age groups consistently reflected the central role of the familial unit in the health of family members.

In considering education activities or messages to improve preventive health, adolescents and adults agreed that messages to youth should occur in the context of caring interactions, preferably one-on-one. They suggested stressing personal education and self-improvement and incorporating fact-based information that is relevant to students’ lives and practical in their circumstances. The authors suggested a specific approach to culturally sensitive health education in Appalachia: one-on-one contact, politeness, and reliance on facts.

Findings such as these suggest that schools might play a role in addressing preventive health and wellness issues through relationships or programming for students *and* their families.

Summary

Data shared in this section support the perception of educators in middle Appalachia that obesity and substance abuse are growing problems in the region. The limited research indicates that given the role schools play as community centers, they may be called upon to partner with other organizations to offer community-based health and wellness programs for extended families. As schools are increasingly called upon to address problems of obesity and substance abuse, research will be needed to identify effective programs and practices.

Discussion and Conclusion

This review of literature on education in middle Appalachia over the past 20 years describes a body of research on issues around college readiness, attendance, and persistence—in keeping with the current national emphasis on college and career readiness. In addition, a number of studies and reflective essays emerged from NSF-funded STEM initiatives in the region, as well as from state and national systemic reform efforts. A smaller number of studies emerged on educator preparation, recruitment, retention, and effectiveness that focused primarily on the need for teachers of mathematics, science, and special education, as well as the need to prepare principals to serve as instructional leaders.

A common theme in the literature was the interaction of the Appalachian culture with education improvement initiatives—specifically, cultural attitudes toward higher education, attachment to family and place, responses to external mandates, and political power structures that influence education institutions. A small body of research supported anecdotal reports that schools in middle Appalachia face increasing problems of health and wellness and may be called upon to play a role in addressing them in the near future.

The vast majority of the literature cited was analysis of quantitative indicators in the region or qualitative research such as case studies and interview-based studies. A few studies were implementation evaluations of improvement initiatives, with little emphasis on systematic analysis of outcomes.

The six states with school districts in middle Appalachia have embraced the **college and career readiness** movement, with positive results beginning to emerge. Findings from the literature indicate that while the region continues to trail the nation on numerous economic indicators, there are signs of progress on various education measures. Although common measures of student achievement were not available across states in the region, data indicated that high school graduation rates have improved and ACT results are comparable in some Appalachian versus non-Appalachian districts in the six states.

In addition, high school graduation rates of current students have surpassed the national rate, although middle Appalachia still has a lower percentage of college graduates than the rest of the nation, across age ranges. Recent labor market analyses found some basis for these trends. Middle Appalachia continues to rely more on occupations that do not require college degrees (e.g., agriculture, forestry,

coal, gas) than in the United States as a whole. At the same time, some studies proposed that career and technical programs in the region did not adequately emphasize current and future labor market needs such as business technology and industrial maintenance.

Research also indicated that attachment to family and place may deter students from attending and/or persisting in college and that there is a cultural wariness about high academic achievement contributing to elitism and denigration of local values and knowledge. Students who did attend college, however, indicated a desire to return to their home communities. Together, these studies suggest that unique supports may be needed for students from middle Appalachia to enroll and persist in college, including social and community supports, as well as place-based pedagogies and curricula that enable students to explore local issues and use their education for the betterment of their home communities.

Educator effectiveness is an issue in middle Appalachia, as states in the region have been influenced by a national emphasis on improving the effectiveness of educators to lead and teach to rigorous academic standards. Research on educator effectiveness focused primarily on the need to better prepare administrators in middle Appalachia to serve as instructional leaders; finding and/or preparing teachers in the hard-to-staff areas of mathematics, science, and special education; and the unique skills and qualities needed by rural, Appalachian educators. The research indicated that the role of educator in middle Appalachia is a respected position to which many aspire because it enables them to enjoy a viable career at home. As a result, attrition of educators is not so much an issue as overall quality—how to ensure that local educators are delivering high-quality leadership and instruction?

The literature indicated a recognition that the region must “grow its own,” and that numerous initiatives have been and are being implemented to increase the knowledge and skills of educators for the region. No research emerged that examined the long-term impact of these initiatives. Similarly, only two studies focused on efforts to recruit and more adequately prepare local students for careers in education.

Another theme in the research was the challenge faced by educators in middle Appalachia to teach to externally generated, rigorous academic standards that may not resonate with all local residents. Some researchers reported the perception among local educators that families and other community members do not value a strong academic education. Some studies reported that educators believed it was their mission to compensate for student backgrounds. These beliefs were turned to positive ends in some cases. At the same time, there were indications that many educators in the region—administrators, in particular—may be from the cultural elite and/or view Appalachian parents and students from a deficit model. These findings, as well as those mentioned above, suggest that educator preservice and inservice

programs might give attention both to recruitment of teachers in hard-to-staff content and program areas and to shaping educator preparation and professional development programs to meet the needs and circumstances of rural Appalachia, including making teaching and learning relevant, understanding parental attitudes, and countering deficit views toward families and students.

The literature on **curriculum and instruction** has not yet addressed implementation and impact of the Common Core State Standards, but focused on two predominant themes: improving mathematics and science education, and making curriculum and instruction relevant through place-based approaches. A third theme that appeared in some research was the need to engage families and the larger community in curricular and instructional improvement.

Reflective essays emerging from math and science improvement initiatives emphasized the need to increase educator effectiveness in teaching to challenging standards, preparing students for high-tech careers, using technology to increase access to high-quality instructional materials, and engaging students and the community through locally relevant pedagogies. While this literature suggested integrating place-based education with math and science, the two ideas did not appear to be well integrated in the actual initiatives that were implemented. Initiatives such as the Appalachian Rural Systemic Initiative and the Appalachian Math and Science Partnership appeared to derive from national, standards-based movements with a perfunctory nod toward community engagement. The literature on place-based education projects did not explicate how these projects were connected to student learning goals. An exception was the *Reading the River* project described by Haight and Gonzalez-Espada (2009), in which a local watershed provided the context for helping teachers integrate teaching of various science concepts using inquiry-based instruction in a locally relevant context.

The *Reading the River* project illustrates the possibilities of integrating challenging academic content with culturally relevant pedagogies and context. Research on such efforts could begin to produce a body of “research-based responsive practices” as recommended by Johnson et al. (2009). Such place-based initiatives could serve the dual purpose of helping all students achieve high standards of learning in a relevant, engaging manner, while revitalizing local communities and engaging them in the work of schools.

A relatively small body of research documented the increasing use of technology to improve access to high-quality curriculum and instruction. Studies to date have found that simply building technology infrastructure does not automatically lead to improved teaching and learning, but few studies have described actual implementation and impact of technology initiatives. An emerging theme in the literature is the need to attend to student diversity in this region once considered to be extremely homogeneous and monocultural.

The literature on building **systemic capacity** focused primarily on initiatives that emanated in large part from the national standards-based movement. Research on implementation of these improvement initiatives in middle Appalachia indicated that they provided much-needed fiscal and material resources for education improvement, increased the diversity of stakeholder involvement in school improvement, and helped equalize education expectations and opportunities for all children. Not surprisingly, those aspects of the reform that were most appreciated were those that stakeholders viewed as meeting local needs. Other components of the initiatives such as externally imposed standards, testing, and accountability were less valued.

This same body of literature highlighted the importance of forming partnerships and coalitions within the region to develop a collective vision and leverage all available expertise and resources to improve education. State and regional colleges and universities have played an especially pivotal role in leading and supporting various initiatives aimed at improving teaching and learning. Research suggests that engaging the broader community in these efforts was a universal challenge. Again, place-based, responsive practices could serve as a vehicle for engaging families and the larger community in more meaningful ways in efforts to improve teaching and learning.

Finally, national **health and wellness** statistics indicated that rates of obesity and substance abuse are higher in middle Appalachia than in many other parts of the country. These statistics supported anecdotal information shared by educators from the region, who believed that schools will increasingly play a role in addressing these issues. The very limited research to date drew a link between academic performance and physical activity, providing schools with a rationale to promote physical activity during the school day. In addition, research recommended that given the link between parent and student health behaviors, schools might do well to offer programs for the extended family. Similarly, studies of substance abuse indicated that peer and family influences play a strong role, and that programs that address the problem should focus on interpersonal relationships and rely on facts that are relevant to students' circumstances, presented in terms of personal education and self-improvement, rather than casting a negative light on family and student behaviors and values.

Directions for the future

The collective findings of research on education conditions and needs in middle Appalachia over the past 20 years suggest a number of directions for policy, practice, and research in the region in future years. Below we discuss, first, the implications for policy and practice, and then consider directions for future research.

Implications for policy and practice

College and career readiness

Given the desire of students from middle Appalachia to remain close to family and home, college and career readiness efforts should be closely aligned with current and future career opportunities, as well as with community development needs in the region. It will be important to connect such efforts to student learning goals so that students simultaneously are developing their own knowledge and skills at high levels while learning how to apply their knowledge to solving problems in their home communities.

The literature suggests a need, in particular, to align career and technical education programs to career opportunities available in the region.

Educator effectiveness

Teacher education programs in the region, in partnership with local school districts, might develop programs to increase awareness of and interest in careers in education among middle and high school students, with a specific focus on instructional leaders and teaching in STEM-related fields and special education.

Teacher education programs might consider how to reframe their preparation programs for teachers destined to teach in middle Appalachia, including a focus on cultural context, attitudes of and toward parents and students, and culturally relevant pedagogies.

There is a strong need to develop education leaders from within the system, given the difficulty of attracting from the outside. Programs that identify and prepare leaders should include internships in Appalachian schools, as well as a curriculum that includes not only the instructional leadership skills needed under standards-based education, but also the focus on cultural context, attitudes toward parents and families, and culturally relevant pedagogies.

Curriculum and instruction

Consideration should be given to how to integrate place-based approaches advocated in the rural literature with implementation of rigorous state and national standards both to increase relevance and engagement for students and to engage the community.

As is true nationwide, school districts in middle Appalachia are challenged to ramp up teaching and learning in mathematics and science. This issue is strongly connected to the issue of educator effectiveness. Again, place-based approaches hold promise for increasing relevance of instruction, but teacher preparation and

professional development programs focused on inquiry-based practices should continue.

Systemic capacity

The research suggests a strong awareness of the importance of obtaining community buy-in and participation in education improvement in the region, yet no powerful models for doing so were described. As new improvement initiatives are developed, reform leaders might consider involving parents and community leaders at the outset in designing more effective strategies for familial and community engagement. A promising idea is to frame improvement initiatives around place-based approaches that seek to make education more relevant while also contributing to local community improvement.

Given the plethora of systemic improvement initiatives in middle Appalachia over the last 20 years, policymakers and educators would do well to document lessons learned from past efforts and build on those initiatives in determining next steps in the quest to improve schools in the region.

Health and wellness

As schools increasingly confront issues of obesity and substance abuse, educators will need guidance from research both within and outside the field of education on effective programs for addressing these problems. Community partnerships will be especially important, given the strong role played by families in modeling health behaviors.

Directions for future research

Research conducted over the past 20 years has laid the groundwork for future studies that will expand on prior research. In general, much research exists that describes the general context for education in middle Appalachia. Additional research is needed to document outcomes of education programs, policies, and practices so that educators and policymakers can more fully understand what works and what doesn't. A number of initiatives currently under way may provide a focus for that research. In addition, more readily available data at a district or regional level would considerably aid the understanding of education issues across middle Appalachia.

Below we list a number of additional, specific possibilities.

College and career readiness

- Research on current initiatives focused on improving the college and career readiness of youth in middle Appalachia—Programs supported by federal Race

to the Top and i3 grants have evaluations under way that will likely contribute to the body of research on education improvement in the region. To contribute to the knowledge base, it is critical that such evaluation reports are widely accessible. Additional research that explores various aspects of these initiatives in-depth also may add knowledge about what works, and why, in middle Appalachia.

- Research on effective student support services and initiatives to increase college enrollment, persistence, and completion, given findings in this review regarding the need for such supports for middle Appalachian students
- Research on college-going decisions that looks at the overall population to supplement and balance current research that describes college-going decisions and experiences from the perspective of college students
- Longitudinal analyses of labor market trends and how these trends relate to education programs and community attitudes toward the pursuit of higher education
- More research on career and technical education programs in the region to identify programs that lead to successful employment in the community, and where gaps exist

Educator effectiveness

- Research to describe the implementation and impact of new teacher evaluation systems in school districts in middle Appalachia relative to non-Appalachian districts in the same state, especially given the different roles and expectations of teachers in rural, middle Appalachia relative to other regions
- Research on teacher recruitment programs that seek to prepare more teachers in hard-to-staff fields
- As current research suggests that the education workforce within Appalachia is relatively stable, research focusing on the effectiveness of professional development for current teachers, from a “grow your own” perspective

Curriculum and instruction/systemic capacity

- Research on the long-term impact of the many STEM initiatives implemented in the region, including impact on teacher and leader capacity, out-of-field teaching in STEM areas, changes in instructional approaches, and student achievement trends—Such studies might identify districts and individuals who have been involved in the various improvement efforts and document their impact.

- Studies of technology implementation and outcomes, given educators' race to incorporate technology—While the literature on STEM initiatives in the region described technology as a key tool, little described how teachers use technology to change instruction or how different uses of technology impact student learning in middle Appalachia.
- Research about specific student populations in middle Appalachia—Additional studies based on gender, English learner status, special education, and other factors would provide a more fine-grained picture of education in the region.
- Studies of curriculum and pedagogy that address state and national standards using place-based approaches, to supplement these currently independent strands of research
- Research that describes effective partnerships, including key components, outcomes, and sustainability of the partnerships—This would be in addition to current research that found that community partnerships, with families, businesses, and local colleges and universities, are important to education in middle Appalachia.

Health and Wellness

- As schools develop programs to address issues related to health and wellness, research on their implementation and impact on physical, social, emotional, and academic outcomes

Conclusion

This review of education in middle Appalachia suggests that the education opportunities and outcomes in the region are improving, likely through the persistent, committed efforts of education leaders in the region at both the K–12 and postsecondary levels. The literature provided examples of several promising initiatives designed to not only improve education but contribute to community development. Colleges and universities in the Appalachian region are to be commended for providing leadership for education improvement and for research focused specifically on rural, Appalachian schools.

This report highlights directions that will build on past improvement efforts, analyze the long-term impact of those efforts, and continue to investigate improvement initiatives in the future.

Appendix A: About CNA's Work in Appalachia

CNA has had a presence in middle Appalachia through several federally and locally funded projects. From 2000 to 2005, CNA managed the Appalachia Technology in Education Consortium (ATEC). The ATEC was a technical assistance organization that assessed the regional needs in education technology and assisted states in aligning their technology plans with the No Child Left Behind Act. In 2004–2005, CNA also managed the U.S. Secretary of Education's Regional Advisory Committees (RACs), helping stakeholders identify their education technical assistance needs in 10 regions, including Appalachia.

CNA's education division is best known for operating the Regional Educational Laboratory (REL) Appalachia since 2006. REL Appalachia is part of a federally funded network of 10 regional laboratories across the country that seeks to meet the research and data needs of policymakers and practitioners. Through the REL Appalachia contract, we provide research, evaluation, and technical assistance to educators throughout the states of Kentucky, Tennessee, Virginia, and West Virginia.

This work has included regular visits to the region to participate in relevant meetings of school and district leaders; provide research-based technical assistance; and conduct research. Topics addressed through REL Appalachia at CNA have focused on college and career readiness, effective data use, and teacher effectiveness, but also include prekindergarten, English learners, supplemental education services, and education economics.

In addition to work through the above programs, CNA has conducted independent research and evaluation projects in middle Appalachia. For example, CNA currently is the external evaluator for the Niswonger Foundation's Investing in Innovation Fund (i3) grant in northeast Tennessee. This grant created a consortium of 30 high schools partnered with local colleges to increase college readiness and enrollment in that rural area. The program emphasizes delivery of rigorous courses through online technology, enhanced professional development for teachers, and expanded college and career counseling programs. The evaluation uses a quasi-experimental matched-control design to examine impact and includes a formative component to provide ongoing feedback on program implementation.

CNA has also studied the impact of National Board for Professional Teaching Standards certification in Kentucky, implementation of mastery learning programs in Kentucky, and career and technical education programs in Tennessee and Virginia.

Appendix B: Data Tables

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Table 7. Population Characteristics (2010)

Region	Population	Population Change 2000 to 2010	Population Density (per sq. mi.)	Median Household Income	White Alone, Not Hispanic	Black Alone, Not Hispanic	Hispanic or Latino	Other, Not Hispanic
United States	309,138,711	9.7%	87.5	\$53,046	63.7%	12.2%	16.4%	7.7%
Middle Appalachia	9,053,102	6.5%	96.2	— ^a	89.7%	4.8%	2.9%	2.6%
North Central Appalachia	2,420,540	4.4%	82.5	\$41,817	93.3%	2.7%	1.2%	2.8%
Central Appalachia	1,915,597	1.6%	64.3	\$33,173	95.4%	1.9%	1.2%	1.5%
South Central Appalachia	4,716,965	9.8%	134.8	\$41,074	85.5%	7.0%	4.5%	2.9%

Source: Pollard & Jacobsen, 2011, 2014. Author's calculations based on sources.

a. Not available.

Table 8. Student Characteristics: Race/Ethnicity (SY 2012/13)

Region	White	Black	Hispanic	American Indian, Alaska Native	Asian, Asian/Pacific Islander	Hawaiian Native, Pacific Islander	Two or More Races
United States	51.1%	15.7%	24.3%	1.1%	4.8%	0.4%	2.8%
Middle Appalachia	85.9%	6.0%	5.0%	0.2%	0.9%	0.1%	1.9%
North Central Appalachia	91.9%	3.9%	1.3%	0.1%	0.7%	0.0%	2.0%
Central Appalachia	95.0%	1.9%	1.7%	0.1%	0.4%	0.0%	0.9%
South Central Appalachia	78.5%	9.0%	8.5%	0.4%	1.2%	0.1%	2.3%

Source: U.S. Department of Education, National Center for Education Statistics, Common Core of Data.

Table 9. Student Characteristics: Poverty, English Learners, Disabilities

Region	Living in Poverty (< age 18) (2008-2012)	FRL (2012/13)	English Learner Students (2012/13)	Disabilities (< age 18) (2008-2012)	IEP (2012/13)
United States	20.8%	46% ^a	8.5%	4.0%	13.0% ^b
Middle Appalachia	25.3%	55.2%	2.1%	5.2%	14.4%
North Central Appalachia	23.5%	50.5%	0.6%	5.4%	15.2%
Central Appalachia	32.0%	58.9%	0.5%	5.8%	15.5%
South Central Appalachia	24.5%	56.0%	3.7%	4.9%	13.5%

Sources: Pollard & Jacobsen (2014); U.S. Department of Education, National Center for Education Statistics, Common Core of Data.

^a. SY 2009/10. http://nces.ed.gov/ccd/tables/2000_schoollunch_01.asp.

^b. SY 2011/12, among students with disabilities. <http://nces.ed.gov/fastfacts/display.asp?id=64>.

Table 10. Employment, by Industry (2010)

Region	Total Employment (thousands)	Farming, Forestry (%)	Coal, Gas, Other, Mining (%)	Utilities (%)	Construction (%)	Manufacturing (%)	Wholesale Trade, Transportation (%)	Retail Trade (%)	Finance, Insurance, Real Estate (%)	Professional, Technical Services (%)	Education, Information Services (%)	Health, Social Services (%)	Food, Lodging, Entertainment (%)	Federal Government, Military (%)	State & Local Government (%)
United States	173,767	2.0	0.7	0.3	5.1	7.0	6.6	10.2	9.8	14.0	4.2	11.0	14.8	3.0	11.2
Middle Appalachia	4,377	3.6	1.7	0.4	6.1	8.9	5.9	11.5	7.2	10.4	2.8	11.6	14.7	2.3	13.1
North Central Appalachia	1,128	3.4	2.7	0.7	5.7	6.4	5.3	11.9	6.7	9.1	2.7	13.0	14.7	3.2	14.5
Central Appalachia	791	6.2	4.8	0.4	6.2	8.3	5.6	11.4	5.6	8.9	2.3	11.0	12.6	2.3	14.4
South Central Appalachia	2,458	2.9	0.2	0.2	6.2	10.2	6.2	11.4	7.9	11.4	3.0	11.2	15.4	1.8	12.0

Source: Appalachian Regional Commission (2014). *Appalachian Region Industry Report-2014*.

Table 11. Race to the Top (RTTT) Grants in Middle Appalachia States

State	Agency	Grant	Year	Award (millions)	Appalachia Focus
KY	Department of Education	RTTT	2011	\$17	Statewide
KY	Green River Regional Educational Cooperative	RTTT-District	2012	\$40	Yes
KY	Kentucky Valley Educational Cooperative	RTTT-District	2013	\$30	Yes
KY	Office of Early Childhood	RTTT-Early Learning Challenge	2013	\$44	Statewide
NC	Department of Education	RTTT	2010	\$400	Statewide
NC	Guilford County Schools	RTTT-District	2012	\$30	No
NC	Iredell-Statesville Schools	RTTT-District	2012	\$20	No
OH	Department of Education	RTTT	2010	\$400	Statewide
TN	Department of Education	RTTT	2010	\$500	Statewide

Sources: <http://www2.ed.gov/programs/racetothetop/awards.html>, <http://www2.ed.gov/programs/racetothetop-earlylearningchallenge/awards.html>, and <http://www2.ed.gov/programs/racetothetop-district/awards.html>.

Table 12. Investing in Innovation Fund (i3) Grants in Middle Appalachia States

State	Agency	Grant title	Year	Award (millions)	Appalachia Focus
KY	Jefferson County Public Schools	Making Time for What Matters	2010	\$5	No
KY	Council for Opportunity in Education	Using Data (DICAP)	2010	\$20	No
KY	Berea College	Accelerating Academic Achievement in Appalachian KY	2011	\$3	Yes
KY	Kentucky Valley Educational Cooperative	College and Career Readiness Transformations	2011	\$3	Yes
KY	Green River Regional Educational Cooperative	Get the Picture?! Guiding and Engaging Exceptional Teens	2014	\$3	Yes
NC	Iredell-Statesville	Collaborative Organizational Model to Promote Aligned Support Structures	2010	\$5	No
NC	North Carolina New Schools Project	Validating Early College Strategies	2011	\$15	No
NC	Montgomery County Schools	ACCESS	2014	\$3	No
NC	Cabarrus County	INSPIRE (STEM)	2013	\$3	No
OH	Ohio State University	Reading Recovery Scale Up	2010	\$50	No
OH	KnowledgeWorks	Corridor of Innovation	2011	\$3	No
TN	Niswonger Foundation	Northeast Tennessee College and Career Ready Consortium	2010	\$18	Yes
VA	George Mason University	VA Initiative for Science Teaching & Achievement	2010	\$28	No
VA	Harvard College	Project READS	2010	\$13	No
VA	New Teacher Project	TEACH Initiative	2010	\$21	No
VA	Old Dominion University	Scale Up of Proven Model of Math Instruction in High Need Schools	2011	\$25	No
VA	VA Advanced Study Strategies (South Boston)	Rural Math Excel Partnership	2012	\$3	Yes

Source: <http://www2.ed.gov/programs/innovation/awards.html>.

Table 13. Math and Science Initiatives in Middle Appalachia

Initiative	Funder	Time	Purpose	Partners
Appalachian Rural Systemic Initiative (ARSI)	National Science Foundation (NSF)	1995–2005	Improve math and science performance of K–12 students by strengthening teacher knowledge and skills	Ohio University, University of Virginia College at Wise, University of Kentucky, University of Tennessee, Marshall University (WV), 66 school districts across six states
Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) ^a	NSF	Estab. 2001	Build mathematics infrastructure in the Appalachian regions of Kentucky, Ohio, Tennessee, and West Virginia through capacity building, professional development, teacher education, and research	University of Tennessee, University of Kentucky, University of Louisville (KY)
Appalachian Technology in Education Consortium ^b	U.S. Department of Education	2000–2005	Help states, school districts, and education institutions in Kentucky, Tennessee, Virginia, and West Virginia use advanced technologies to improve teaching and learning	ARSI, CNA (VA), EdVenture Group (WV), University of Memphis (TN)
South Fork Local Systemic Initiative ^c	NSF	Unknown	Develop science teacher leaders in 11 high-poverty districts in Kentucky and Tennessee	University of Tennessee, Eastern Kentucky University, Oak Ridge National Laboratory (TN)
Coalfields Rural Systemic Initiative ^d	NSF	2002–2007	Developing leadership capacity, data-driven approaches, parent and community support, and partnerships with local higher education institutions in 18 rural districts in Virginia and West Virginia	Virginia Department of Education, West Virginia Department of Education, Appalachia Educational Laboratory, eight regional institutions of higher education

Initiative	Funder	Time	Purpose	Partners
Appalachian Math and Science Partnership (AMSP) ^e	NSF	2002–2014	Eliminate achievement gap in math and science in Central Appalachia	Nine postsecondary institutions and 51 school districts (the great majority in middle Appalachia) in Kentucky, Tennessee, and Virginia

Sources: (a) Waters et al. (2008) and archived ACCLAIM website at <http://web.utk.edu/~vlong/acclaim.html>. (b) CNA website at <http://www.cna.org/centers/education/selected-projects/ATEC>. (c) National Science Foundation website at http://www.nsf.gov/awardsearch/showAward?AWD_ID=0101910. (d) Boyer (2006) and Harmon & Smith (2012). (e) Inverness Research (2008) and project website at <http://appalachian.mspnet.org/>.

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