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Going Further: A Roadmap to the Works of the ACCLAIM Research Initiative

Zach Wilson
Craig Howley

Ohio University
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ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The project aims to (1) understand the rural context as it pertains to learning and teaching mathematics; (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people; and (3) improve the professional development of mathematics teachers and leaders in and for rural communities..

ACCLAIM Research Initiative
314F McCracken Hall
Patton College of Education
Ohio University, Athens, OH 45071
Contact: howleyc@ohio.edu
Web: https://sites.google.com/site/acclaimruralmath/Home

Funded by the National Science Foundation as a Center for Learning and Teaching, ACCLAIM is a partnership of the University of Tennessee (Knoxville, TN), University of Kentucky (Lexington, KY), West Virginia University (Morgantown, WV), Marshall University (Huntington, WV), University of Louisville (Louisville, KY), and Ohio University (Athens, OH).

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Going Further:

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Zach Wilson

Teacher Education Department, Ohio University

Craig B. Howley

Educational Studies Department, Ohio University

February, 2012

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EXECUTIVE SUMMARY

Going Further presents a roadmap to the works of the ACCLAIM[1] Research Initiative, the research effort of one of the Centers for Learning and Teaching (CLTs) created with a grant (2001-2005) from the National Science Foundation. No-cost extensions and one supplemental grant extended the period of funding to September 2011. At this writing, the initiative continues unfunded to manage ongoing projects.

Our Center began with a broad mission to include practitioners, a doctoral program, and a research program. This report focuses on the most substantive *works* produced for the Center's research program (known as the "Research Initative"). Some insight into the *processes* of the Research Initiative is, however, available in the Inverness Research Associates third-party evaluation of the Center (St. Johns, Helms, & Smith, 2008). The Center developed rich connections across its participating institutions, such that a wide range of Center scholars were fully involved in the research effort.

This report also offers an internal evaluation of the works produced (the present authors work for the Center), but it relies rather more heavily on descriptions of the works, and less on nuanced judgments than might an essay review. We adopt this approach in the name of the main mission: *making the range of work accessible via a single document* (i.e., the "roadmap" mission).[2]

One section deals specifically with the evaluation of individual works, as to be explained shortly, but one section engages a wider discussion around the critique of several key ideas that surface across the ACCLAIM opus. Both these presentations are

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[1] The acronym stands for "Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics."

[2] Internal evaluations receive less credence than third-party efforts, and for good reason. We are quite aware that not every reader would judge the research effort worthy; its commitments are opposite those of some colleagues in the field.

best read as part of the roadmap mission; they give a somewhat deeper engagement with the scope of the works than the simple descriptions initially presented.

We begin with background about the Center and the research effort, and then develop a scheme for classifying the works produced. The following categories emerge in this section:

1. Contextual factors on (and in) rural schools, and how they are perceived;
2. Structural factors on (and in) most rural schools;
3. Place-based education and other suggested reforms; and
4. Content and conduct of research.

A table displays the works thus categorized, by the year of publication. With the table, one can observe which themes were engaged most strongly and when. The core members of the ACCLAIM research team needed time to debate relevant issues, conceptualize studies, and then to execute them. And the sequence of work reflects this reality.

Three other interesting points are evident: First, there are six think-pieces focused on contextual factors, but *none* focused on structural factors as defined there; second, ACCLAIM works studied place-based education by *quantitative* means in just one study (Lipka & Adams, 2004); third, there are no quantitative overviews (e.g., meta-analyses) of the conduct and content of research in rural mathematics education, possibly because the field has not yet produced a sufficient body of work to warrant such a review.

Empirical Studies

The report synthesizes the results of ACCLAIM's empirical work, summarizing the findings of individual studies (14 quantitative studies and 20 qualitative studies; unduplicated accounting) but also characterizing the overall findings, as follows.

The findings of the quantitative research conducted by ACCLAIM tend to coincide in (1) falsifying rural deficiency in mathematics outcomes (Alfonso, & Long, 2005; Hopkins, 2005); (2) providing evidence rather for the effectiveness of math instruction in rural schools (Hopkins, 2005; Lee, 2003); (3) disclosing the damage associated with consolidation, both overall and for math outcomes in specific (Gleason, Belcher, Britt, & Savich, 2008; Howley, Howley, & Hopkins, 2005; Howley & Howley, 2004); and (4) disclosing the advantage of small schools for the math outcomes of impoverished students (Howley, & Howley, 2004). Two studies (5) describe the rural-specific benefits for the mathematics education of impoverished students (Bickel, Howley, & Maynard, 2003; Hopkins, 2005) and (6) suggest that higher percentages of funding devoted to instruction results in achievement gains, particularly in Ohio schools where overall funding is low (Howley, Howley, & Hopkins, 2005, p. 27). A description of *each work* (see reference list for full bibliographic entry) comprehends three qualities (see Table 2): (1) theme, (2) sample, and (3) findings.

The brief summary of the 20 qualitative ACCLAIM studies is a necessarily high-inference one, reflecting key ideas evident in the studies more than specific findings. Readers should consult Table 3 for findings of individual studies. One might in general make the following observations as applicable across studies: (1) Rural communities continue to invest their schools with *local* practical, social, and cultural significance, and this rural difference continues to constitute part of the struggle *within* rural schooling (Anderson, 2006; DeYoung, 2003; Lucas, 2005). (2) Engagement with impoverished students is a significant phase in the struggle to sustain rural community and provision it with decent mathematical educational experience (Best, 2006; Howley, Howley, Burgess,

& Pusateri, 2008; Lucas & Fugitt, 2009), although egalitarian class structure changes the terms of such engagement (Howley et al. 2008). (3) Structures associated with rural schools (e.g., small size, possibility of focused curriculum, less bureaucracy) seem to facilitate math education reform (Anderson, 2006), but incremental changes do not necessarily entail a shift to instruction vigorously focused on concepts (Boyd, 2007; Howley, Larson, Adrianaivo, Rhodes, & Howely, 2007). (4) Part of the difficulty of reform in rural schools may entail a lack of capacity to imagine mathematics as more than a set of useful rules and definitions (Boyd, 2007; Howley, Howley, & Helm, 2007; Howley, Pendarvis, & Gholson, 2006; Nichols, 2010; Owens, 2010; Ratliff, 2011; Smith, 2010; cf. Stigler & Hiebert, 1999). (5) Although place-based mathematics is quite rare, multiple "existence proofs" suggest that it can thrive given a champion and other auspicious circumstances (Howley, Howley, Klein, Belcher, Howley, Tusay, et al., 2010; Howley, Howley, Burgess, & Pusateri, 2008; Howley, Howley, Camper, & Perko, 2011).

Theoretical Works

We discuss ACCLAIM's theoretical publications (the "think pieces" listed in Table 1; n = 23) in terms of the relevant insights, again writ large. The primary entitlement of theoretical work, of course, is wider freedom to pursue and develop ideas, a mission particularly germane to developing a new field of inquiry such as "rural mathematics education." Some works were created by interdisciplinary teams of authors (Long, Bush, & Theobald, 2003; Lucas & Fugitt, 2009; Huber, Howley, & Howley, 2004; Waters, Howely, & Schultz, 2008; Howley, Showalter, Howley, Howley, Klein, & Johnson, 2011), but efforts by authors from one or the other discipline to contextualize the issues of the other field to their own disciplinary context were more common, perhaps

because of the difficulty of implementing a fully interdisciplinary effort, a difficulty clearly anticipated by one early theoretical piece (Harmon, 2003). The seven ACCLAIM Research Symposia 2002-2011 did, however, serve to foster cross-disciplinary collaboration across the 10-year span.

Discussion of mathematics and resistance tended to overlap in theoretical work. (By "resistance" we mean problematizing dominant educational aims, curricula, pedagogies, and their sources in the wider political economy; by "mathematics" we mean school math, everyday mathematical practice, and the formal disciplinary field of human inquiry generally conducted in universities). The topic of mathematics encompassed concern for what constitutes mathematics (Howley, 2003a); how mathematics is seen and discussed (Bush, 2005); the curriculum and practices used to teach mathematics in local context (Long, Bush, & Theobald, 2003); and the relevance of ethnomathematics and culture (Bush, 2005; Eglash, 2004). The topic of resistance encompassed the contested nature of what constitutes reform, and for whose purposes (Civil, 2006; Lubienski, 2006); resistance to practices and aims that are dominant in public education, particularly those indifferent to locale (Klein, 2008); resistance to common views of rural areas and rural people (Howley, 2002b); and resistance to notions that there is a 'one best system,' or set of practices, in testing, curriculum, pedagogy, or education research (Gruenewald, 2006). Such skepticism, of course, has implications for programs of study in all fields of education, and specifically for the contextualized approach to both theory and practice that can be promoted there (Theobald, 2005). Again, a key summary of the Center's theoretical commitments appears in its Theoretical Framework (see Appendix B). Notably, too, the theoretical works included recommendations for how to conduct or

prepare for inquiry in this new field (Bush, 2005; Coladarci, 2004; 2007; Howley, 2003a; Theobald, 2005).

Evaluating the ACCLAIM Opus

We understand the limitations of internal evaluations. The aim here is not so much a judgment of goodness but a judgment of qualities engaged by the works.

First, we characterize the conceptual engagements, in this instance a necessarily impressionist identification. Third-party evaluators might apply discourse analysis to provide a more rigorous identification (see the full discussion and Appendix F for our list). We find the current more superficial approach, however, sufficient for a "roadmap" to the ACCLAIM opus. The list in any case suggests that the Center's explicit commitments succeeded in securing a pluralist contribution from willing colleagues and partners.[3]

Second, in order to provide a roadmap-style evaluation of each of the works, in addition to an overall impressionistic evaluation of the relevant concepts engaged by them, we created a list of qualities *evident in the theoretical pieces* and related to the themes engaged across all works and rated each work accordingly. We think the qualities used to judge works thus represent (1) the Center's stated commitments but als (2) the notable features exhibited across the range of published works. We judged the comparative presence or absence of six qualities:

[3] One overall observation seems worthy of note: both national cultures in general and the scholarly disciplines themselves judge rural life and education as poor by comparison to metropolitan, national, or international valorizations of "the best" (Herzog & Pitman, 1995; Williams, 1989; Weber, 1976). A research program such as ACCLAIM's, which positioned itself theoretically to *value* rural outlooks (see Appendix B), would be expected to deploy a systematic skepticism toward works, outlooks, or positions that took a superficial view of rural or that accepted claims about rural deficiency as their starting points.

Engaging:

1. place-based education,
2. rural issues,
3. mathematics teaching and learning,
4. assets or affordances of place, community, family.

And exhibiting:

5. empirical or theoretical substantiveness
6. conceptual nuance or elaboration.

Ratings judged works to possess or not to possess these features (0, 1), so that works that reflected more of these features received higher ratings. The ratings should be read as indicating the works' reflection of the ACCLAIM commitments. Table 4 provides the ratings for each paper, and Table 5 lists those works (n = 17) that received the maximum rating. Appendix D identifies the works indicated by the numerical codes used in Tables 4 and 5 to make the presentation manageable.

Critique

Because ACCLAIM's theoretical commitments involved skepticism toward the usual superficial engagements of education research with rural places and people (rural cultures, rural ways of being), and also rural education's usual superficial engagement with mathematics education, a sort of intellectual resistance is evident in many (not all) of the published works. Indeed, some Center leaders and allied scholars (e.g., Corbett, 2011; Gruenewald, 2006; Howley, 2009; Long, Bush, & Theobald, 2003) explicitly theorized varieties of this resistance, and many works implicitly embraced an outlook reflective of such critique (e.g., Anderson, 2006; Beach, 2004; Belcher et al., 2005; Best,

2006; Bush 2005; Civil, 2006; Nichols, 2010). For this reason, this section of the roadmap engages some of the key constructs (see Appendix F) more deeply, partly to demonstrate the connections between the ACCLAIM opus and the wider related literatures, and partly to interpret a sample of such ideas more extensively for interested readers. The presentation is merely suggestive.

The key constructs reflected in this critical discussion are: (1) instrumental education aims, (2) best practice, and (3) rural deficiency theory. The purpose of critique is to probe the limits of ideas, and in the discussion on offer in this section, those limits are pressed toward, rather than reached. We want, in this report, simply to illustrate the possibility of critique for a funded project such as ACCLAIM. Responsible scholarship, we believe, must press beyond conventional wisdom (e.g., instrumental construction of educational purpose, best practice, and rural deficiency).

Recommendations

The penultimate section of *Going Further* presents six recommendations, framed for different role groups, but in fact accessible across them:

Recommendation 1. The recommendation for rural citizens is deceptively simple: get involved in place-based education, and in particular in rural forms of mathematics education—math education that helps, both directly and indirectly, sustain everything significant in rural life.

Recommendation 2. Oppose the dominant outcomes and intentions imposed so widely and stringently on schooling. Embrace, instead, alternatives that make local sense and help to sustain local community, in particular helping students, including academically able students, envision local rural futures for themselves and their families.

Recommendation 3. Accept test score results with justifiable skepticism; in particular, do not propagate desperation to "boost" test scores, nor fixate on measures to "raise test scores." Aiming for a test score jump is much like aiming directly for happiness: it can't really work, because better scores and happiness are the result of something else—engagement and devotion to things that matter.

Recommendation 4. Recognize and promote rural perspectives in your policy work. For those who care about rural places, the emphasis is on protecting them, and the communities that exist within them. Challenging the negative impacts of consolidating rural schools, of the outmigration of talented students from their communities, and of the neglect of rural issues by most researchers in education and of most programs that sponsor education research would be good starting points.

Recommendation 5. Part of the self-imposed responsibility of the public intellectual[4] is to engage the public in critical issues, and for us, rural mathematics education is one such issue (among others, such as school consolidation and the outmigration of rural youth). Scholars and others (as public intellectuals) should write about the relevant issues in popular venues—in policy briefs and research translations, in large-circulation magazines in education, and in local and state newspapers.

Recommendation 6. One high purpose of empirical research is to ask dangerous questions, and the recommendation is especially apt in the case of rural math education, a field conceived as a sort of provocation. Such questions as "what is math?" and "whose math is this anyway?" and "what's rural about math education?" and "what rural

[4] The sorts of thinkers and writers and activists for whom these recommendations are intended probably already consider themselves public intellectuals. ACCLAIM has collaborated with a broad swath of those long active and those who are joining the rural education and rural math education fields and the related frays.

purposes should mathematics serve?" and "what mathematics knowledge will serve rural purposes?" illustrate where the dangers lie. ACCLAIM's empirical work has only scratched the surface.

GOING FURTHER:

A ROADMAP TO THE WORKS OF THE ACCLAIM RESEARCH INITIATIVE

This monograph characterizes, synthesizes, and evaluates the scholarly works produced by the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) from its inception September 1, 2001 through August 31, 2011, the period of its funded activity. The purpose is to serve as roadmap to the ACCLAIM research opus for those interested in rural mathematics education, as this work *goes further* in the future.

We classify the papers by type and theme; we characterize, as well, the empirical findings related to those themes, together with the positions taken and concepts favored in these works; we offer evaluative reflections on the works, including reflections on the embedded critique; and, finally, we reflect, with recommendations, on future directions for research in rural mathematics education.

One might do a great deal more with these works and the research trajectory they indicate. In fact, we think such additional work is already underway, and has been for some time: the work is *already* going further.

Background

In the ten years since its founding in 2001, ACCLAIM organized *rural mathematics education* both as a concept and a field of study (Waters, Howley, & Schultz, 2004). It was one of sixteen U.S. Centers for Learning and Teaching (CLTs) sponsored by the National Science Foundation (NSF) (St. John, Helms, & Smith, 2008), with similar overall missions principally focusing on "capacity building" (that is, doctoral

education and research, but with tentacles into classroom practice and education research). ACCLAIM's most particular grounding was Central Appalachia: "eastern Kentucky, east Tennessee, southeastern Ohio and all of West Virginia" (Bush, 2003, p. 5), with the Center's well-coordinated research effort based in Appalachian Ohio at Ohio University. Uniquely among the CLTs, ACCLAIM dealt (a) with math education only (instead of both science and math education) and (b) with rural education and the related constructs of place and community.[5]

What is "rural mathematics education"? Early in the history of the Center, the management team had earnest discussions about whether to focus attention on (1) mathematics education in rural schools or (2) a rural sort of mathematics education. The team selected the latter focus and prepared a formal "Theoretical Framework" document to share widely with colleagues and prospective individual and institutional partners (see Appendix B). The Center produced 98 documents in the course of its 10-year existence. Not counting four pieces[6] that did not directly further the research initiative of ACCLAIM and twelve papers[7] that were supplanted by later versions (mostly as peer-reviewed journal articles), the Center produced 82 distinct research documents.

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[5] The work of ACCLAIM overall was funded by more than $10 million in grants from NSF – one major, one supplemental (St. John et al., 2008). The Research Initiative received somewhat more than one-fifth of this total via subcontracts with Ohio University. The University of Tennessee at Knoxville was the prime contractor.

[6] Occasional Paper No. 4, which discusses input from focus groups for the ACCLAIM website; Occasional Paper No. 13, which transcribes a story told at an ACCLAIM gathering; Working Paper No. 39, which is a third-party qualitative review of ACCLAIM; and the article *Professional development for mathematics teachers: A team approach*, which does not present research, review research, discuss how to conduct future research, or contain a bibliography. Of these, only Working Paper No. 39 appears in Table 1 or in the list of numerical codes for ACCLAIM materials.

[7] Nine of these were Working Papers replaced by peer-reviewed articles, one was a Monograph replaced by a peer-reviewed article, one was a Working Paper replaced by a later Working Paper, and one was a dissertation replaced by a Working Paper. The numerical codes for these replaced pieces are as follows:

By "research" we mean written reports of either empirical investigation or theoretical speculation. We exclude evaluation; prescription about practice; and short, informal reflection. Excluded from analysis, as well, are the numerous articles appearing in the 10 volumes (comprising, in this timespan, 24 separate issues) of ACCLAIM's online magazine, *The Rural Mathematics Educator.* The online magazine considered relevant issues "through the lens of research" but did not itself aim to produce research as defined here.

Of the 82 documents, we identify 34 as *strictly empirical research* (14 quantitative studies and 20 qualitative studies), a definition that excludes works that might, in colleges of education, be considered as research.[8] Of literature reviews and think-pieces (broadly called 'theoretical'), we identified 21 as substantive, based on their scores on the rubric for evaluating original academic works by ACCLAIM (see Appendix E).

Categorizing the ACCLAIM Opus

In order to characterize the ACCLAIM opus, we categorized the 82 unduplicated ACCLAIM papers by types and themes. This process also allowed us to chart the intersections of types and themes, and thus identify the type of inquiry most frequently used by researchers to address a given theme.

We accomplished the categorization not via formal discourse analysis, but instead holistically, on the basis of a close reading of the documents. That is, we read the documents and made the required judgments based on direct familiarity with the texts;

02.05., 03.02., 03.07., 03.15., 04.07., 04.11., 06.04., 06.07., 06.11., 06.13., 07.06., and 07.07 (see Table 1). To see the full citations for these documents and the documents that superseded them, see Appendix A.

[8] Under the Boyer scheme designed specifically for education, "research" comprises the scholarships of discovery, integration, and application; here we focus only on the scholarship of discovery.

this method seemed sufficient to this comparatively simple task: The types of articles were identified quite readily as (1) quantitative research, (2) qualitative research, (3) literature reviews, and (2) "think pieces."

Identifying themes required rather more struggle. Our challenge was transparency—something more like indexing than like synthesis—rather than nuance. For nuance, we provide, following this section, separate syntheses for the quantitative studies, the qualitative studies, and the theoretical pieces. Thus, for this section we initially indexed the works by seven themes, as follows:

1. Theorizing apart from original empirical inquiry;
2. Evaluations of previous literature and recommendations for future work;
3. The findings and impact of programs, applications, interventions, and so forth;
4. Descriptions of the functions of rural education, especially rural math education;
5. Practices in teacher education, classroom pedagogy, and professional development;
6. Place-based education, and the role of community in place and schooling; and
7. Equity issues.[9]

Indexing by these concepts, however, revealed problems: The themes were imprecise, they applied spottily across types, and struck us ultimately as both too numerous and too disconnected. A plurality of the articles dealt with how the teaching of mathematics

[9] Equity issues included: negative assumptions and stereotypes about rural and Appalachian communities and students ('rural deficiency' and 'Appalachian otherness'); consolidation of rural and Appalachian schools and districts; rural outmigration; the role of socioeconomic status in educational outcomes; curriculum and assessment procedures; gender; and race.

functions in rural schools[10] and why, others considered alternatives to the prevailing paradigm of schooling (i.e., the prevalent instrumentalist purpose and decontextualized forms of instruction), while still others engaged in judgments about the research trajectory *of* or *for* rural mathematics education.

In short, we decided that the seven themes identified might compose themselves more usefully into just three: (1) how mathematics functions in rural schools at present, and why; (2) suggestions for how mathematics might function differently in rural schools and empirical investigation of such alternatives in actual practice; and (3) the content and conduct of research on rural mathematics education. These themes are conceptually and even ontologically related. The first engages current realities, the second engages alternative realities ("improvement"), and the third deals with the system that assesses or implements the first two (i.e., rural math education research *per se*).

We were still not, however, content. Making use of an insight that emerged in the course of reading and re-reading the literature, we split the first theme in two, based on whether the works focused attention on out-of-school "context" or within-school "structure." We adopted the term "structure" here as perhaps idiosyncratic short-hand for influences that might be understood as *within the control or purview of educators*. Of course, we understand that reality is complex and (indeed) "nuanced," so that the distinction of outside and inside is not so simple *in reality*. Clearly, in species of place-based education, educators treat context as content; and this is just one vector through which the outside comes inside and exerts inside an influence not typically under educators' "control." And the opposite is true, educators also gain influence over

[10] Which entails, among other things, the practices math teachers in rural schools generally use, the influence of the beliefs, values, and aims, of teachers, administrators, state and national assessments, and accountability policies upon those practices, and the outcomes that result.

"context" in such work. Such mutual influence is one of the aims of place-based education. Nonetheless, the distinction seems applicable to developing a synoptic view of the ACCLAIM opus as a whole.

Thus, the four themes on which we finally settled for our indexing task were:

1. Contextual factors relevant to rural schools, and how they are perceived;
2. Structural factors within rural schools;
3. Place-based education and other suggested reforms; and
4. Content and conduct of research.

Although the works are often, of course, relevant to more than one theme, we categorized them by what we judged as the predominant theme. A more complex rendering of the intersection of themes and types is beyond the scope of this monograph, which, again, functions as a roadmap of the ACCLAIM opus for those interested in going further with rural mathematics education, particularly as a project of discovery and invention.

Contextual factors, as we employ the term here, encompass such matters as neighborhood character, social class, race and ethnicity, locale, and the commitments, beliefs, attitudes, and social and cultural practices that constitute the circumstances of rural districts and schools (and of a rural sort of education per se). As noted above, context does exert an influence on schooling such that the boundary with what we are calling "structural" conditions within schools is less clear than is often presumed. Again, the distinction, we think, imposes a delimitation useful for the prescribed purpose.

Structural factors, as we use the term here, pertain to funding, school and district size, classroom size, curriculum, general instructional practices, assessments, teacher quality, classroom environment, and so forth. The term encompasses all potential

influences on educational achievement that are within the supposed control of the educational system (i.e., including those who determine funding and policy). Of course, the notion of "control" is, overall, as doubtful as context.[11]

Place-based education entails a *contextualized* frame of reference for curricula and pedagogy. Whereas structural factors include general instructional practices, this theme (theme 3) focuses on the particular connection of place to practice. "Other reforms" in this theme refers to educational approaches that one or more of the ACCLAIM authors understand as potentially useful in informing the theory and practice of place-based education. Such approaches predictably include progressive education, constructivism, environmental education, critical pedagogy, and ethnomathematics.

The intersections of the 4 types of works, and the 4 themes we decided upon, appear in Table 1, with numerical codes for each work (see Appendix D for the works, which are numbered there alphabetically by year). The first two numbers of each code indicate the year the article was published; the second two numbers give a within-year identifier.

[11] Many schools and many individual educators seem unable to control the very things seemingly "under" their control, and the reason is not necessarily ignorance, laziness, or incompetence. Institutional theory (e.g., Powell, 1988; Tye, 2000) explains, for instance, a great deal of the observable difficulties.

Table 1.

ACCLAIM Opus by Theme and Type

	Quantitative	Qualitative	Literature reviews	Think pieces
Contextual factors relevant to rural schools, and how they are perceived	03.02. 03.03. 03.04 05.01. 05.04. 05.12. 07.08.	03.08. 05.07. 06.02. 06.06. 06.10. 06.13. 06.14. 07.07. 09.02.	02.02. 02.05. 03.05. 03.19	02.03. 03.07. 03.14. 04.01. 04.03. 04.05.
Structural factors in rural schools	03.15. 03.16. 04.04. 05.02. 05.05. 05.08. 07.03. 07.09. 08.01. 08.05.	06.01. 06.07. 06.08. 06.11. 07.01. 07.02. 07.04. 10.02. 10.03. 10.04. 11.03.	03.01. 04.09. 05.09.	None.
Place-based education and other suggested reforms	04.08.	07.05. 08.03. 08.04. 10.01. 11.01. 11.02.	02.06. 03.06. 03.09. 03.17. 05.11. 06.15. 08.02.	04.02. 04.10. 05.10. 06.03. 06.04. 06.05. 07.06. 08.06. 11.04
Content and conduct of research	None.	08.07.	03.12. 03.20 04.06. 04.07. 04.11. 05.03. 05.06. 06.09. 08.08.	02.01. 02.04. 03.10. 03.11. 03.13. 03.18. 06.12. 09.01.

Note: (See Appendix D for the citations that coincide with each numerical code.)

One of the most interesting results of showing the intersection of themes and types with coding by year is that one can see not only which types of research were most prominent within each theme, but when.

For instance, in studying contextual and structural factors in rural mathematics, most ACCLAIM research initially used quantitative methods; beginning in 2006, however, qualitative methods received much greater attention. A likely contributor is the evolution of the Research Initiative's own studies; earlier studies cultivated interested partners outside the Center's core, partly in order to build a network of relationships and partly to secure relevant existing work already in progress for publication by the Center. The core members of the ACCLAIM research team needed time to debate relevant issues, conceptualize studies, and then to execute them. Thereafter, qualitative research became arguably more likely thereafter—particularly since qualitative methods predominate in math education research. The character of the rural mission as a cultural engagement (both in itself and in the emerging discussions of the ACCLAIM management team) also indicated the particular suitability of qualitative methods to access rich information about subjects' experiences.

Another, but similar, influence is the fact that ACCLAIM dissertations began to appear only as students completed coursework and qualifying exams and organized studies. Dissertation studies more frequently deployed qualitative than quantitative methods, again probably influenced by scholarly traditions in mathematics education research.

Three other interesting points are evident: First, there are six think pieces focused on contextual factors, but *none* focused on structural factors as defined there; second, ACCLAIM works studied place-based education by *quantitative* means in just one study (Lipka & Adams, 2004); third, there are no quantitative overviews (e.g., meta-analyses) of the conduct and content of research in rural mathematics education, presumably because there is not yet enough material within the field to warrant such a review. To a limited extent, the present work provides such a review[12] (though on arguably less objective terms than is typically the case, considering the within-Center authorship of this monograph). The absence of theorizing related to within-schooling conditions likely stems from ACCLAIM's principal concern with place, a key vector of context for rural studies, and one that the Center's Theoretical Framework (Appendix B) delineates.

Synthesis of Quantitative Research Findings

The ACCLAIM corpus of quantitative studies would be identified as such, we believe, by most observers. It consists of 14 works that used data gathered with questionnaires comprised of varied forms of close-ended items producing dichotomous, categorical, or continuous numerical values, analyzed as such. Some tested hypotheses, and some did not, but all used familiar quantitative methods.

In Table 2 we list the 14 quantitative works, comprised of peer-reviewed articles and dissertations by ACCLAIM students. The description of each work (see reference list for full bibliographic entry) comprehends three qualities: (1) theme, (2) sample, and (3) findings. A brief synopsis of the findings across the studies appears immediately following Table 2.

[12] Though not, of course, a meta-analysis.

Table 2: Fourteen Quantitative Works Produced by ACCLAIM Characterized by Theme, Sample, and Findings

Author and Title	Theme	Sample	Findings
Alfonso, Z., & Long, V. (2005). *Graphing calculators and learning styles in rural and non-rural high schools* (Working Paper No. 24).	Contextual factors on (and in) rural schools, and how they are perceived	75 students from a rural high school, 55 students from a nonrural high school, both in Tennessee. Data was collected during the fall semester 2003.	Between rural and non-rural students, no statistically significant differences were found in personality, preferred learning style, performance in Algebra, writing in class, homework, working in groups, comfort or frequency of graphing calculator use, or overall achievement (p. 26). The article concluded there were no significant differences between rural and nonrural environments (p. 27).
*Bickel, R., Howley, C.W., & Maynard, S. (2003). No Child Left Behind in poor, Appalachian school districts: Confronting contextual factors in the modern world.	Contextual factors on (and in) rural schools, and how they are perceived	331 students from 12 randomly selected elementary schools in 2 poor counties in western West Virginia; data collection began in the fall of 1992 and ended in the spring of 1996, and took place on five occasions: the beginning of kindergarten, the end of kindergarten, the end of first grade, the end of second grade, and the end of third grade.	Higher social class (SES) was correlated with higher math achievement; neighborhood quality exerted an effect on the growth of math achievement independent of social class; math achievement diminishes as the percentage attending private day care increases; students attending rural schools had higher math achievement even when school size, SES composition, neighborhood quality, and daycare composition were taken into account.

*Bickel, R., & Howley, C.W. (2003). *Math achievement and the development of poor, rural areas: Effects of contextual factors intrinsic to the modern world.*	Contextual factors on (and in) rural schools, and how they are perceived	Based on the same sample as the paper above.	"[NCLB] oversimplifies the social context of schooling and underestimates the importance and complexity of contextual factors. It does so by ignoring …the increasing importance of social class background; the need for two breadwinners in most families, requiring heavy reliance on dubious-quality day care; and the weakening of established institutions, including neighborhoods." (p. 338)
*Hopkins, T. (2005). *Gender issues in mathematics education in Tennessee: Does rural school locale matter?* (Doctoral dissertation, University of Tennessee, 2005).	Contextual factors on (and in) rural schools, and how they are perceived	Made use of data from the Tennessee Department of Education's 2003 Report Card, the Tennessee Comprehensive Assessment Program (TCAP), and scores from the ACT Mathematics subtest. Surveys were sent to each high school in Tennessee to study mathematics course enrollment figures.	Rural schools are more effective at teaching students of low SES than urban TN schools; ACT scores were comparable between locales; females do better at math in middle school than males, but worse in high school; and, despite higher enrollment in non-foundational math courses at the beginning of high school, the number of females enrolled in math classes decreases in TN as the math sequence progresses until the percentages of males and females taking calculus are even.

**Perry, C., *Motivation and attitude of preservice elementary teachers toward mathematics: is rural relevant?* (Doctoral dissertation, University of Louisville, 2007).	Contextual factors on (and in) rural schools, and how they are perceived	384 participants from 4 universities- 83 at Eastern Kentucky, 86 at Morehead State, 131 at University of Kentucky, 84 at University of Louisville (p. 107).	Preservice KY elementary teachers had significantly higher mastery and performance-avoidance goals than performance or performance-approach goals, and were less confident in learning math than a sample of female students pursuing a variety of non-education majors; those from Appalachian rural areas were less confident in learning math than the nonrural group; those from rural areas (Appalachian and non-Appalachian) had less confidence in learning math, and were also more likely to view mathematics as a male domain.
*Williams, J. H. (2005, April 23). *Cross-national variations in rural mathematics achievement: A descriptive overview.*	Contextual factors on (and in) rural schools, and how they are perceived	Individual-level data from PISA 2000 (which evaluates achievement among 15-year-olds in 24 participating countries). Sample sizes of 2,000 – 5,000 per nation. Area population size used across nations as proxy for locale (population less than 15,000=rural).	In 14 of 24 countries, mathematics scores in rural areas were significantly lower than those in urban (large) and medium-size communities. Across all countries a marginal rural achievement gap, prevailed but this disappeared in 20 of 24 countries, including the U.S, when SES was controlled. In the U.S., students in urban communities scored the lowest, and scores in rural areas were in the middle of the distribution. The relationship of SES and achievement was strongest in US urban areas, more moderate but significant in rural areas, and weakest in mid-size communities.

**Fugitt, J., *Does the grade level at which algebra I is completed affect future mathematics performance?* (Doctoral dissertation, University of Tennessee, 2008).	Contextual factors on (and in) rural schools, and how they are perceived	449 students at a small liberal arts college in the Midwest, grouped according to the grade level at which they completed Algebra I.	"Early entrants into algebra had higher mathematics achievement as measured by Algebra II grades, mathematics grade point averages, and ACT Mathematics scores." (p. vi) Neither school-district size nor rural locale were associated with differences in the timing of Algebra I completion.
**Gregory, J., *Presentation software and its effects on developmental students' mathematics attitudes*	Contextual factors on (and in) rural schools, and how they are perceived	99 students enrolled in a community college in Eastern Tennessee.	Presentation software (PowerPoint) increased math anxiety among subject rural students, but not among non-rural students; math anxiety was higher among females pre-test and mid-test, but comparable to that of males after the test. Presentation software did not affect the differences in math anxiety that existed between the genders' pre-test or mid-test.
Howley, C. B., Howley, A. A., & Hopkins, T. (2005). *Does place influence mathematics achievement outcomes? An investigation of the standing of Appalachian Ohio school districts* (Working Paper Series 23).	Contextual factors on (and in) rural schools, and how they are perceived	District-level data from the Ohio State Education Agency (SEA) from 2000-2001.	The charge of deficiency is inapt; Appalachian districts are more efficient in the production of mathematics achievement than other districts; the proportion of expenditures devoted to instruction, particularly among lower-spending districts, exerts a positive influence on achievement.

*Howley, C., & Howley, A. (2004, September 24). *School size and the influence of socioeconomic status on student achievement: Confronting the threat of size bias in national data sets.*	Contextual factors on (and in) rural schools, and how they are perceived	Individual-level data from the restricted-use version of the NELS data set. 19,396 eighth-grade students in public schools during 1988. (pp. 12-13)	Of all schools, the 10% that are smallest maximize the achievement of the poorest 25% students; the appropriate size of a school varies by student SES.
*Lee, J. (2003). *Evaluating rural progress in mathematics achievement: Threats to the validity of "Adequate Yearly Progress."*	Contextual factors on (and in) rural schools, and how they are perceived	Eighth-grade mathematics achievement data from national and state assessments in the 1990s.	Rural schools had greater progress than nonrural schools on AYP and NAEP measures; the instability of small sample sizes have not been sufficiently corrected by rolling averages; resulting errors of interpretation leave smaller, particularly rural schools vulnerable to unjust criticism; rural schools "have a better prospect of progress than their nonrural counterparts," but are also unlikely to meet overly optimistic AYP targets. (p. 76)

**Rice, C., *Comparing recent high school graduates placed in developmental and college-level mathematics courses.* (Doctoral dissertation, University of Tennessee, 2007).	Contextual factors on (and in) rural schools, and how they are perceived	2,443 students from two community colleges in East Tennessee	Between rural and non-rural students, no significant differences were found in high school course-taking patterns in math, attitudes and beliefs towards math, or likelihood of placement in developmental math courses upon entering college. Between students placed in developmental and college-level math courses, the former took significantly fewer math courses in high school, were less likely to have gone beyond Algebra II or Geometry in high school, and had lower levels of: confidence and motivation, belief in math's usefulness, and belief in their ability to solve time-consuming problems.
**Jones, S., *The question of learning equity between online and onsite undergraduate mathematics courses in rural Appalachia.* [note: this is a mixed method study; only findings derived from quantitative methods are presented here]	Contextual factors on (and in) rural schools, and how they are perceived	Sample: 24 students in a mathematics course at Glenville State College, Spring 2008 semester	"No significant differences in online and onsite student final grades, in rural online and rural onsite student final grades, or in rural and nonrural student final grades. Equity of learning occurred among the student groups in this study." (from abstract)

Lipka, J., & Adams, B. (2004). *Culturally based math education as a way to improve Alaska Native students' math performance* (Working Paper No. 20).	Contextual factors on (and in) rural schools, and how they are perceived	"One semester's worth of data (258 students in 15 classes). …The study involved one urban school district, Fairbanks, and four rural school districts with approximately a 97% Yup'ik population." (from abstract)	Statistically significant improvements for both the urban and rural experimental groups which received the culturally based math curriculum; the urban group that received this curriculum saw the greatest improvement.

Note. Three quantitative studies from ACCLAIM do not appear in Table 2, as follows: (1) Working Paper 15, which was replaced (in Table 2) by a peer-reviewed version of the same, titled "Math achievement and the development of poor, rural areas: Effects of contextual factors intrinsic to the modern world"; (2) Working Paper 26, which was quantitative, but more an evaluation of a specific teacher-development initiative run by ACCLAIM than a research study; and (3) Working Paper 27, which was quantitative, though not an empirical research study in the sense adopted for this analysis; its quantitative aspect concerned reworking bus routing algorithms to accommodate community preferences.

Brief synopsis of quantitative findings. The findings of the quantitative research conducted by ACCLAIM tend to coincide in (1) falsifying rural deficiency in mathematics outcomes (Alfonso, & Long, 2005; Hopkins, 2005); (2) providing evidence for the effectiveness of math instruction in rural schools (Hopkins, 2005; Lee, 2003); (3) disclosing the damage associated with consolidation, both overall and for math outcomes in specific (Gleason, Belcher, Britt, & Savich, 2008; Howley, Howley, & Hopkins, 2005; Howley & Howley, 2004); and (4) disclosing the advantage of small schools for the math outcomes of impoverished students (Howley, & Howley, 2004). Two studies (5) describe the rural-specific benefits for the mathematics education of impoverished students (Bickel, Howley, & Maynard, 2003; Hopkins, 2005) and (6) suggest that higher percentages of funding devoted to instruction results in achievement gains, particularly in Ohio schools where overall funding is low (Howley, Howley, & Hopkins, 2005, p. 27).

Synthesis of Qualitative Research Findings

ACCLAIM researchers produced nearly 50% more qualitative than quantitative studies. In part because the Center argued that rural context most properly comprehended rural meanings, the qualitative approach could be seen as a preferred, but, hardly an exclusive method for pursuing an approach to such meanings.

These 20 qualitative works (characterized in Table 3) each used some form of interview transcription as their principal data source. As in Table 2, we list in Table 3 the qualitative works according to theme, participants, and findings. A brief synopsis of the findings given for each study appears immediately following Table 3.

Table 3. Twenty Qualitative Empirical Works Produced by ACCLAIM Characterized by Theme, Participants, and Findings

Article name and title	Theme	Participants (i.e., subjects)	Findings
Best, C. (2006). *Community college students' perceptions of their rural high school mathematics experience* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.	Contextual factors of rural schools, and how they are perceived	18 students who recently graduated from rural high schools and taking their first math class in college, interviewed midterm of fall semester 2005. Follow up interviews with 7 of them the following spring. Data also used high school transcripts and the student information system at Pellissippi State Technical Community College.	Students from rural transitional counties do not see rural as a major factor in their education, whereas those from at-risk counties do; the latter are negative about their high school experiences with math, in part because of ineffective explanations of the material and the low expectations of teachers and administrators.
DeYoung, A. J. (2003). *The social construction of rural mathematics: Final report to ACCLAIM.* (Working Paper No. 17). Athens, OH: ACCLAIM Research Initiative.	Contextual factors of rural schools, and how they are perceived	Two rural Kentucky high schools (p. 1); several weeks of data collection (p. 19); ethnographic interviews and field notes (p. 20); interviews of administrative staff (the principal, at least one guidance counselor, and at least one other staff member at both schools) and math teachers (p. 20); 100 in-school hours spent collecting data (p. 21)	School accountability concerns motivated administrative concern about how math was taught. "Some [students] felt that higher level teaching, courses, or both were desirable, but few thought it was the teachers' fault that these levels could not be attained." (pp. 67-68) Both schools put a great deal of effort into "finding, recruiting, or training adequate math teachers." (p. 69). Both schools were "Focused upon changing the image of math from an abstract and distant subject to one useful and immediate for either [a vocational or academic post-secondary] future." (p. 70).

Heaton, R., Smith, W., Kromminga, R., & Hartman, D. (2008). *Understanding the meaning of rural within a middle school mathematics professional development and research project in Nebraska* (Working Paper No. 40). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Contextual factors of rural schools, and how they are perceived	63 rural in-service teachers from the first three cohorts at The Math in the Middle Institute Partnership (M2) at the University of Nebraska-Lincoln (UNL) in summer 2006. 30-60 minute interviews. (abstract)	"Teachers the researchers considered "rural" "did not necessarily refer to themselves that way, and sometimes even teachers from the same town did not agree on whether or not to call themselves rural" (abstract).
Howley, C. B., Howley, A. E., Howley, C. W., & Howley, M. D. (2006). *Saving the children of the poor in rural schools* (Working Paper No. 28). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Contextual factors of rural schools, and how they are perceived	24 interviews at each of "six rural schools serving low-income students… honored by the SDE for… high achievement in mathematics during (2003-04 school year). [They] included one 9-12 high school, two 7-12 high schools, one 5-8 middle school, one K-8 elementary school, and one K-4 elementary school" (p. 6).	"Three distinct approaches to engaging the poor. The major tendency is "saving the poor," a benign middle-class attempt to support impoverished families and intending to help children from such families enter the local middle class. Four of the six schools embrace this approach. The other two schools were different. In one, the poor were repudiated and even demonized. In the other, the poor were not even identified as a group; instead, interviewees described all residents as "common people," and the school exhibited a strong community purpose and a strong concern for the common good" (abstract).

Lucas, D. (2005). *A rural community's perceptions of the importance of math and math education in Appalachia* (Monograph No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Contextual factors of rural schools, and how they are perceived	"650 surveys and conducted nearly 250 interviews with informants in three age groups (youth, adults, seniors)" conducted in "the community of Padua (a pseudonym), in a state in the Appalachian south" (from abstract).	"Informants were found to value mathematics principally for its utility, to esteem good mathematics teaching and good mathematics teachers, and few blamed any failure to understand mathematics on teachers. Many, however, appeared to believe that some mathematics teachers could be more sympathetic in their instructional role. …Possibly because of the prevailing utilitarian outlook, many informants saw little use in the community or region for higher forms of math should the current economic decline persist in the region" (from abstract).
Lucas, D., & Fugitt, J. (2009). The perceptions of math and math education in *Midville*, Illinois. *The Rural Educator, 31*(1), 38-54.	Contextual factors of rural schools, and how they are perceived	"A community that will be referred to as Midville, located in the state of Illinois… over one hundred miles from the nearest metro complex. The study was conducted in May of 2006" (from abstract). Study uses the method of folknography.	"Many adults see schools as failing to offer effective math education… emphasis on technology, instead of mental computational skills, makes for weaker curriculum and instruction…. Math students wish for more positive, pleasant, kind instruction …respondents seek math instruction that challenges, inspires, and motivates the youth. …they believe that quality schools offer a rigorous and comprehensive math education." (from summary of results)

Sloan, M. H. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors* (Working Paper No. 35). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Contextual factors of rural schools, and how they are perceived	Focused on Mayfair County School, a charter school with 275 pre-K through 12th grade students in rural Georgia	"The mathematics faculty… set out to improve not only the educational opportunities of the students but also their awareness of the "outside world," and… the social skills necessary to succeed there" (p. 57). "The Charter Assurances specified that both academic and vocational tracks would be offered. [However,] the mathematics program was evolving into a single college track… There seems to be a serious breakdown in communication and/or understanding of the school's policy, if one exists, about curricular matters, at least in the area of mathematics" (p. 63).
Anderson, R. (2006). *Factors contributing to rural high school students' participation in advanced mathematics courses* (Working Paper No. 34). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Structural factors exerting influence within rural schools	Research conducted over three months at a small rural high school in the Pacific Northwest (p. 2). Interviews with 14 of the sixteen students enrolled in Pre-calculus, 1 of the four students enrolled in calculus (p. 4). "After the survey was administered, nine of the students were selected for individual, semi-structured interviews" (p. 4). Data collected using ethnographic techniques, including observations and interviews (p. 3).	"Rural high schools may have an advantage over their non-rural counterparts when it comes to making changes to the mathematics curriculum that would encourage all students to study mathematics each of the four years of high school" (p. 38). Three reasons: 1) There is generally less bureaucracy to navigate in making curriculum changes in rural schools. 2) Students in rural schools may have the same math teacher for more than one year; as a result, the teacher will not need to spend time getting to know them, and may have more time to spend on time-consuming reform efforts and community projects (p. 39). 3) Rural schools generally have fewer electives to choose from, so "If mathematics teachers design a relevant and engaging mathematics curriculum students may be more apt to make that choice whether or not they intend to go to college" (p. 39).

Boyd, B. (2007). *Effects of state tests in Ohio on assessment practices in mathematics education* (Unpublished doctoral dissertation). University of Louisville, Kentucky.	Structural factors exerting influence within rural schools	9 eighth-grade mathematics teachers and their classes; data collected for 2003-04 and 2005-06, the school years before & after implementation of the eighth-grade Ohio Achievement Test (OAT) in mathematics. Data included classroom tests, interviews with teachers about their assessment practices, and classroom assessment data.	Presence of a state test led to an increase in class test items of material below the eighth grade level, but did not increase or decrease the already low conceptual difficulty of class tests
Howley, A., Larson, W., Adrianaivo, S., Rhodes, M., & Howley, M. (2007, May 17). Standards-based reform of mathematics education in rural high schools. *Journal of Research in Rural Education, 22*(2). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/22-2.pdf	Structural factors exerting influence within rural schools	Twenty principals from three rural regions of Ohio, semi-structured interviews.	"The reforms adopted at their schools neither fully embraced the reform agenda nor completely ignored it. Instead, the reforms tended to entail incremental changes involving curriculum alignment, minor modifications of curriculum content, and provision of individualized instruction." (abstract)

Howley, A., Pendarvis, E., & Gholson, M. (2006). How talented rural students experience mathematics. *Journal for the Education of the Gifted, 29*(2), 123-160.	Structural factors exerting influence within rural schools	Interviews with 16 gifted children from a rural Appalachian school district (p. 132)	"The children's experience was constrained by the presentation of mathematics as a discipline focused on calculation and bound by rules. Students' view of mathematics was further limited by a narrow conception of its usefulness. …Notably, instruction provided in the gifted program was reported as being more advanced, more challenging, and more engaging than what was offered in regular classrooms." (abstract)
Nichols, S. (2010). *Perceptions and implementation of the Ohio Academic Content Standards for Mathematics among middle school teachers* (Unpublished doctoral dissertation). Ohio University, Athens.	Structural factors exerting influence within rural schools	12 inservice teachers. Data included interviews, observations, and surveys of lesson plans and assessments	Traditional methods are more common than standards-based instruction, even when teachers believe they are engaging in the latter; standards-based instruction itself is often not well understood even by teachers who have undergone professional development in regard to it. Instruction held to a standard is often conflated with teaching the Standards themselves.
Owens, S.K. (2010). *Professional development: a case study of Mrs. G* (Unpublished doctoral dissertation). University of Louisville, Kentucky.	Structural factors exerting influence within rural schools	1 inservice teacher. Data included transcripts from professional development sessions, teacher's reflections, and classroom observations.	Professional development is more likely to succeed when the teacher is allowed autonomy and choice in selecting professional development opportunities.

Ratliff, M. (2011). *Preservice secondary school mathematics teachers' current notions of proof in Euclidean geometry* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.	Structural factors exerting influence within rural schools	4 preservice teachers. Data included interviews, and discussion of justifications for proof in Euclidean geometry.	In teaching and learning about proofs in Euclidean geometry, empirical and deductive evidence should be used.
Smith, R. (2010). *The impact of secondary mathematics methods courses on preservice secondary teachers' beliefs about the learning and teaching of mathematics* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.	Structural factors exerting influence within rural schools	16 secondary mathematics methods courses at 16 different universities [class sizes ranged from 3 to 27 (p.64)]; data collected before and after the course. Data used included the Mathematics Belief Instrument (MBI), syllabi, interviews with instructors, and examination of course textbooks.	A significant positive relationship was found between the number of methods used in the course and improvement in MBI scores.

Howley, A., Howley, C., Burgess, L, & Pusateri, D. (2008). Social class, Amish culture, and an egalitarian ethos: Case study from a rural school serving Amish children. *Journal of Research in Rural Education*, *23*(3). Retrieved from http://jrre.psu.edu/articles/23-3.pdf	Place-based education, and other suggested reforms	"25 interviews lasting from 30–90 minutes and observed in five classrooms once (and sometimes twice) for periods of time lasting from one to two hours" (p. 5) Willemsburg Elementary School, K-8, about 200 students, one of four elementary schools in a rural district. No formal sample size- students, parents, teachers, administrators, and non-parent members of the community participated in interviews and five classrooms were observed.	"Almost no evidence of negative views about the poor or even of much awareness of social class… a pervasive egalitarianism… a collectivist and communitarian ethos." (p. 7) "Four themes emerged from the analysis of transcripts: (1) "in league with parents," (2) "teaching agrarian values," (3) "educating for community participation," and (4) "embracing all children."" (from abstract)
Howley, A., Howley, C. B., & Helm, V. (2007). *Reform of secondary mathematics education in high-performing rural schools* (Working Paper No. 36). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Place-based education, and other suggested reforms	"…four case studies of mathematics education in rural secondary schools" (from abstract)	"Two emergent themes: (1) math teachers address calls for improvement by building on traditional practices and (2) math teachers meld traditional and reform practices" (from abstract).

Howley, A., Howley, C., Klein, R., Belcher, J., Howley, M., Tusay, M., Clonch, S. Perko, H., Foley, G., Pendarvis, E., Miyafusa, S., & Jimerson, L. (2010). *Community and place in mathematics instruction in selected rural schools* [ACCLAIM Monograph No. 4]. Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	Place-based education, and other suggested reforms	Case studies at 7 rural schools (in OH, AL, KY, NE, VT, ME, WA), with research conducted during the 2007-2008 school year. A total of 85 interviews and 27 classroom observations (p. 7).	"We would cite all these cases as successes—the activities and engagement described were at least ongoing, and most were *clearly* thriving" (p. 59). "…the educators we studied, and the sites we visited were unusual, though not always aware of either their rarity… maybe they would not be happy with the mantle "contrarian." Maybe they embraced the State's "standards," interpreting them according to purposes not exactly entertained by the accountants and enforcers of standards" (pp. 60-61).

Howley, A., Howley, M., Camper, C., & Perko, H. (2011). Place-based education at Island Community School. *The Journal of Environmental Education, 42*(2), 216-236.	Place-based education, and other suggested reforms	Island Community School has 71 students, P-12. Interviews with 2 student focus groups of 5 students each, 8 teachers, 1 place-based educator hired by a local nonprofit, 1 school board member, 1 parent actively engaged with the school, and 2 community members who engage in fund-raising and foundation management for the school. (pp. 13-14) Data also from participant observation, and artifacts such as newspapers, school plans, and community documents, were also gathered (p. 14)	"Illustrates the overlap between place-based and environmental education" (p. 3) "Place-based efforts at Island are inextricably tied to the community… [and] ecological dimensions of place… As a result of these two major foci, students come to understand that they have a direct personal stake in promoting the survival of both their rural community and the ecosystem from which their community draws sustenance." (p. 38)

Howley, A., Showalter, D., Howley, M., Howley, C., Klein, R., & Johnson, J. (2011). Challenges for place-based mathematics pedagogy in rural schools and communities in the United States. *Children, Youth, and Environment*, *21*(1), 101-127. Retrieved from http://www.colorado.edu/journals/cye/21_1/21_1_05_MathematicsPedagogy.pdf	Place-based education, and other suggested reforms	Case studies at 7 sites nominated by national experts; subjects included educators, parents, non-parent community members, and students. Interviews were the primary data source of data, supplemented by field notes and relevant documents from each site.	"The higher the level of the math taught, the less frequently used were place-based methods… the typical use of these methods was with less capable math students, often in "vocational" or "general" rather than "college-prep" curriculum tracks." The schools did not effectively embrace the egalitarian or communitarian spirit of place-based education, or sufficiently integrate mathematics into this approach.

Note. Smith (2010) is actually a multi-method study, and the principal findings strike us as proceeding from the study's quantitative analysis; however, his theme accords better with those undertaken by the strictly qualitative studies

Brief synopsis of qualitative findings. By its nature, qualitative research produces findings that are more idiopathic than quantitative research—more germane to the specifics of the subjects as purposively involved in the research project. For this reason, the synopsis here proceeds according to theme, which does serve as a sort of generalization about the findings. The synopsis, then, attempts to extract a more particularized finding relevant to the theme. The extraction is a necessarily high-inference one; the following three paragraphs, in order, treat the three themes listed in Table 3: (1) contextual factors, (2) structural factors, and (3) place-based education and other reforms.

(*Contextual factors relevant to rural schools*) In sharp contrast to professional expectation, rural communities continue to invest their schools with *local* practical, social, and cultural significance, and this rural difference continues to constitute part of the struggle *within* rural schooling (Anderson, 2006; DeYoung, 2003; Lucas, 2005). Indeed, according to Heaton and colleagues (2008), rural identification itself is sometimes problematic for rural math teachers. The salience of rural context to schooling in mathematics depends partly on the nature of that context; economic impoverishment, for instance, is weakly associated in some accounts, with (literally) impoverished forms of schooling in mathematics (Best, 2006; Lucas & Fugitt, 2009). Engagement with impoverished *students*, then, would comprise a significant phase in the struggle to sustain rural community and provision it with decent mathematical educational experience. Finally, although sharp class divisions work systematically to subvert this intention, most especially in rural communities riven by class divisions, a more egalitarian class structure

would perhaps tend to make the intention itself unnecessary (Howley and colleagues, 2006).

(*Structural factors within rural schools*) Based on interviews and observations in an Oregon school, structures associated with rural schools (e.g., small size, possibility of focused curriculum, less bureaucracy) may facilitate math education reform (Anderson, 2006). Math reform efforts in rural and other locales in Ohio, however, led to modest incremental changes, but, according to self-reported practice as disclosed in teacher and principal interviews, did not entail a shift to instruction that focused more vigorously on concepts (Boyd, 2007; Howley, Larson, Adrianaivo, Rhodes, & Howely, 2007). Part of the structural difficulty (i.e., in the limited sense of "structure" used in this monograph) within some or many rural schools may entail a lack of capacity to imagine mathematics as more than a set of useful rules and definitions (Boyd, 2007; Howley, Pendarvis, & Gholson, 2006; see also Stigler & Hiebert, 1999, for the generality across American schools). Indeed, many teachers appear not to improve their mathematics instruction because of a narrow understanding of standards, a narrowness not overcome by professional development; indeed, some teachers conflate teaching according to standards with teaching *the standards themselves* to students (Nichols, 2010). Perhaps professional development is too rigid in general (Owens, 2010) or insufficiently concerned with conceptual understanding, as illustrated by one study about teachers' engagement with proof (Ratliff, 2011). Smith (2010) demonstrated the relationship between capacity and professional development in his study of mathematics pre-service education: math education students' preconceptions are perhaps too seldom and too weakly challenged as they prepare to assume responsibility for their own classrooms.

(*Place-based education and other reforms*) Teachers in mathematically high-performing rural schools blend traditional and reform practices (Howley, Howley, & Helm, 2007). Although place-based mathematics is quite rare, multiple "existence proofs" suggest that it can thrive given a champion; other auspicious circumstances also help (Howley, Howley, Klein, Belcher, Howley, Tusay, et al., 2010). In place-based math education *community focus* seems important, as may be ongoing dialogue about practice and perhaps also tolerance of diverse professional outlooks (Howley, Howley, Camper, & Perko, 2011). In a case study, one school serving a 40% Amish enrollment appeared to center some of its instruction on place as a result of the Amish participation, but also seemed remarkably egalitarian in comparison with cases of other rural schools in the same study (Howley, Howley, Burgess, & Pusateri, 2008).

Synthesis of Theoretical Work

A great deal of overlap characterizes ACCLAIM's "theoretical" works (literature reviews and essays) and the empirical works (characterized above). The overlap is conceptual: the topics they contend with, the background of research and ideas they draw upon, and the arguments they develop. The primary entitlement of theoretical work, of course, is a comparatively much wider freedom to pursue and develop ideas. This entitlement represents an opportunity to pursue critique to an extent sadly uncommon in much empirical work, with its focus on very particular questions with data imported more or less directly from evident reality.

In sum, theoretical work in the social sciences hardly brushes aside the value of data, but rather contends explicitly with ideas that inform research work in the field in ways that are often more implicit in empirical efforts. Therein lies its arguable value.[13]

Many of the commonalities among ACCLAIM's theoretical works are reflective of common themes and issues discussed across the entire output, and in the present summative work. Some of these theoretical works, however, have features of intellectual foundation-building that seem comparatively rare in funded social science research. This feature of the opus perhaps proceeds from the imperative to invent a new field of inquiry (i.e., the decision to pursue "rural math education" rather than "math education in rural schools").[14]

Of course, all the theoretical works (and also the ACCLAIM research symposia) explicitly expanded the overlap of mathematics education with rural education, with some works created by interdisciplinary teams of authors (Long, Bush, & Theobald, 2003; Lucas & Fugitt, 2009; Huber, Howley, & Howley, 2004; Waters, Howely, & Schultz, 2008; Howley, Showalter, Howley, Howley, Klein, & Johnson, 2011). In the end, however, more common than interdisciplinary authorship was the attempt by authors from one or the other discipline to contextualize the issues of the other field to their own

[13] Qualitative empirical work nearly always deploys broader questions than quantitative work, and often (not always) exhibits a fuller engagement with critique since its "data" typically consist of debatable and interpretable *meaning* as the freight of language. The language of informants signifies ideas whose limits must be engaged by an analyst if "themes" are to "emerge" from such "data." Perhaps this inherent quality of critique already resident in language explains, in part, why quantitative researchers so often actively seem to avoid critique and even extended interpretation (see Howley, 2009, for further discussion). Perhaps, also, such engagements are simply outside the positivist and post-positivist traditions of quantitative empiricism.

[14] The decision of this apparently simple issue seems, in retrospect, remarkably important. In recent years (over the same time-span as the major work of the Center), debate in rural education has been caught up in the press of the Institute of Education Sciences for randomized controlled trials, which test, for the most part, the efficacy of commercial educational products. The upshot has been studies that give short shrift to rural purposes and meanings, but instead treat rural as a setting largely devoid of meaningfulness in its own right—just the opposite of the construction inherent in "rural math education."

disciplinary context. Such efforts were perhaps more common because of the difficulty of implementing a fully interdisciplinary effort, a difficulty clearly anticipated by one early theoretical piece (Harmon, 2003). Evidently, research-related events sponsored by ACCLAIM (e.g., the seven Research Symposia 2002-2011) were planned by the multi-disciplinary management team and brought together scholars from both fields, but as the lists of works demonstrate, actual joint production of published scholarship was perhaps less common that had been initially hoped and aimed for.[15]

But what are the key substantive overlaps in the theoretical works?

Commonalities include the overlapping topics of mathematics and resistance. The topic of mathematics encompasses concern for what constitutes mathematics (Howley, 2003a); how mathematics is seen and discussed (Bush, 2005); the curriculum and practices used to teach mathematics, and the importance of making both relevant to locality (Long, Bush, & Theobald, 2003); the potential benefits of adapting ethnomathematic methods to studying how math is taught in rural areas and mention of

[15] Initial discussion had imagined teams of researchers from both fields as a condition of support, but in practice the Research Initiative solicited proposals from any colleague who could subscribe to the principals of the Framework document and who presented a proposal or description of in-progress work that bore clear linkages to the Framework. In general, the solicitation (accepted proposals specified an honorarium of $3,000 for an original empirical research report acceptable to the Research Initiative) appealed more to rural education researchers with an interest in math education than to math education researchers with an interest in rural education. Indeed, the *only* two math education applicants for such support came from doctoral students, one at the University of Georgia (Sloan, 2006) and one from the Portland State University (Anderson, 2006). The Research Initiative did decline to fund one proposal that comprised a multi-disciplinary team because the research leadership concluded, with the endorsement of the Management Team, that the amount of funding sought ($40,000) was not supportable. Works generated from the Research Symposia, however, better represented both fields because participation (a) included presenters from both fields by design and (b) the terms of participation included authorship of a paper (not typically an empirical study, however). Thus, the Research Symposia evoked many of the theoretical works in the ACCLAIM opus. Planning for the second round of CLT funding, however, included four carefully designed studies that would, in the event of funding, have become ACCLAIM's empirical focus for a second five-year term. The cancellation of that competition removed that possibility, but the Center continued its funded existence on no-cost extensions from 2006-2011, and did , in fact, conduct one long-term multidisciplinary empirical study that is still producing publications at this writing (e.g.., Howley et al., 2011). At this writing date (February 2012), an additional manuscript has been submitted for journal submission.

how ethnomathematics has neglected locality as a relevant area of study (Bush, 2005; Eglash, 2004). The topic of resistance encompasses the contested nature of what constitutes reform, and for whose purposes (Civil, 2006); resistance to practices and aims that are dominant in public education, particularly those indifferent to locale (Klein, 2008); resistance to common views of rural areas and rural people; and resistance to notions that there is 'one best system,' or set of practices, in testing, curriculum, pedagogy, or education research (Gruenewald, 2006).

Such skepticism, of course, has implications for programs of study in all fields of education, and specifically for the contextualized approach to both theory and practice that can be promoted there (Theobald, 2005). A rurally contextualized approach, of course, is extremely rare (Ayalon, 2003), despite the large proportion of student population living in rural places in the US (i.e., at least 20% of students, and nearly 30% if one includes rural towns and not simply "open countryside").

Unique to the category of theoretical works are introductions to foundational constructs and perspectives for a broader course of study (Howley, 2002); statements of commitments for the work (Appalachian Collaborative Center, 2002); and identifying key questions to investigate (Waters, Howley, and Schultz, 2008). The earliest contributions reveal substantial concern for the shape the ACCLAIM opus might take. Above all, in retrospect, four qualities stand out as essential, both to how ACCLAIM was articulated from the beginning, and to how its theoretical work might be characterized.

These qualities are:

1. Commitment to rural places and communities;
2. Resistance (Gruenewald, 2006) to the forces, actions, ideologies, and institutions, in government, culture, and economics[16], that have undermined rural places, particularly in and through formal education (Bush, 2002);
3. Cultivation of understanding among rural people sufficient to help them sustain their communities and schools via rural mathematics education; and
4. Critique to improve research in rural math education, including its motives, methods, results, and applications.

Some of the works in this category that did not explicitly, or formally, engage the ideas just described nonetheless contributed something special to the body of this work (e.g., Lubienski, 2006; Schmidt, 2004). Lubienski's and Schmidt's contributions might be characterized as "confessions," a genre with a distinguished literary history. Indeed, sometimes, works of personal sensitivity, introspection, and insight can provoke more reflection and thought than a paradigmatic work (cf. Bruner, 1996, on "paradigmatic" versus "narrative" accounts). They can also remind us of the human side – and the human stakes – behind every data point (Schmidt, 2004). The observations embedded in a confessional narrative, and causal relationships suggested between events, are not easily dismissed out of hand precisely because of the widely recognized authority inherent in

[16] Key economic ideologies and phenomena that undermine rural places include (these are not mutually exclusive): neoliberal economics, globalization (an economic phenomena that goes hand-in-hand with globalism and cosmopolitanism, both of which de-emphasize national borders and favor 'world cities' – a term used by Jane Jacobs), an economic view of human nature (which neatly renders human beings into 'human resources' and 'consumers'), standardization, *laissez faire* capitalism, deregulation, a 'race to the bottom' justified by the notion of comparative advantage, and – most viciously – the use of 'impersonal' market forces as a justification for evacuating social contracts and social obligations between economic institutions, their employees, and the places and people where the operations of an economic institution exist.

the action of *witnessing* (Derrida, 1980). When this witnessing is rooted in the rural lifeworld, it offers something important: It provides a sense of the whole of a place, a people, a way of life, quite useful as a companion in our work to understand data (Howley, 2009) but also meaningful in itself. As Jerome Bruner (1996) observes: research is itself inherently a narrative (even with its justifiable paradigmatic pretensions). Rather than considering stories and research as mutually exclusive, then, we should acknowledge not only their similarity but their convergence in the description of reality, and in the possibilities for wise counsel that each, in the best circumstances, harbors. This outlook can also remind us that, just as not every person sees a story as inherent in their personal circumstances, not everyone sees truth in their data.

Similarly, whereas every circumstance has a story, waiting to be seen, actual data does not always harbor truth (e.g., "garbage in, garbage out"). Further, what counts as *data* can be, and perhaps always is, a political matter (see Gruenewald, 2006). Alas, empirical studies may sometimes harbor more in the way of data than of story, and perhaps as a result of this lack, may too often harbor a truth so limited it exhibits little meaning and presents little opportunity for application; with much research set in rural places, this observation is all too apt (Coladarci, 2007). It seems that in rural mathematics education research, moreover, the challenges are especially sharp (Coladarci, 2004). The motives, the questions, the methods, the findings, and the suggested applications or recommendations need, in the first place, to comprehend and honor a rural story.[17]

[17] This omission is, for example, the failing of many randomized controlled trials merely "set" in rural places, at least in so far as their purpose has nothing to do with rural experience per se.

Stories remind us that we are subjective, even when we would like to think ourselves otherwise. And research reminds us that truth often eludes subjectivity, however broad our experience and careful our reason, though truth eludes data just as well, and especially in the present domain in the absence of a rural story.

This conclusion is not mere abstraction; it is an affirmation that lifeworlds are elusive and that good and appropriate research into them is difficult. The hubris of knowing what is "best" within a lifeworld is based on an even greater hubris: believing that social and personal *reality* is not, in the end a lifeworld that is intrinsically elusive as such. But elusive is precisely what reality (particularly human reality – human life, human social structures, and human subjectivity) is, whether we attempt to apprehend it directly by senses, by data, by algorithms, by reason, or even by intuition.

A Tentative Evaluation of the ACCLAIM Opus

We want to assess the worth of the ACCLAIM opus, but we fully recognize that a third-party effort would strike everyone as preferable. This evaluation is not a substitute, but it is something else. It is an account from insiders, and though conducted with a view to objectivity, its merits in this respect are, *prima facie*, untrustworthy. We acknowledge that fact.

It seems to us however, that an insider evaluation should be part of a roadmap to the ACCLAIM opus. In one Occasional Paper (St. John et al., 2008) we do have a third-party evaluation of the overall effort of the Center; but that study does not detail the *content* of the research production. This discussion, then, is the only attempt of the Center to render such an account. Readers ought to receive it, we advise, with this understanding and not some other. It has a formative purpose for others who might seek

to understand or to use the opus on their own terms, a usage the Center and its colleagues decidedly invite. We are not trying to interpret the work, but simply to represent the whole as best we can in view of our own limitations.

Key commitments inferred from the works. Any body of work will disclose commitments of various sorts. Even work that pretends to the status of science (e.g., social science) necessarily exhibits a standpoint (Guba & Lincoln, 1994). ACCLAIM in fact issued its Theoretical Framework (Appendix B) in order to make its commitments explicit. It sought collaborators on that basis, and one may therefore expect a concurrence of commitments between the framework and the works thus encouraged and eventually published, for such was the obvious intention. At the same time, one would expect differences, nuances, and variations in the works since the Center specifically valued a pluralist approach to research (as evidenced in the variety of qualitative, quantitative, and theoretical works produced). In addition, open invitations to new collaborators and partners were a part of each issue of the Center's online magazine and featured on the homepage of the Center's website.

To begin our evaluation of the ACCLAIM opus, we ask about the conceptual engagements of the works themselves. Our identification is impressionistic (see the list that follows, plus the associated glossary given in Appendix F), again based on familiarity and not on a systematic analysis of the discourse used in these works. Again, we think this approach is sufficient for a "roadmap" of the ACCLAIM opus. We invite readers to choose particular locales for a longer visit and further exploration:

1. Best practice;
2. Deficiency models of rural life and education, including attributions of "Appalachian otherness";
3. Instrumental aims of schooling advertised as self-evidently best;
4. Cosmopolitanism (or the cultural domination of the World-Class city, if you prefer) as the ideology appropriate to global competitiveness;
5. The Platonic view of mathematics conceived as self-evidently best;
6. Education reform;
7. Constructivist learning theory;
8. Ethnomathematics;
9. Progressive education;
10. Perspectives on social class;
11. Middle-class theory;
12. Schooling as a cultural and value-embedded enterprise;
13. Schooling and education;
14. Place-based education;
15. Critical pedagogy;
16. Rural variability;
17. Agrarianism; and
18. Communitarianism

The underlying vector, perhaps, is concern over continuing prescriptions of "the best": the best way to school, the best way to live, the best way to accomplish a task; the best cultural artifacts.

The response in the ACCLAIM opus is by no means an assertion of cultural relativism. Not only national cultures generally, but the scholarly disciplines themselves, exhibit a long history of judging rural life and education as poor by comparison to metropolitan, national, or international valorizations of "the best" (Herzog & Pitman, 1995; Williams, 1989; Weber, 1976). Logically, then, a program that positioned its theoretical framework to *value* rural outlooks would elicit a systematic skepticism of such conceptions of rural existence and purpose. The list, however, again suggests that the Center's explicit commitments (per the Framework) succeeded in securing a pluralist contribution from willing colleagues and partners.

Rubric for evaluating the papers, and the results of its application. Upon recognizing the need for a systematic evaluation of the papers, the authors decided upon a rubric. Our rubric identifies papers that engage the topics ACCLAIM is intentionally devoted to studying, and also provides a concern with some of the technical qualities of the works. Our evaluation is, admittedly, subjective, and therefore constrained and directed by our interpretations, which do not necessarily represent the particular views or divergent commitments of our colleagues in this work. While we stand by the need to provide some sort of selection of representative works, we have not sought to identify papers that provide a single perspective of the challenges faced in rural schools and communities, or that are uniform in quality. We believe that the works to which we will draw attention, on the basis of our rubric and evaluation, are representative of the breadth of concerns, ideas, and approaches which our collaborating authors have brought to this project.

The commitments of study, as identified in the rubric, are topics and realities relevant to mathematics education in rural areas. Works that engage with more of these commitments receive higher scores not *necessarily* to indicate that breadth of engagement is synonymous with quality (goodness, here, rather than character) as works of writing or research, but to indicate the level of their relevance to the research interests of ACCLAIM.

a.1. Engagement with place-based education

a.2. Engagement with rural issues

a.3. Engagement with mathematics teaching and learning

a.4. Engagement with assets or affordances of place, community, family

The works were then evaluated on the basis of two additional criteria:

b.1. Empirically or theoretically substantive and

b.2. Conceptually nuanced or elaborate.

Scoring was dichotomous: 1 for "arguably more evident" and 0 for "arguably less evident." The comparatives acknowledge the normative nature of our judgments.

Table 4. Evaluation of unduplicated academic ACCLAIM publications

	a.1.	a.2.	a.3.	a.4.	b.1	b.2.	Score
02.01.	1	1	1	1		1	5/6
02.02.			1	1	1	1	4/6
02.03.	1	1		1	1	1	5/6
02.04.	1	1	1	1	1	1	6/6
02.06.		1	1	1		1	4/6
03.01.		1	1			1	3/6
03.03.		1	1	1	1	1	5/6
03.04.		1		1	1	1	4/6
03.05.	1	1	1	1		1	5/6
03.06.	1	1	1	1	1	1	6/6
03.08.		1	1	1	1	1	5/6
03.09.		1	1	1	1	1	5/6
03.10.		1	1		1		3/6

03.11.		1	1	1			3/6
03.12.	1	1	1	1	1	1	6/6
03.13.	1	1		1	1	1	5/6
03.14.	1	1	1	1	1	1	6/6
03.16.		1	1		1	1	4/6
03.17.	1	1	1	1	1	1	6/6
03.18.	1	1	1				3/6
03.19.			1	1		1	3/6
03.20.		1	1		1	1	4/6
04.01.	1	1	1	1			4/6
04.02.			1	1		1	3/6
04.03.	1	1	1	1	1	1	6/6
04.04.		1	1		1	1	4/6
04.05.	1	1		1		1	4/6
04.06.	1	1		1	1	1	5/6
04.08.			1	1		1	3/6
04.09.		1	1		1	1	4/6
04.10.	1	1	1	1			4/6
04.12	1	1	1	1	1	1	6/6
05.01.		1	1		1	1	4/6
05.02.		1	1	1		1	4/6
05.03.	1	1	1	1	1	1	6/6
05.04.		1	1	1	1	1	5/6
05.05.		1	1	1	1	1	5/6
05.06.	1	1	1	1	1	1	6/6
05.07.		1	1	1			3/6
05.08.			1			1	2/6
05.09.		1	1	1	1	1	5/6
05.10.	1	1	1	1		1	5/6
05.11.	1	1	1	1	1	1	6/6
05.12.		1	1		1	1	4/6
06.01.		1	1	1		1	4/6
06.02.		1	1	1		1	4/6
06.03.			1	1			2/6
06.05.	1				1	1	3/6
06.06.		1	1	1			3/6
06.08.	1	1	1	1	1	1	6/6
06.09.	1	1	1	1			4/6
06.10.	1	1	1	1	1	1	6/6
06.12.		1	1	1	1	1	5/6
06.14.		1	1	1	1		4/6
06.15.	1	1	1	1	1	1	6/6
07.01.		1	1	1	1	1	5/6
07.02.			1		1	1	3/6
07.03.		1	1			1	3/6

07.04.	1	1	1	1	1	1	6/6
07.05.		1	1	1	1	1	5/6
07.08.		1	1		1	1	4/6
07.09.			1	1	1	1	4/6
08.01.			1		1	1	3/6
08.02.	1	1	1	1		1	5/6
08.03.	1	1	1	1			4/6
08.04.	1	1	1	1	1	1	6/6
08.05.		1	1		1	1	4/6
08.06.	1		1		1		3/6
08.08.	1	1	1	1	1	1	6/6
09.01.		1		1	1	1	4/6
09.02.		1	1	1		1	4/6
10.01.	1	1	1	1	1	1	6/6
10.02.		1	1		1	1	4/6
10.03.			1				1/6
10.04.			1			1	2/6
11.01.	1	1	1	1		1	5/6
11.02.	1	1	1	1	1	1	6/6
11.03.			1			1	2/6
11.04.	1	1	1	1	1	1	6/6

Rubric

Commitments of study	*Qualities of the works*
a.1. Engagement with place-based education	b.1. Empirically or theoretically substantive
a.2. Engagement with rural issues	b.2. Conceptual nuance or elaboration
a.3. Engagement with mathematics teaching and learning	
a.4. Engagement with assets or affordances of place, community, family	

Caveats

This evaluation is a rough guide to representative papers rather than a claim of which ACCLAIM works are "best," and its judgments are tentative and even dubious (considering the internal source). It is not, in short, a summative judgment, but it may be a potentially useful tool as part of the intended "roadmap." The rubric fails to identify some works not because they are inadequate, but because empirical and theoretical works

set their own delimitations: the Research Initiative had no requirement, for instance, that works address place-based education, nor was it appropriate that all works would advance empirical or theoretical substance (some Occasional Papers were intentionally light or informal, whereas others are remarkably substantive). The following list, then, more closely resembles a roster of possible "poster children" for the Center's research effort. Other equally, or perhaps more, defensible rubrics would identify different works. Papers that received scores of 6/6, on the basis of our relevance-weighted rubric, are as follows:

Table 5. Papers with Maximum Rating

	a.1.	a.2.	a.3.	a.4.	b.1	b.2.	Score
02.04.	1	1	1	1	1	1	6/6
03.06.	1	1	1	1	1	1	6/6
03.12.	1	1	1	1	1	1	6/6
03.14.	1	1	1	1	1	1	6/6
03.17.	1	1	1	1	1	1	6/6
04.03.	1	1	1	1	1	1	6/6
05.03.	1	1	1	1	1	1	6/6
05.06.	1	1	1	1	1	1	6/6
05.11.	1	1	1	1	1	1	6/6
06.08.	1	1	1	1	1	1	6/6
06.10.	1	1	1	1	1	1	6/6
06.15.	1	1	1	1	1	1	6/6
07.04.	1	1	1	1	1	1	6/6
08.04.	1	1	1	1	1	1	6/6
08.08.	1	1	1	1	1	1	6/6
10.01.	1	1	1	1	1	1	6/6
11.02.	1	1	1	1	1	1	6/6

-02.04. Howley, C. B. (2002). *What is our work? Planning a future understanding of mathematics education in rural context--a prolegomenon.* (Occasional Paper No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.06. Cooney, T. J. (2003). *Mathematics teacher education in rural communities: Developing a foundation for action* (Working Paper No. 6). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

-03.12. Howley, C., & Gunn, E. (2003). Mathematics achievement in the rural circumstance. *Journal of Research in Rural Education, 18*(2), 86-95.
-03.14. Howley, C. (2003). Understanding mathematics education in rural context. *Educational Forum, 67*(3), 215-224.
-03.17. Long, V., Bush, W. S., & Theobald, P. (2003). *Place value: The rural perspective* (Occasional Paper No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.03. Hackenberg, A. J., & Mewborn, D. S. (2004). *Questioning assumptions: A critical pedagogical perspective on mathematics teaching and learning in rural places.* (Working Paper No. 18). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.12 Coladarci, T. (2004). Reflections at 35,000 feet: An open letter to the ACCLAIM doctoral cohort. (Occasional Paper No. 5). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics Education.
-05.03. Bush, W. S. (2005, July 11). Improving research on mathematics learning and teaching in rural contexts. *Journal of Research in Rural Education*, *20*(8). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/20-8.pdf
-05.06. Howley, C., Howley, A., & Huber, D. (2005, June 1). Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature. *Journal for Research in Rural Education, 20*(7).
-05.11. Waters, M. S. (Ed.). (2005). *A mathematics educator's introduction to rural policy issues* (Monograph No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.08. Howley, A., Pendarvis, E., & Gholson, M. (2006). How talented rural students experience mathematics. *Journal for the Education of the Gifted, 29*(2), 123-160.
-06.10. Howley, C. B., Howley, A., Howley, C. W., & Howley, M. D. (2006). *Saving the children of the poor in rural schools* (Working Paper No. 28). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.15. Wanich, W. (2006). *Place-based education in the United States and Thailand: With implications for mathematics education* (Working Paper No. 33). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-07.04. Howley, A., Larson, W., Adrianaivo, S., Rhodes, M., & Howley, M. (2007, May 17). Standards-based reform of mathematics education in rural high schools. *Journal of Research in Rural Education, 22*(2). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/22-2.pdf
-08.04. Howley, A., Howley, C., Burgess, L, & Pusateri, D. (2008). Social class, Amish culture, and an egalitarian ethos: Case study from a rural school serving Amish children. *Journal of Research in Rural Education*, *23*(3). Retrieved from http://jrre.psu.edu/articles/23-3.pdf
-08.08. Waters, M., Howley, C., & Schultz, J. (2008). An initial research agenda for studying rural mathematics education. *Journal of Appalachian Studies, 14*(1&2), 125-144.
-10.01. Howley, A., Howley, C., Klein, R., Belcher, J., Howley, M., Tusay, M., Clonch, S. Perko, H., Foley, G., Pendarvis, E., Miyafusa, S., & Jimerson, L. (2010). *Community*

and place in mathematics instruction in selected rural schools [ACCLAIM Monograph No. 4]. Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-11.02. Howley, A., Showalter, D., Howley, M., Howley, C., Klein, R., & Johnson, J. (in press). Challenges for place-based mathematics pedagogy in rural schools and communities in the United States. *Children, Youth, and Environment*, *21*(1), 101-127. Retrieved from http://www.colorado.edu/journals/cye/21_1/21_1_05_ MathematicsPedagogy.pdf

Readers will, on one hand, be justly suspicious that the present second author (Craig) appears as a member of many of the teams responsible for these works. His voice was, of course, influential in the management and leadership of the Research Initiative, and his role entailed taking part in many studies and providing intellectual direction.

On the other hand, readers should note the wide range of other voices. Six of these works are authored or edited by others; the present second author is the sole author on just two works in the list; and on four works he is a member of teams with mathematics educators. Further, the list attests to the fact that the Research Initiative agenda resonated well with some math educators not at all part of an ACCLAIM institution (Cooney, Mewborn), as well as with similarly positioned rural education scholars (Coladarci, Theobald). Moreover, the list of authors includes many doctoral students (Adrianaivo, Belcher, Gholson, Hackenberg, Huber, Rhodes, Showlater, Wanich, and Waters). Wanich, author of the paper comparing place-based education efforts Thailand and the U.S., was a doctoral student in educational research and evaluation. Several were students in education administration.

Going Further: Critique

Because ACCLAIM's theoretical commitments involved skepticism toward the usual superficial engagements of education research with rural places and people (rural

cultures, rural ways of being), and also rural education's usual superficial engagement with mathematics education, a sort of intellectual resistance is evident in many (not all) of the published works. Indeed, some Center leaders and allied scholars (e.g., Corbett, 2011; Gruenewald, 2006; Howley, 2009; Long, Bush, & Theobald, 2003) explicitly theorized varieties of this resistance, and many works implicitly embraced an outlook reflective of such critique (e.g., Anderson, 2006; Beach, 2004; Belcher et al., 2005; Best, 2006; Bush 2005; Civil, 2006; Nichols, 2010). For this reason, the section of the roadmap engages some of the key constructs (see Appendix F) more deeply, partly to demonstrate the connections between the ACCLAIM opus and the wider related literatures, and partly to interpret a sample of such ideas more extensively for interested readers. The key constructs reflected in this discussion are: (1) instrumental education aims, (2) best practice, and (3) rural deficiency theory.

One might hazard that critique is the essential method of philosophy. But critique, at least in the sense we intend, has a great deal to do with the elaboration of the ideas on which social science (e.g., rural education and mathematics education) inevitably rests, but also with the conceptualization of individual empirical studies and the interpretation given to the findings of particular studies. This role of critique is sorely neglected in education research: the AERA standards for reporting research barely mention the term (Howley, 2009), an omission that strikes us as disturbing indeed.[18] Although critique *is* familiar in the math education research influenced by critical theory (e.g., Frankenstein,

[18] It's difficult, in fact, to find evidence that critique is actually widely prized in American education research, which is perhaps the largest and most elaborate national infrastructure for studying education on the planet (but cf. Ernest, 2010). Larger nations (e.g., China and India) have perhaps too recently emerged as industrial powers to sponsor such a regime as yet. Critique is therefore all the more curious an omission in American education research. Perhaps, as a generality, education researchers are too narrowly trained and too narrowly read to judge the relevance and relationships among ideas useful to empirical investigation but uncommon within education research?

1990; Gutstein, 2006; Skovsmose, 1994), our meaning is more pluralistic. By "critique" we mean simply the systematic examination of the limits of relevant ideas, especially some of those highlighted previously. In this light, a researcher's judgment of "relevance" is critically important.

Introduction: The Foundational Question

What is education for? Or, more instrumentally, "What results of education are valuable?" Without seriously engaging this question, there can be no education, no purposeful schooling, and certainly no meaningful education research. Too often, it seems, researchers simply accept the prevailing mandated aims as necessarily legitimate. That knee-jerk decision undermines inquiry itself.

This claim is itself a sharp criticism. Nonetheless, the most long-standing traditions of educational purpose *have* enjoyed widespread acceptance. They seem notably to have included (1) socialization of the young (i.e., functionality with others) and (2) preparing them to be responsible adults (helping them contribute to their communities by hard and respectable work, marriage, and the raising of children in accordance with community norms and mores).[19]

These aims were clearly embedded in child-rearing practices in nomadic-tribal and early settled pre-literate and pre-modern societies, but they were certainly in evidence as well in the very decentralized system of American schooling that emerged

[19] What constitutes 'responsible adulthood' is a matter of sharp disagreement across cultures and points in history, and necessarily represents a set of expectations particular to social, cultural, and political context. For instance, in a society with the construct of citizenship, a responsible adulthood also entails engaging in civic matters, but not all societies have had this construct. And societies can lose such functions, often when imperial aims supersede republican aims.

across the 19th century.[20] These aims ought to strike readers, we think, as comparatively unexceptional, ordinary, and common-sensically human; 19th century common schools were an *adjunct* in this sort of education, and not the whole part of it (DeYoung, 2002; 1995).

One needs to recall, moreover, that the worlds and lives in which such a reality prevailed in the 19th century were overwhelmingly rural: in the US the number of urban citizens surpassed the rural citizenry only at the 1920 census (Bureau of Census, 2007).

Things have changed. Bush (2005, p. 2) observed, "The No Child Left Behind legislation stresses reading and mathematics as essential parts of the economic infrastructure." The idea that formal education (schooling), however, serves as an economic infrastructure *for society as a whole* (even the whole world) is a distinctly modern one—perhaps even one that reflects a postmodern, or at least post-industrial, condition.[21] In other words, formal education (P-20 schooling) is now normatively understood to prepare students to seek the highest educational attainment *in order* to secure the highest-status job. That is, this economic end justifies the means (pursuit of credentials per se over intellectual substance).

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[20] Family and church were perhaps more, or at least equally, influential organizations (Cremin, 1961). The more centralized the system has become, however, the less important have family and church become as acknowledged educational institutions. Indeed, some recent accounts maintain that the family itself has become a dysfunctional educational institution, perhaps even more dysfunctional than schooling; see the Children's Defense Fund's annual *State of America's Children* for relevant evidence (without the interpretation suggested in this note).

[21] The post-industrial economy is the presumptive "knowledge economy," even as (postmodern) digital accomplishment, as Norbert Weiner predicted, actually evacuates the human exercise of knowledge from the economy. Note also that the status of infrastructure confers an entitlement of investment, upkeep, and profit (if privately held). It's certainly clear that for-profit companies are now operating portions of the schooling infrastructure.

This answer to the question of what education is for embeds a concern that rests not only on an economic view of human nature, but notably on *credentialism*.[22] Most contemporary frameworks for state and national standards actually highlight this aim, and no wonder: Preparation for community, and even for citizenship, receives far, far less attention (see Timar & Tyack, 1999, for the relevant history).

Education-as-economic-infrastructure is pursued by means of assessments, best practices, increased standardization, and both centralization and consolidation.[23] With respect to rural places, moreover, the influence of such an infrastructure has been to extract talent—the famous abandonment of rural places by ambitious students after completing locally-funded rural high schools. In other words, the current official and prevalent aims of formal schooling wreak varieties of havoc on rural communities, at largely local expense according to many rural education researchers (e.g., Carr & Kefalas, 2009; Corbett, 2007; DeYoung, 1995, 2002; Hektner, 1995; Theobald, 1997).

Contrasting approaches, which preserve a civic and intellectual mission[24], still exist, and even though they are not dominant, they remain widely written about: for

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[22] "The framework for analysis in demand for educational credentials that is suggested by the writings of both Dore (1976) and Collins (1979) is one in which students are engaged in a ritualistic process of 'certificate gathering', with these certificates valued solely in terms of their power in helping the holder to get (rather than to do) a job and certainly not in terms of any in terms of any intrinsic value in the educational experiences behind them. …Collins' version of the model, however, differs in that the rationale of credentialism and credential inflation are located in the class structures and distribution of power in a country (primarily the USA, in Collins' case). In a form of 'social exclusion' analysis he argues that educational qualifications are a central part of the mechanism by which elites maintain their economic advantage through the linkage between judgments of educational success and class-based cultural capital." (Lowe, 2000, p. 364).

[23] Consolidation—the merging of districts and schools—was a major project of the 20th century project of "infrastructure" building. Usually it was sold to an unsuspecting public as a cost-saving measure, though national education leadership never conceived it as such and never promoted it as such, and indeed, our consolidated system is now much, much more expensive than the system that prevailed in 1920 (Howley, Johnson, & Petrie, 2011).

[24] Intellectual purpose refers to accomplishment beyond tested achievement, particularly engagement with intellectual projects based in reading and writing or scientific analysis for significant meaning. Such

instance, project-based learning; expeditionary learning; environmental education; place-based education; outdoor education; and aesthetic education. Most such alternatives embed arguments for greater teacher autonomy and notions of contextualized practice in which diversity of educational curricula and pedagogy is a good thing for its own sake and standardization a bad thing for its own sake. In these alternatives, the care and reflective engagement of teachers in their mission figures prominently. Teachers are themselves an important source of the valued variability and contextual adaptability (see, e.g., Miller & Hahn, 1997; Powers & Duffin, 2003; Shelton, 2005; Sobel, 2004; Theobald, 1997).

Very clearly, via its Theoretical Framework (Appendix B), the Center announced its work as part of the critique directed against the largely economic purposes authoritatively articulated for schooling (cf. Timar & Tyack, 1999). The Framework articulated the relevant commitments as follows:

> We believe that future research into mathematics education in rural places should:
>
> 1. describe the salient relationships between mathematical knowledge and rural context;
> 2. examine rural schools as they serve or subvert the development of mathematical knowledge and expertise within the rural lifeworld;
> 3. examine hypotheses about the place occupied by mathematics knowledge in and (prospectively) *for* rural communities; and,
> 4. elaborate theories of, and knowledge about, "pedagogy of place" for mathematics education in rural schools. (ACCLAIM, 2003, p. 2)

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activities could derive, for instance, from investigations, constructions, or expeditions but won't involve test-preparation or an obsessive calculus of "meeting the standards." One might suggest that intellectual purpose entails a curriculum of thinking and thoughtfulness, and an extended engagement with giving reasons and reasoning. The mission is difficult in America, with its anti-intellectual culture (Hofstadter, 1963; Howley et al., 1995).

Assessments: Economic competitiveness and academic inferiority. Political and business leaders in the United States want to maintain its economic competitiveness with other countries, and to train more scientists and mathematicians as human capital imagined as essential for sustaining the global economic position of the nation: the rhetoric is ubiquitous. The means to such an end is, apparently, a testing regimen centered on the low-level concepts in which students have, according to many observers been instructed (e.g., Weiss, Pasley, Smith, Banilower, & Heck, 2003; Stigler, & Hiebert, 1999).

Other observers claim that few schools sponsor galvanizing treatments of sophisticated concepts or even assess students on their grasp of the reasoning behind mathematical ideas and their potential applications (e.g., Egan, 2002; Gatto, 2002; Shelton, 2005; Howley, Pendarvis, & Gholson, 2006). Certainly in mathematics instruction, schools expect memorized procedures[25] and algorithms – rote learning – that entails little understanding or reasoning.[26,]

Boyd (2007) found that, both before and after implementation of NCLB, students were unlikely to be instructed or assessed in sophisticated concepts by their teachers, and were often instructed and assessed, in part, on items whose difficulty fell below their grade level (2007, pp. 132-133). He also referenced work that shows that state

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[25] "If I simply taught each procedure individually then gave the students sheets of problems that reflected what I had just taught them, outside appearances would suggest that they had mastered the concepts. But their misunderstandings come to light in their conversations and in their attempts to apply previous knowledge" (Schmidt, M., 2004, p. 26-27).

[26] "Far from seeing mathematics as a way of expressing ideas or as a method for characterizing relationships and patterns, these gifted children instead saw mathematics principally as a set of procedures with numbers—as calculations and algorithms. Asked, for example, if math lessons ever involved problem solving, one eighth grader commented, 'No. It's just math'" (Howley, A., Pendarvis, E., & Gholson, M., 2006, p. 138).

assessments consistently failed to address adequately their own learning objectives and content standards. And, according to Boyd (2007), teachers instructed and assessed students in ways that were less comprehensive and less sophisticated than state assessments. One might observe that although testing may *be* schooling today, it certainly cannot *constitute* education, nor has it ever.

Assessments under *No Child Left Behind*. Lee (2003) found a number of problems with the way assessments function under NCLB. To summarize some of the issues:

- The instability of small sample sizes, and the errors resulting from interpreting their natural fluctuations as significant, have not been sufficiently corrected by the rolling averages option for analyzing whether schools did or not meet their Average Yearly Progress (AYP) targets;[27]
- These errors of interpretation continue to leave smaller schools, particularly rural schools, vulnerable to criticism on a basis that is statistically insignificant;
- Though rural schools "appear to have a better prospect of progress than their nonrural [urban] counterparts" (Lee, 2003, p. 76), both rural and urban schools are unlikely to meet overly optimistic AYP targets.

Lee concluded with two main recommendations: (1) AYP targets should either be lowered, or the time-line for meeting them should be extended;[28] (2) AYP targets should

[27] "For an average nonrural school, the variability of mathematics scores drops from 30 to 20 in standard deviation units by using this rolling average. For an average rural school, the same measure of variability decreases from 40 to 30. This comparison tells us that rural schools still remain relatively more unstable than their nonrural counterparts, as the use of rolling average procedure tends to reduce the variability by the same degree for both nonrural and rural schools" (Lee, 2003, p. 73).

[28] From a case study set in Georgia: "Despite its successes, of which there are many, this small rural community and its school remain vulnerable to the whims of state and federal policy makers who may or

not be uniform, but differentiated based on a school's initial achievement status (2003). He also suggested that, due to the importance of reliable representations of student performance in the context of high-stakes assessments, multiple measures of student performance should be used to determine whether students have met AYP targets.[29]

Best practices. Like most concepts, *best practice* entails some assumptions worth examining. Three seem implicit:

1. Standards of value exist by which to judge the worth and value educational practices;
2. Both practitioners and researchers agree on the standards of value to use in judging the worth and value of educational practices;
3. A practice that meets this agreed-upon standard of value, as demonstrated by the results of the use of this practice in one or more contexts, has the capacity to meet this standard of value, in all contexts if faithfully implemented.

The first assumption is clearly true: standards of value do exist in the human mind, implicit in our thinking, choices, and behavior. Standards of curriculum and pedagogy exist—many of them. Standards for reporting education research exist, and for conducting and reporting education evaluations. Even those who choose to question such official standards can often articulate their own alternative standards.

The profusion of such standards, of course, is an issue, and it often seems as if official bodies are in quest of a set of one-best standards universally applicable in the relevant jurisdiction (i.e., each state, and sometimes nationally), at least for a mid-range

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may not… give this community school the time it needs to establish itself as a model of academic excellence" (Sloan, 2006, p. 64).

[29] Lee suggested the following on this issue: American Educational Research Association, American Psychological Association, & National Council on Educational Measurement, 1999 (Lee, 2003, p. 71).

future. Different jurisdictions, of course, retain the sovereign right of difference. And official standards change—sometimes in an evolutionary and sometimes a revolutionary manner. We seem, at any rate, quite distant from a universal set of relevant standards. Standards for schooling are difficult to standardize, though various bodies in the US are working on the project.

The second and third assumptions are thus more dubious than the first; indeed, the second assumption is famously false, namely that practitioners and researchers agree about what is valuable in school practices. Disagreement among researchers is at least as sharp as between practitioners and researchers; the historian Carl Becker (1958) famously noted that "A professor is someone who thinks otherwise." Becker, it turns out, was not a supporter of standardized schooling (Becker, 1958).

Although educators may acknowledge that practices shown to "raise" accountability test scores are important for avoiding the negative consequences of seeing them decline or *not* raising them (Sloan, 2006, p. 60), the importance of a practice is not the same as the *value* of that practice and such value remains an issue that is sharply disputed (e.g., Hursh, 2008; Ravitch, 2011; Schoenfeld, 2006; Shelton, 2005).

The third assumption, that the practice best for one context in raising test scores is best in another – is at least worth questioning, though available evidence is not at first glance encouraging. Randomized controlled trials (RCTs) in education research are still new to the field, but they have thus far *rarely* found contextual interactions that nuance a generalized result of "best." Hattie (2008), in a meta-analysis of meta-analyses, reported comparatively *few* effects that were contingent on context.[30] The evidence can of course

[30]Hattie does report that the effect of school size may depend on social class, citing some of the second author's work to that effect.

be doubted, but so far as it goes, it hardly provides encouragement to the supporters (such as ACCLAIM's participants) of adapting instruction to varied contexts.

How far does such evidence go, however? Not very far, and for the obvious reason. "Raising test scores" is a not a comprehensive educational aim, but an approximate one (which, argue Ravitch and others, is not the lifeblood, but the death of public schooling). RCTs and meta-analyses in education in recent decades have understandably focused on the effects of "interventions" on test scores across the board.

An example from rural education will suffice to illuminate the difficulties in general, and for concern for rural places and ways of being in specific. Place-based education is probably the most notably rural "intervention" proposed for rural schools (Howley et al., 2011; Theobald, 1997), but most theorists of the approach propose other sorts of "good," as both intention and valued outcome, than a comparative achievement advantage; namely, community-building, authenticity of curriculum, student engagement, and intellectual facility (Gruenewald & Smith, 2008; Sobel, 2004; Theobald, 1997).[31] Some evaluations of place-based education do, however, attempt evaluations of achievement effect, and find them (e.g., Powers & Duffin, 2003), but none thus far has been conducted as an RCT. In a sense, the effort is ontologically impossible—adaptation of content to context, and of context to content, is the point of basing instruction, curriculum, and pedagogy on place. And the issue of differing aims remains.

That is, place-based education intends responsiveness to rural context, it demands diversity of approaches, and it anticipates wide variance in processes and results

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[31] Some evaluations of place-based education do attempt evaluations of achievement effect, and find them (e.g., Powers & Duffin, 2003), but none thus far have been conducted as RCTs.

(Gruenewald & Smith, 2008). Fidelity of implementation is a non-starter, and a non sequitur. Moreover, place-based education is by no means an "intervention" in the typical sense (i.e., of a manipulable "package" of testable elements; cf. Cook, 2002). It is more *invention* than an intervention with prescribed elements to be faithfully enacted in disregard of contextual variances.

Experientially, different types of localities are different in substantial ways, and particular localities of the same type have differences that go beyond their different locations on a map. Those differences, some argue (and the ACCLAIM Framework with them), are the *point* of rural (math) education rather than the unfortunate "challenges" ever-so-conveniently housed in a rural jurisdiction.[32] With what may be mistaken for arrogance, advocates of the "best practice" notion argue that this experience of difference is, in fact, nearly *irrelevant* to improving practice in rural schools (Arnold, Newman, Gaddy, & Dean, 2005; but see Howley, Theobald, & Howley, 2005, for one response).

When the same "best practices" produce different results in different places, as often happens, this sort of difference is often attributed to poor *fidelity of implementation*. In other words, once a practice is dubbed 'best,' its failure to produce results when used in a particular context is most apt to be viewed not as a reflection on the practice itself or of the dubious suitability of that practice in a particular context, but as failure to follow the script. Indeed, most discussions of fidelity of implementation ignore context as a

[32] The deficiency is often construed as broadly cultural (Williams, 1973), but in the age of NCLB, and in comparison to affluent suburbs, achievement gaps of various sorts (Cogan et al., 2001; Provasnik, KewalRamani, Coleman, Gilbertson, Herring, & Xie, 2007) in rural places that warrant RCT in the name of addressing the deficiencies (Stockard, 2011). The cultural affordances, and the cultural meanings, inherent in these places become, in this way, actually irrelevant to the RCT effort.

possible influence; the popular threats to fidelity of implementation during RCTs are all *internal* to the "intervention."[33]

Once an intervention survives an RCT (especially a large-scale RCT) and proves itself (somewhat) superior (to something, often a generic status quo) at producing achievement and therefore worthy of advertisement as "best," subsequent signs of the practical failure in a particular "setting" are likely to be ascribed to the failings of educators (ignorance, laziness, or resistance). The *remedy* that will restore the intervention to effectiveness, will require that teachers, whatever their circumstances, strive to use the practice more exactly—with greater fidelity—as designed.

Hence, the ideology associated with "best practice" goes beyond an overarching disregard of contextual differences: it would necessitate the presumption that poor results from a *faithful* implementation of best practices would stem from abnormal deficiencies in students, communities, or teachers. Children are indeed routinely "constructed" by schooling as deficient in this way according to some observers (e.g., Popkewitz, 2007, 2004).[34]

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[33] See, for example, the discussion in Carroll, Patterson, Wood, Booth, Rick, & Balain, 2007, which synthesizes reviews about implementation fidelity and proposes yet another scheme restricted to internal threats. In some measure, of course, the notion of "fidelity" is intended to ignore context on the assumption, as with RCTs, that evaluation design helps to control for "extraneous" contextual influences. For an example of the seriousness of fidelity of implementation as an internal threat to RCTs, see Stockard's (2010) critique of the What Works Clearinghouse for fidelity issues. In this mode of thinking, the widest context of concern might be school climate or culture, the inexperience or poor engagement of educators, or the academic deficiencies of children from impoverished families. Actual local culture remains educationally irrelevant.

[34] Popkewitz is a follower of the philosopher Michel Foucault, who argued that the reforming "disciplines" (psychology, sociology, psychoanalysis, penology, medicine, and schooling) shape personal and political identities and reconstitute reality (and the perception of reality) in accord with their dictates. The RCT example given here is a reasonable example of how this process works, as is the inscription in NCLB of "adequate yearly progress" as a universal aim (at least in the jurisdiction of the US federal government). The frenzy and fear now surrounding public schooling in the US is the palpable result (Ravitch, 2011).

One might profitably turn this logic around, however: a concept that entails decontextualization will recognize context only as deficiency relevant to the "intervention." Any other contextual significance will continue to be ignored because the event horizon of the developers and managers of the implementation is *artificially restricted* to the intervention, which remains of key significance. Context is lesser, and the method of the RCT formally decontextualizes the "intervention." In a sense, decontextualization is (typically) the point.

The tacitly presumed sameness of context is thus challenged by the all-too-common local failure of practices scheduled to succeed everywhere. Not surprisingly, standardized approaches to education mention or identify "context" principally when they construe it as a difficulty or deficiency (Howley, 2003). After all, the alternative to seeing context as a problem would be rejecting the decontextualization so firmly inscribed in best practice, seeing context instead as a generative blend of strengths and weaknesses that might well resemble, but nonetheless differ from, those of another place. Some of this significant difference and similarity is what makes "the rural" a construct to which one ought to pay attention (again, cf. Arnold et al., 2005, and Howley et al., 2005 for the relevant debate).

Of course, in certain contexts widely judged to be deficient (i.e., "poverty stricken" communities), deficiencies must be charitably addressed. In these presumably deficient contexts, schools typically add "poverty-training" professional development programs (e.g., Payne, 1998) to help teachers train impoverished students in the middle-class behaviors presumptively necessary for human success.[35] Several observers have

[35] For rural education research of this sort see, for instance, Stockard (2011) and the relevant interchange with Eppley (2011), which elaborates and demonstrates issues considered in this section.

noted the condescension involved with this outlook (Osei-Kofi. 2005). In this fashion, nonetheless, the conventional wisdom, for both technical and cultural reasons, neatly rules out the related issues of social justice and power. Such research helps maintain the illusion that schooling is a neutral technology of improvement and advancement for everyone. Other research, however, demonstrates that it's not and that we've known it's not for a very long time (e.g., Anyon, 1980; Coleman, Campbell, Hobson, McPartland, Weinfeld, & York, 1966; Oakes, Ormseth, Bell, & Camp, 1990; Orfield & Yun, 1999).

Fitted practice as an alternative. Education for civic and intellectual purposes would seem to require practices that are not so much universally "the best," as that construct is generally (mis)understood, but that are variously good for these alternative purposes in specific places. Such a view could be termed "fitted practice," to imply that supposedly best practices should be modified or even ignored (e.g., see Pendarvis, 2005, discussion of "situated practice" for rural mathematics education, and Tye, 2000, for insight about successful reform and the "deep structure" of schooling). Such an outlook, of course, conflicts with fidelity of implementation principally with respect to the scope permissible for professional action.[36]

"Fitted practice" would necessarily affirm a broad scope for the agency of teachers and community members, and an inductive, experiential view of schooling: one in which those who live in a place are seen not only as the people most qualified to discuss what does and does not work there, but virtually the only ones who might possess

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[36] As Stockard (2011) notes, even with a faithful implementation some discretion necessarily remains to teachers—in matters of pacing or re-teaching, for instance. Ends and means, of course, become off limits, and pedagogy becomes the technology of implementation: far less art-writ-large, far more science-narrowly-construed.

the *capacity* to make such a determination. On the basis of similar considerations, ACCLAIM expressed in its Framework and in many of its research products, skepticism about a form of scientific endeavor (scientism) that disregards context, experience, and robust evidence of its own failures.

What do we mean by "failures"? The What Works Clearinghouse (WWC) is the federal effort to promote, classify, and publicize RCT evaluations of educational "interventions." In a recent effort, one of the present authors and one of the Center colleagues (Theobald & Howley, 2011) reviewed the status of the 508 interventions listed on The Clearinghouse website as of Spring 2011. The most frequent designation was "no studies meeting evidence standards" or "no studies identified"; 82 interventions showed, according to the WWC, "positive or potentially positive" effects; 35 showed "mixed or no discernable" effects; and 1 showed "negative or potentially negative" effects. Small samples are the norm in these studies, so generalizability is moot. In other words, the Clearinghouse finds essentially that (a) a large majority of evaluations does not meet its evidentiary standards, (b) a minority finds effects, (c) most such effects are weak, and (d) without much applicability.[37] One can, in this fashion, rely on the work of the WWC to argue that claims of best practice have been dramatically over-stated.[38] Should one use the 82 interventions with potentially positive effects? For what should one use them?

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[38] Hattie's (2008) claim that nearly everything works actually seems more robust. Hattie reports, for instance, that the average effect size (on achievement) of a teacher, net the maturational effect of student aging, is +.20. Overall, teachers, the best and worst together, are effective! He takes this magnitude as the baseline for effectiveness of an intervention: it should beat the effectiveness of the average teacher, and he finds (from meta-analyses, not RCTs that much does. If much "works" with respect to tested achievement, then good teachers should be prepared and expected to combine features of approaches, ideas, methods, pedagogies, curricula, and techniques in ways that seem to them to make sense locally. This expectation is perfectly consistent with the concept of place-based education… and much else.

How should one use them? In the end, local circumstance still matters a great deal, as Tye (2000) has observed in general, quite apart from any concern with rural context.

Educational scale. In its schooling, the US appears to have selected centralization and standardization as organizing principles. Long-standing trends in educational practice (e.g., Conant, 1959; Cubberley, 1914) have favored consolidation of buildings into ever larger schools and districts and, in recent decades, consolidation of control at the state and federal levels (Schlecty, 2008; Zancanella, 2008; Shaker & Heilman, 2008).

It's an early 20th century notion of mass production that still isn't working well (Ravitch, 2011). The adoption, in a post-industrial society, seems odd, but given the sense of the "infrastructure" and economic aims described previously, the centralization and standardization of schooling is perhaps predictable. Many education leaders seem to accept these goals and means, partly out of frustration with low performance (on the one hand) and partly from satisfaction with comparative excellence (on the other hand).

Big-city systems, however, are often in dreadful shape, even if comparatively well funded. And affluent suburban systems (and even semi-affluent ones) are performing sufficiently well under current testing regimes and accountability schemes that they escape the fear and loathing that are the lot of many huge city systems. One has to ask what is going on with such odd provisions and such odd or complacent responses from "leaders."

As Zancanella (2008) observes, States (i.e., federal and state governments) tend to view all issues "like a state." Zancanella is alluding to James Scott's *Seeing Like a State*, an extended investigation into the reasons for the failure of social engineering projects

worldwide (Scott, 1998). In brief, Scott argues that regimens of social engineering fail to respect, or even account for, the legitimate agency of local actors close to the problem, or the issues, of concern to the State. The result, according Scott has been twofold: (1) a massive deformation of ways of living and (2) widespread failure of the vaunted reforms. One may argue, like Zancanella (2008), that such blindness and hubris characterize the general thrust of education reformism in the past three decades; certainly Ravitch (2011) agrees.[39]

Educational scale comes into view as an issue in this way: if the current aims are misguided and the current regimes to enforce them are bankrupt, then the "economies of scale" exported from manufacturing to schooling are equally dubious. If a truer education were to prize such aims as creating active citizens, fostering intellectual growth and engagement, and sustaining community, then a very different regime would be necessary.

Why? First, the concept of mass production appears inapt. Children need care and attention in their formation as active citizens, thinking beings, and community members. And this means, second, that large buildings and extreme bureaucratic procedures would appear inapt means to the end. One of the least mentioned challenges of big-city schools, in fact, is the hugeness of the big-city district. The schools are also huge, and the urban small-schools movement has for decades taken on that problem, with some apparent success in New York and Chicago—despite the odds against accomplishment in huge bureaucratic systems (see Meier, 1995, for a partial account of the New York struggle).

[39] Scott (1998) articulates his own view of the foundational aims of schooling, at least by implication from the principal aims of all well-organized states: (1) the creation of tax-paying citizens and (2) the production of military conscripts. One can certainly observe the schools attempting to fulfill these purposes, and political and educational leaders endorsing them. Both Scott and Ravitch, incidentally, appreciate the work of Jane Jacobs, a persuasive and influential 20th century critic of sorting, standardizing, and centralizing.

Briefly put, the thesis for the constellation of alternative aims mentioned above is that the enabling care and attention demand school institutions (e.g., districts and schools) that are "humanly scaled." That term means sizes that are compatible with the way the human organism functions well. For this sort of project (civic engagement, intellect, community), those involved need to know one another well: to be proximate, familiar, and collegial—even in a sense "intimate." In such circumstances, indeed, those involved exercise increased authority and increased responsibility, at least in numerous compelling accounts (e.g., Gatto, 2002; Meier, 1995; Schumacher, 1973; Shelton, 2005; Weisman, 1998). Supporting evidence in education comes from a series of school- and district-size studies conducted by several teams of researchers working in both rural and urban contexts, and some conducted in the ACCLAIM research program (Bickel & Howley, 2003; Howley & Howley, 2004). Other teams have recently shown that fiscal efficiencies ("economies of scale") peak at a district enrollment of just 3,000 students (Duncombe & Yinger, 2007) and at 15,000 students districts accumulate substantial diseconomies of scale. In a very real sense, then, small rural districts are paragons of scale—for an enterprise based on an *industrial* model that implements a model of schooling largely contrary to their own interests![40]

In short, hard data (i.e., on achievement and cost efficiency) indicates that both schools and districts should—even for optimum performance under the current aims—be much smaller than those that now enroll the large plurality of students. How much less appropriate such arrangements are for the alternative aims—the formation of active citizens, thinking beings, and community members—should clearly suggest itself. The

[40] That is, an enterprise that exports developed talent away from rural communities and one based on standards that with few exceptions ignore the role of schooling in community and community in schooling (Carr & Kefalas, 2009; Theobald, 1997, 2009; Schlecty., 2008).

poor performance of students in such circumstances is thus entirely predictable. Not only are the means insufficient to the (dubious) ends, but the mismatch of ends (forming functional consumers and workers) and means (institutions far too huge to function well on the very terms articulated by the State) is precisely the sort of deformation of reality that Scott (1998) had in mind in *Seeing Like a State*.

Fortunately, despite the deformation, one clear affordance to students and communities in rural places is the comparatively much smaller scale of schooling. And this fact of life is acknowledged in much rural education research; the smaller size of rural institutions was an issue engaged in many of the studies conducted by ACCLAIM (e.g., Anderson, 2006; Bickel & Howley, DeYoung, 2003; Gleason, J., Belcher, J., Britt, D., & Savich, P., 2008; Green, 2008; Howley & Howley, 2004; Jones, 2008; Lee, 2003; Nichols, 2010). In some of these studies, moreover, school size was the focal issue. In these studies, and in the wider literature on school size, smaller size has often figured as particularly beneficial to the tested achievement of students in impoverished communities (e.g., Howley & Howley, 2004). Rural places, then, offer a peculiarly rural affordance to students and communities, one that would yield arguably greater benefits with a set of rural-friendly aims alternative to the prevailing set.

Rural deficiency theory. The politics of poverty, or at least the political economy of grant-making and charity to rural places, requires the assertion and the social construction of rural deficiency. Fortunately, for grant applications, the general culture already constructs rural places as culturally deficient (Herzog & Pittman, 1995; Williams, 1989), so the argument is not difficult to make. All that a grant maker need do is establish economic and educational deficiency on some basis. Because educational attainment

(years of schooling) is generally lower, even now, in rural as compared to nonrural regions, educational deficiency is still easy to affirm.

And, of course, some regions face issues of impoverishment and racism associated with common constructions of deficiency. The sins of the parents (in not going to college or in not completing high school) suffice in the present—but the contemporary college-going rate *also* remains somewhat lower in rural as compared to non-rural areas (Provasnik et al., 2007). Not all rural places are impoverished, but many are, and overall rural poverty rates generally exceed overall non-rural poverty rates, and have often equaled overall inner-city poverty rates. Conclusion: rural areas *are* deficient overall.

Another way of regarding the attribution of rural deficiency exists, however. One might, from a rural vantage, adopt this definition: "Deficiency is attributed to rural places based on prejudiced preconceptions about the lack of admirable qualities deemed necessary to social respectability and economic success." These prejudices have significant effects (Herzog & Pittman, 1995; Edington & Koehler, 1987). The ACCLAIM Framework repudiated deficiency theory and called for investigations that more accurately described rural places and people, and that acknowledged the existence of varied rural cultures and concerns.

Far from representing a bias, ACCLAIM research leadership asserted this outlook as *more objective* (Howley, 2002). This intent at objective description perhaps helped studies test hypotheses of rural and non-rural difference, rather than assuming or constructing rural deficiency as the foundation of study (e.g., Alfonso, & Long, 2005; Bickel et al., 2003; Hopkins, 2005; Howley & Howley, 2004; Lee, 2003). Some of the

study findings affirmed the null hypothesis of no difference, and others rejected it, in many cases affirming rural advantage.

The American norm of success, however, is not urban ways of being, so much as it is the standard of *suburban affluence*, and not only in schooling, but in life. Rural places generally are, in fact, "deficient" by such a standard. The difficulty, however, is the inappropriateness of the standard. Among a handful of critics, the American suburban standard is itself a standard of failure—cultural, ecological, ethical, and aesthetic (e.g., Borsodi, 1933; Kunstler, 1993; Schumacher, 1973). The ACCLAIM research effort shared the skepticism exhibited by these cultural critics.

One hopes that, with such evidence and such uncommon doubts at their disposal, the abstract public (and political and educational leaders) could become less inclined to direct groundless insults at rural places, rural people, and rural schools.[41] One might note, of course, the irony: those lodging the insults cannot (by definition) recognize their own ignorance. Rural people and educators (including rural math educators) who do recognize the facts will continue to be necessarily patient. Some are convinced that the planet not only *has* a rural future, but already needs it.

Going Further: Recommendations

Since the theme of this work is "going further," we think it right to conclude with a few recommendations from the Research Initiative. In fact, however, the following recommendations originate only with the authors, who seem literally "authorized" at this juncture to speak for the Initiative, partly in light of the foregoing "roadmap," with its

[41] "In Appalachian Ohio about 47 percent of districts were placed in the troubled categories of "academic emergency" and "academic watch," versus 19 percent of the rest of the state's districts. On the terms of the Ohio accountability system, Appalachian districts are widely troubled and deficient. *None* of these 125 districts, for example, was considered effective (in the year in question, 2000-2001)" (Howley, C. B., Howley, A. A., & Hopkins, T., 2005, p. 6).

summaries, evaluation, and critique. We organize recommendations by role, and in the understanding that readers occupy overlapping and even competing roles: citizen, activist, educational practitioner, policymaker, or researcher. Some of us involved with ACCLAIM occupy portions of all these roles, in varied proportions.

Citizens

Perhaps everyone is a citizen or perhaps few really are, but *the citizen* is the legitimate foundation of the modern nation state (Hobsbawm, 1992). Nonetheless, according to some observers (e.g., Sassen, 1996), the post-industrial political regime seems to be supplanting the citizen with the trans-national corporation as the founding entity for political authority. Americans are likely to believe that the chief responsibility of citizenship is voting, but it's a mistaken impression cultivated by interests that find it convenient to *restrict* citizen responsibility to exercise of the franchise. Most of us comply.

A wider view of the citizen is what the American founders seem to have had in mind, with the citizen political responsible for taking political action (Hobsbawm, 1992; Sassen, 1996; Theobald, 2009). In general, most of us are now doing a bad job of being citizens on this view. We are otherwise occupied fulfilling what we've learned: consuming and striving to get ahead.

How do these general observations related to the involvement of *rural* citizens in *mathematics* education? The experience of many (not all) rural education scholars is that rural (many, not all) citizens are passionately devoted to their rural places: our families, our town; the old homeplace; our fields and forests, mountains, rivers, and deserts. This short list captures not only rural affections (so easily dismissed in hard-nosed politics),

but rural meanings, purposes, and occupations: everything significant in rural life. Citizens thus have an inalienable role in sustaining, promoting, elaborating, and defending such meanings, purposes, and occupations.

So here's the connection: Knowledge of mathematics and participation in cultivating such knowledge is their right and responsibility, in spite of the fact that 20th and 21st century schooling has very actively excluded them from such participation—through consolidation and school closures; from a closeted professionalism imposed on teachers and school administrators;[42] and through standardization, centralization, and bureaucratic administration in general.

Recommendation 1. The recommendation for rural citizens is deceptively simple: get involved in place-based education, and in particular in rural forms of mathematics education—math education that helps, both directly and indirectly, sustain everything significant in rural life. The effort requires reading and also meeting with local educators: teachers, principals, and superintendents. Several accessible guides or suggestions are available to help inform such an effort (e.g., Adsit, 2011; Fanselow, 2006; Howley & Eckman, 1997; Howley & Harmon, 2000; Passmore, 2002). As with most acts of citizenship, not everyone has the capacity, the time, or the requisite disposition. Some do.

Practitioners (Teachers of Mathematics and Local Administrators)

Doubt exists, as noted in the section devoted to critique, in a number of quarters that "best practice" and "accountability" (as presently practiced) are beneficial to students, educators, families, or communities. Perhaps more clearly, and with more

[42] Professionalism has seemed to exclude the participation not only of amateurs (those local people who like math), but of the lay population in general; knowledge of pedagogy, curriculum, and assessment having been restricted to the jurisdiction of the professional educator.

agreement, benefits would not accrue across all these venues, since the aims of rural families and communities are not likely consistent with the intentions and outcomes loudly proclaimed for US schooling. For instance, rural families and communities do not want to see their children leave home for good and their schools closed for good (e.g., Burnell, 2003; Carr & Kefalas, 2009; DeYoung, 1995; DeYoung, Howley, & Theobald, 1995). Some, perhaps many, rural educators recognize this state of affairs, but receive little support for doing something about it, and certainly almost none for opposing the dominant intentions and outcomes. Quite the contrary: discouragement for such activity is strong and prevalent.

Recommendation 2. Oppose the dominant outcomes and intentions imposed so widely and stringently on schooling. Embrace, instead, alternatives that make local sense and help to sustain local community, in particular helping students, including academically able students, envision local rural futures for themselves and their families (see Burnell, 2003, and Carr & Kefalas, 2009, for how needful such an effort has become).[43]

Inventive and insightful teachers of mathematics are doing some of this work, even under the regime of standardization that now prevails, but comparatively fewer take up this work in mathematics than in other fields, and hardly any at the secondary level. One can incorporate a mathematical project relevant to rural place, however, at any level. Place-based education does not require the abandonment of direct instruction, or the wholesale replacement of convergent instructional routines with divergent ones. It does require a spirit of inventiveness, an affection for the rural place, and it can probably

[43] A nuanced conception of history will remain our best means of conceptualizing the rural future; and, in this case, the history that we must understand is that of rural education itself, within the history of American schooling as a whole.

benefit from an incremental approach, one that builds capacity and friends slowly but surely (Howley et al., 2011; Tye, 2000).

Heeding this recommendation will involve reading sources that are typically not recommended to rural educators by State Education Agencies and professional development programs. Rural education scholars of our acquaintance will, however, happily recommend such readings and would be willing to talk about issues by telephone and perhaps in person. Their names appear in the reference list.

Organization of such opposition should start slowly and small, perhaps with regular conversations among friends, including both professional educators and their friends in the community. This action is not science, or professional development, but a form of politics. Keep the distinction in mind; relevant research is important as both information and a source of ideas—but it's the action that makes things happen, and not the reading.

Recognize, as well, that conversation in this realm *is* action. In the end, the action of schooling (whether complying with mainstream dogma or opposing it; whether teaching and learning, or evading teaching and learning) consists of talk (ideally, but not typically, *conversation*). Recommendation 2 is as complex as recommendation 1; but similar sources are relevant to both recommendations.

Recommendation 3. Accept test score results with justifiable skepticism; in particular, do not propagate desperation to "boost" test scores, nor fixate on measures to "raise test scores." Aiming for a test score jump is much like aiming directly for happiness: it can't really work, because better scores and happiness are the result of something else—engagement and devotion to things that matter.

Mathematics instruction incorporates a great deal of testing quite beyond the accountability regimes. Curricula and lessons are tightly structured, at least in the standard textbooks, and right answers on tests almost universally accepted as markers of student success. Less structured demonstrations of knowledge—performances, projects, team efforts—offer an alternative, and perhaps an inviting one. Such alternatives are very compatible with the thinking that informs place-based education—and contemporary views of mathematics education reform.

The accountability-testing regimes that prevail within states and across the nation provoke fear and even a measure of self-loathing among educators in impoverished places. The fear and loathing generated by this depressing game creates what some researchers (e.g., Daly, 2010; Olsen & Sexton, 2009) are calling *organizational threat rigidity*. In effect, the theory runs, accountability schemes punish impoverished schools and districts for not equaling the supposed "excellence" demonstrated by affluent suburban schools. Given the increasing separation of rich and poor in the US, the expectation is a punishing *fantasy*. The schemes are therefore unable to recognize statistically average student performance in substantially impoverished districts as a nearly *miraculous* accomplishment (given the circumstances that propagate poverty in the US).[44]

[44] "The accountability model must not set expectations for annual achievement based upon student background and school characteristics" (O'Malley et al., 2009, p. 5). Such denial is extreme (and bears, in the work cited—which articulates an actual federal mandate, on the technical debate over which variables should enter a value-added statistical model). But a similar denial is built into many state accountability measures, such that the most affluent schools predictably receive highest ratings and schools serving the most impoverished communities predictably receive the lowest ratings.

Policymakers (Politicians, Bureaucrats, & Related Functionaries)

According to many observers (e.g., Gruenewald, 2006; Hursh, 2008; Ravitch, 2011; Meier, 1995; Theobald, 2009), the official outlook on the intentions and outcomes of schooling (characterized previously) is misguided and short-sighted. Among such critics, few have been policymakers, though Diane Ravitch is a notable exception. The recommendations in this subsection are addressed to those policymakers who appreciate such a perspective. Others may come to it in time.

Recommendation 4. Recognize and promote rural perspectives in your policy work. For those who care about rural places, the emphasis is on protecting them, and the communities that exist within them. Challenging (1) the negative impacts of consolidating rural schools (Howley, Johnson, & Petrie, 2011), (2) the outmigration of talented students from their communities (Carr & Kefalas, 2009; Domina, 2006),[45] (3) the neglect of rural issues by most researchers in education (DeYoung, 1991) and of most programs that sponsor education research (Sherwood, 2001) would be good starting points.

Responsive policymaking also needs to expand the circle of advocates for localism beyond those who live or grew up in rural places themselves. For the moment the most forceful arguments are made by thinkers and critics well outside the trendy mainstream (e.g., Gruenewald, 2006; Kunstler, 1993; Orr, 1995; Theobald, 1997). One must remind oneself that significant change nearly always emerges from such margins, and astute thinkers (e.g., Williams, 1973) have always advised attention to those margins.

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[45] "Recent data suggest that nonmetropolitan America is experiencing an outmigration trend. …annual data from the 1989–2004 rounds of the Current Population Survey March Demographic Supplement… demonstrates that highly educated nonmetropolitan youth are leading contemporary nonmetropolitan outmigration. Contrary to the clean break theory, this paper argues that economic incentives continue to be relevant to current nonmetropolitan/metropolitan migration patterns." (Domina, 2006, p. 373)

Rural mathematics education is surely an enterprise lodged well back within the margins. Mathematics education reform does not yet recognize it; though a few well-respected mathematics educators have pointed in its direction (e.g., Cooney, 2003; Silver, 2003). Some mathematics education policy leaders might be ready to entertain general doubts from the margin, and these few would be well positioned to take up the work of supporting place-based efforts in mathematics education. Obviously, a great deal of work awaits their support and influence.

Researchers, Scholars, and Critics

As Howley and colleagues (2005) discovered, the mathematics reform efforts counseled for rural schools simply repeat those directed at schools in general. If one agrees that schooling everywhere should emulate the intentions and outcomes of schooling in affluent suburban realms, then what this team discovered is the logical corollary. The argument offered for this thinking is that contemporary standards represent universally applicable excellence.

The ACCLAIM research effort took a quite different view, not disputing the intent, for instance of the 1989 NCTM standards (in which Jim Schultz, co-director of the Research Initiative for the first five years, took part), but harboring sharp misgivings about the prescriptiveness of the 2000 NCTM standards.[46] Indeed, if regarding "the rural" as more than a jurisdictional line-in-the-sand, one instead understands "the rural" to be constituted of ways of living and being that relate to a land ethic (rural engagement with the land for family, community, and vocation) then the prescriptiveness and presumptions of universality will seem like hubris (much in line with James Scott's analysis of the

[46] The view of the Research Initiative in this regard probably did not represent the views of the ACCLAIM management team; neither the research leadership nor the rest of the management understood debate of the standards as a necessary or useful exercise, even if it remained a possible one.

nature of failed reformist schemes).[47] These recommendations are directed at researchers, independent scholars, and education critics to whom these reflections make sense. Those who regard the mainstream prescriptions as self-evidently important will, perhaps inevitably, not find the following recommendations helpful.

Recommendation 5. Part of the self-imposed responsibility of the public intellectual[48] is to engage the public in critical issues, and for us, rural mathematics education is one such issue (among others, such as school consolidation and the outmigration of rural youth). Such scholars should write about the relevant issues in popular venues—in policy briefs and research translations, in large-circulation magazines in education, and in local and state newspapers. Research, in this vein, is not an esoteric or arcane technical exercise of interest only to fellow researchers, but a critical empirical engagement intended to yield practical results. Some of that practicality rests with well informed activism.

Recommendation 6. One high purpose of empirical research is to ask dangerous questions, and the recommendation is especially apt in the case of rural math education, a field conceived as a sort of provocation—to such questions as "what is math?" and "whose math is this anyway?" and "what's rural about math education?" and "what rural purposes should mathematics serve?" and "what mathematics knowledge will serve rural purposes?" ACCLAIM's empirical work has only scratched the surface.

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[47] The Research Initiative invited Scott to participate in one of the concluding ACCLAIM Research Symposia; Scott expressed interest but said his schedule conducting research in Southeast Asia prevented it.

[48] The sorts of thinkers and writers and activists for whom these recommendations are intended probably already consider themselves public intellectuals. ACCLAIM has collaborated with a broad swath of those long active and those who are joining the rural education and rural math education fields and the related frays.

As the foregoing list demonstrates, dangerous questions are not necessarily complex (on the surface) and they can perhaps better be seen in the silences and shadows of mathematics education and rural education. Dangerous questions, in fact, *are* dangerous because they bring such silences and shadows, and the meaning of such silences and shadows, into focus.

What makes such work *research*, however, and not activism or theory is systematic empirical engagement with the issues. Not all ACCLAIM's empirical work demonstrated dangerous question-asking, but among doctoral studies Nichols (2010) and Green (2008) are perhaps notable. Nichols initially wondered how traditional teaching could produce valued outcomes (high test scores) and that wonder led her to examine the quality of rural teachers' engagement with mathematics education reform; Green asked what remained of the work done by the Annenberg Rural Challenge in one locale. But other doctoral studies also engaged interesting and potentially "dangerous" issues.

Several useful guides exist to empirical approaches to studying rural education issues after the fashion embraced by ACCLAIM (Coladarci, 2004, 2007; Howley, 2001, 2009). Please observe that discovering ways to improve mathematics test scores in rural schools in not a dangerous, useful question, or even interesting question by these lights.

A Perspective on the Future: Finally

ACCLAIM's varied works and actions reaffirm the value of an education focused on social and civic aims and not strictly academic ones.[49] The Center also clearly affirms

[49] Academic aims are by no means equivalent to intellectual aims, and this truth is rarely acknowledged and perhaps not much understood. Academic aims are *school* aims and, as noted previously, have been shaped to serve dominant economic (human capital) ends. The historian Richard Hofstadter (1963, p. 234) wisely observed, "The values of business and intellect are…eternally and inevitably at odds." In the same work, he observed (p. 46), "Intellect needs to be understood not as some kind of a claim against the other human excellences for which a fatally high price must be paid, but rather as a complement to them without which they cannot be fully consummated." Reading, writing, and thinking mathematically are important for a

the value of an education and a schooling conscious of and responsive to rural place. Consciousness precedes response, and responsiveness is a negotiation of those elaborating a shared consciousness of rural place—citizens and educators together. Place-based education, moreover, cannot ethically be a simple implementation of what locally influential residents desire. Such a situation is less likely, some believe, under the guidance of a localist sort of communitarian framework (e.g. Theobald, 2009, 1997).

To readers whose views correspond with the current policy climate in education—geared as it is towards standards, accountability, and human capital—the work of ACCLAIM may seem an anachronism (see, e.g., Arnold, 2005, who referred to the approach as rural-conservative; a peculiar charge given the commitments of the ACCLAIM Framework). We want, finally, to give some account of the perspective of the Research Initiative, partly to address the concern raised by Arnold, who was an ACCLAIM author (see Arnold, 2003).

Many of us are not content, ideologically, with being forced into the left or the right shoe. Some of our colleagues have communitarian instincts, and these instincts lead such colleagues to question cultural and political forms that sponsor self-interest and greed. This outlook explains the interest of Raymond Willaims (1989) in cultural forms persisting in the margins (e.g., in the rural margins) of modernist culture; for both Williams and many of the ACCLAIM colleagues, rural life and rural communities are an essential, perhaps the essential, part of that work of reclamation…of reclamation, conservation, and advancement. This is not a nostalgic, nor a reactionary project. Many

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reason, and that reason isn't a test score. Important in themselves, the are also useful for creating and acting in the world.

of us indeed argue that sustaining rural community is an effort more concerned with the future than with the past.

One needs to remember that "conservation" has been a progressive project for at least 100 years (since the time of Theodore Roosevelt), and conservation efforts actually have made some progress since the opening of the previous century, despite the dire state of the global environment at present. The forces of conservation are, of course, outmaneuvered by the immense wealth and power of the forces of depredation. No surprise there!

That global crisis is another part of the present concern for many who seek to sustain rural communities. With many others, these colleagues believe, or predict, that a fully urbanized future will not be a humanly sustainable one. Perhaps a sustainable human future will be one altogether more humanly scaled, perhaps on the template of rural community. This sort of future ought to be one in which rural communities and peoples have an informed and assertive voice. Mathematical knowledge, ACCLAIM participants do believe generally, must inform such an imagined future voice, starting now.

References

Adsit, T. L. (2011). *Small schools, education, and the importance of community: Pathways to improvement and a sustainable future.* Blue Ridge Summit, PA: Rowman & Littlefield Education.

Alfonso, Z., & Long, V. (2005). *Graphing calculators and learning styles in rural and non-rural high schools* (Working Paper No. 24). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED494991

Allman, A. (2005). *Lessons from an old muleskinner's experience* (Occasional Paper No. 13). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

Anderson, R. (2006). *Factors contributing to rural high school students' participation in advanced mathematics courses* (Working Paper No. 34). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED494990

Anderson, R. (2007). Mathematics, meaning, and identity: A study of the practice of mathematics education in a rural high school (Portland State University, 2006). *Dissertation Abstracts International*, *68*. (AERA Rural Education SIG dissertation award winner, 2007)

Anyon, J. (1980). Social class and the hidden curriculum of work. *Journal of Education*, *162*(1), 67-92.

Appalachian Collaborative Center. (2002). *Theoretical framework for the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics* (Occasional Paper No. 1b). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. (See Appendix B)

Arnold, M. L. (2005). Jump the Shark: A rejoinder to Howley, Theobald, and Howley. *Journal of Research in Rural Education, 20*(20). Retrieved from http://www.umaine. edu/jrre/20-20.pdf

Arnold, M. L. (2003). *Mathematics teaching and learning in rural contexts: A social systems perspective* (Working Paper No. 5). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED474744

Arnold, M. L., Newman, J. H., Gaddy, B. B., & Dean, C. B. (2005). A look at the condition of rural education research: Setting a difference for future research. *Journal of Research in Rural Education, 20*(6). Retrieved from http://jrre.psu.edu/articles/20-6.pdf

Ayalon, A. (2003). Why is rural education missing from multicultural education textbooks? *The Educational Forum*, *68*, 24-31.

Beach, B. W. (2004). *Ponderings of a rural mathematics educator on others' perceptions of the teaching and learning of mathematics in rural areas* (Occasional Paper No. 9). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED484843

Beeson, E., & Strange, M. (2003). *Why rural matters 2003: The continuing need for every state to take action on rural education*. Washington, DC: Rural School and Community Trust.

Belcher, J., Britt, D., Granade, S., Powell, L., & Schlessinger, P. (2005). *Bus routing algorithms: application to a rural school district* (Working Paper No. 27). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED491045

Best, C. (2006). *Community college students' perceptions of their rural high school mathematics experience* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from http://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/CBestDissertation.pdf

Bickel, R., & Howley, C. W. (2003a). *Elementary math achievement for rural development: Effects of contextual factors intrinsic to the modern world* (Working Paper No. 15). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED474654

Bickel, R., & Howley, C.W. (2003b). Math achievement and the development of poor, rural areas: Effects of contextual factors intrinsic to the modern world. *Educational Foundations, 17*(4), 83-105.

Bickel, R., & McDonough, M. (1997). Opportunity, community, and reckless lives. *Journal of Social Distress and the Homeless*. 6: 29-44.

Bickel, R., Howley, C.W., & Maynard, S. (2003). "No Child Left Behind" in poor, Appalachian school districts: Confronting contextual factors in the modern world. *Journal of Appalachian Studies, 9*(2), 321-340.

Bierce, A. (1911). *The devil's dictionary*. New York & Washington, DC: Neale Publishing Co. Retrieved from http://www.gutenberg.org/ebooks/972

Boyd, B. (2007). *Effects of state tests in Ohio on assessment practices in mathematics education* (Unpublished doctoral dissertation). University of Louisville, Kentucky. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/BBoydDissertation.doc

Brown, R., Copeland, W. E., Costello, E., Erkanli, A., & Worthman, C. M. (2009). Family and community influences on educational outcomes among Appalachian youth. *Journal of Community Psychology*, *37*(7), 795-808. Doi:10.1002/jcop.20331

Bruner, J. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.

Bureau of Census. (2007). *Population 1790 to 1990: United States urban and rural population (Table 4)*. Washington, DC: US Bureau of the Census. Retrieved from http://www.census.gov/population/censusdata/table-4.pdf

Bush, W. S. (2002). *Culture and mathematics: An overview of the literature with a view to rural contexts* (Working Paper No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

Bush, W. S. (2003). *Bridging the gap between culture and mathematics: the Appalachian perspective* (Occasional Paper No. 2). Athens, OH: ACCLAIM Research Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED471919

Bush, W. S. (2005). Improving research on mathematics learning and teaching in rural contexts. *Journal of Research in Rural Education*, *20*(8). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/20-8.pdf

Campbell, P., & Silver, E. (1999). *Teaching and learning mathematics in poor communities*. Reston, VA: NCTM.

Carr, P., & Kefalas, M. (2009). *Hollowing out the middle: The rural brain drain and what it means for America*. Boston: Beacon Press.

Civil, M. (2006). *Working towards reform in mathematics education: Parents', teachers', and students' views of "different"* (Working Paper No. 31). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495032

Cogan, L., Schmidt, W., & Wiley, D. (2001). Who takes what math and in which track? Using TIMSS to characterize US students' eighth-grade mathematics learning opportunities. *Educational Evaluation and Policy Analysis*, *23*(4), 323-341.

Coladarci, T. (2004). *Reflections at 35,000 feet: An open letter to the ACCLAIM doctoral cohort*. (Occasional Paper No. 5). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics Education.

Coladarci, T. (2007). Improving the yield of rural education research: An editor's swan song. *Journal of Research in Rural Education, 22*(3). Retrieved August 27, 2007 from http://www.umaine.edu/jrre/22-3.pdf

Coleman, J., Campbell,, E., Hobson, C., McPartland, J., Weinfeld, F., & York, R. (1966). *Equality of educational opportunity*. Washington D.C.: National Center for Educational Statistics, Department of Health, Education, and Welfare. Retrieved from http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED012275

Conant, J. (1959). *The American high school today*. New York: McGraw-Hill.

Cooney, T. J. (2003). *Mathematics teacher education in rural communities: Developing a foundation for action* (Working Paper No. 6). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED475058

Cook, T. D. (2002). Randomized experiments in education: Why are they so rare? *Educational Evaluation and Policy Analysis, 24*(3), 175-199.

Corbett, M. (2011). *A companion to the film, Putting mathematics education in its place* (Working Paper No. 41). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-publications/WP41Corbett7.15.11.pdf

Corbett, Michael J. (2007). *Learning to leave: The irony of schooling in a coastal community*. Halifax, NS: Fernwood.

Cremin, L. (1961). *The transformation of the school*. New York: Vintage Books.

Crenson, M., and Ginsberg, B. (2002). *Downsizing democracy*. Baltimore, MD: John Hopkins.

Cubberley, E. (1914). *Rural life and education: A study of the rural-school problem as a phase of the rural-life problem*. Boston, MA: Houghton Mifflin.

Cummings, S. (1998). *Left behind in Rosedale*. Boulder, CO: Westview.

Daly, A. (2009). Rigid response in an age of accountability: The potential of leadership and trust. *Educational Administration Quarterly, 45* (2), 168-216.

DeBoer, G. (2004). High-quality assessment items on the horizon. *2061 Connections*. Retrieved on January 5, 2006, from http://www.project2061.org/publications/2061Connections/2004/2004-05c.htm

Derrida, J. (1980). *Writing and difference*. Chicago: University of Chicago Press.

DeYoung, A. (1991). Preface. In A. DeYoung (Ed.), *Rural education: Issues and practice* (p. ix-xii). New York: Garland

DeYoung, A. J. (2003). *The social construction of rural mathematics: Conjectures, contradictions and a few hypotheses.* (Working Paper No. 7). Athens, OH: ACCLAIM Research Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED474125

DeYoung, A. J. (2003). *The social construction of rural mathematics: Final report to ACCLAIM.* (Working Paper No. 17). Athens, OH: ACCLAIM Research Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/ servlet/ERICServlet?accno=ED512642

DeYoung, A. J. (2002). *Dilemmas of rural life and livelihood: Academics and community.* (Working Paper No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED471920

DeYoung, A. (1995). *The life and death of a rural American high school: Farewell, Little Kanawha*. New York: Garland.

Dix, K. (1989). *What's a coal miner to do: The mechanization of coal mining*. Pittsburg: University of Pittsburgh.

Domina, T. (2006). What clean break? Education and nonmetropolitan migration patterns, 1989-2004. *Rural Sociology*, *71*(3), 373-398.

Edington, E., & Koehler, L. (1987). *Rural student achievement: Elements for consideration* (ERIC Digest). Las Cruces, NM: ERIC Clearinghouse on Rural Education and Small Schools. Retrieved from http://eric.ed.gov/ERICWebPortal/ contentdelivery/ servlet/ERICServlet?accno=ED289658

Edson, C.H. (1979). Sociocultural perspectives on work and schooling in urban 84lobali. *The Urban Review*, *11*(3), Retrieved from http://journals.ohiolink.edu/ejc/pdf.cgi/ Edson_C._H.pdf?issn=00420972&issue=v11i0003&article=127_spowasiua

Egan, K. (2002). *Getting it wrong from the beginning: Our progressivist inheritance from Herbert Spencer, John Dewey, and Jean Piaget*. New Haven, CT: Yale University Press.

Eglash, R. (2004). *Black chaos, white trash: Order and disorder at the intersection of mathematics and culture* (Occasional Paper No. 7). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/ servlet/ERICServlet?accno=ED484861

Erlandson, J. M. (2008). Racing a Rising Tide: Global Warming, Rising Seas, and the Erosion of Human History. *Journal of Island & Coastal Archaeology*, 3(2), 167-169. Doi:10.1080/15564890802436766

Etzioni, A. (1998). *The new golden rule: Community and morality in a democratic society*. New York: Basic Books.

Fanselow, J. (2006). Expanding the school circle. Principal Leadership, 7(3), 27-31.

Fears, K. (2011). *Making the most of NAR's local market updates*. Retrieved from http://www.realtor.org/research/reinsights/infocus

Frankenstein, M. (1990). Incorporating race, class, and gender issues into a critical mathematical literacy curriculum. *Journal of Negro Education*, *59*(3), 336-347

Freudenburg, W. R., & Wilson, L. J. (2002). Mining the data: Analyzing the economic implications of mining for nonmetropolitan regions. *Sociological Inquiry*, 72(4), 549-575.

Fugitt, J. (2008). *Does the grade level at which Algebra I is completed affect future mathematics performance?* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/JFugittfinalpdf.pdf

Fuller, W. (1982). *The old country school*. Chicago: University of Chicago Press.

Gatto, J. T. (2002). *Dumbing us down: The hidden curriculum of compulsory schooling* (Vol. 2). Gabriola Island, BC: New Society Publishers.

Gjelton, T. (1982). *A typology of rural school settings*. Washington, DC: U.S. Department of Education.

Glascock, C. H. (2003). *The principal as instructional leader: A position for enhancing mathematics learning in rural schools* (Working Paper No.8). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED475870

Gleason, J., Belcher, J., Britt, D., & Savich, P. (2008). Incorporating a critical pedagogy of place in the mathematics classroom: Rural school busing. *Journal of Teaching and Learning, 5*(2), 23-36.

Good, C.J. (2010). A nation at risk: Committee members speak their mind. *American Educational History Journal*, *37*(2), 367-386.

Grant, M. (2002). *Down and out on the family farm: rural rehabilitation on the great plains, 1929-1945*. Lincoln, NE: University of Nebraska.

Green, C. (2008). *The Annenberg rural challenge ten years later: looking for a place for mathematics in a rural Appalachia place-based curriculum* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/CGreenDissertation.pdf

Greenwald, R., Hedges, L., & Laine, R. (1996). The effect of school resources on student achievement. *Review of Educational Research, 66*(3), 361-396.

Gregory, J. (2007). *Presentation software and its effects on developmental students' mathematics attitudes* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/JGregoryDissertation.pdf

Gruenewald, D. (2006). Resistance, reinhabitation, and regime change. *Journal of Research in Rural Education, 21*(9). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/21-9.pdf

Gruenewald, D. (2006). *Resistance, reinhabitation, and regime change* (Working Paper No. 30). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495029

Gruenewald, D. A., & Smith, G. A. (2008). *Place-based education in the global age : local diversity*. New York: Lawrence Erlbaum Associates.

Habermas, J. (1987). *Lifeworld and system: A critique of functionalist reason* (The Theory of Communicative Action, Volume 2, T. McCarthy, trans.). Boston: Beacon Press.

Hackenberg, A. J., & Mewborn, D. S. (2004). *Questioning assumptions: A critical pedagogical perspective on mathematics teaching and learning in rural places.* (Working Paper No. 18). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED498108

Hamlin, H. M. (1968). Education to serve occupational ends. *Monthly Labor Review*, 91(3), 49.

Harmon, H. L. (2003). *Interdisciplinary research for teaching and learning mathematics in rural schools: Considerations for creating a mathematics and vocational education research agenda* (Working Paper No. 9). Athens, OH: ACCLAIM Research Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED476058

Hartford, E. (1977). *The little white schoolhouse*. Lexington, KY: University of Kentucky Press.

Hatfield, L. L. (2003). *Up the back holler, down the dusty road, cross the windy prairie: Issues, perspectives, and strategies for research in the crisis of improving mathematical education of rural youth* (Working Paper No. 10). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED474108

Hattie, J. (2008). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. New York: Routledge.

Heaton, R., Smith, W., Kromminga, R., & Hartman, D. (2008). *Understanding the meaning of rural within a middle school mathematics professional development and research project in Nebraska* (Working Paper No. 40). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED512641

Hektner, J. M. (1995). When moving up implies moving out: Rural adolescent conflict in the transition to adulthood. *Journal of Research in Rural Education*, *11*(1), 3–14.

Hemelt, S. W. (2011). Performance effects of failure to make Adequate Yearly Progress (AYP): Evidence from a regression discontinuity framework. *Economics of Education Review*, 30(4), 702-723.

Herzog, M. J. R. (1996). *Conditions, attitudes and concerns in rural education: An examination of the Appalachian counties of North Carolina.* Paper presented at the Annual Meeting of the National Rural Education Association, San Antonio, Texas. (ERIC Document Reproduction Service No. ED411104)

Herzog, M. J., & Pittman, R. (1995). Home, family, and community: Ingredients in the rural education equation. *Phi Delta Kappan*, *77*(2), 13-18.

Hobsbawm, E. (1992). *Nations and nationalism since 1780: Programme, myth, reality* (Vol. 2). New York: Cambridge University Press.

Hoffman, L. (2002). *Overview of public elementary and secondary schools and districts: School year 2000–01*, (NCES 2002–356). Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved May 30, 2003 from: http://nces.ed.gov/pubs2002/2002356.pdf

Hofstadter, R. (1963). *Anti-intellectualism in American life*. New York: Vintage Books.

Hollingshead, A. (1949). *Elmtown's youth*. New York: John Wiley and Sons, Inc.

Hopkins, T. (2005). Gender issues in mathematics education in Tennessee: Does rural school locale matter? (Doctoral dissertation, University of Tennessee, 2005). *Dissertation Abstracts International*, *65*, 3315. (AERA Rural Education SIG dissertation award winner, 2005)

Howley, A., Gholson, M., & Pendarvis, E. (2006). *How talented rural students experience school mathematics* (Working Paper No. 29). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED494992

Howley, A., Howley, C., Burgess, L, & Pusateri, D. (2008). Social class, Amish culture, and an egalitarian ethos: Case study from a rural school serving Amish children. *Journal of Research in Rural Education*, *23*(3). Retrieved from http://jrre.psu.edu/articles/23-3.pdf

Howley, A., Howley, C. B., & Helm, V. (2007). *Reform of secondary mathematics education in high-performing rural schools* (Working Paper No. 36). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED498066

Howley, A., Howley, C., Klein, R., Belcher, J., Howley, M., Tusay, M., Clonch, S. Perko, H., Foley, G., Pendarvis, E., Miyafusa, S., & Jimerson, L. (2010). *Community and place in mathematics instruction in selected rural schools* [ACCLAIM Monograph No. 4]. Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

Howley, C., Howley, A., & Pendarvis, E. (1995). *Out of our minds: Anti-intellectualism in American schooling*. New York: Teachers College Press.

Howley, A., Howley, M., Camper, C., & Perko, H. (2011). Place-based education at Island Community School. *The Journal of Environmental Education, 42*(4), 216-236.

Howley, A., Larson, W., Adrainaivo, S., Rhodes, M., & Howley, M. (2007, May 17). Standards-based reform of mathematics education in rural high schools. *Journal of Research in Rural Education, 22*(2). Retrieved from http://jrre.psu.edu/articles/22-2.pdf

Howley, A., Pendarvis, E., & Gholson, M. (2006). How talented rural students experience mathematics. *Journal for the Education of the Gifted, 29*(2), 123-160.

Howley, A., Showalter, D., Howley, M., Howley, C., Klein, R., & Johnson, J. (2011). Challenges for place-based mathematics pedagogy in rural schools and communities in the United States. *Children, Youth, and Environment*, *21*(1), 101-127. Retrieved from http://www.colorado.edu/journals/cye/21_1/21_1_05_MathematicsPedagogy.pdf

Howley, C. B. (2009). Critique and fiction: Doing science right in rural education research. *Journal of Research in Rural Education*, *24*(15). Retrieved January 5, 2010, from http://jrre.psu.edu/articles/24-15.pdf

Howley, C. B. (2004). *Ten precepts about the circumstance of rural education* (Occasional Paper No. 11). Athens, OH: ACCLAIM Research Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED491047

Howley, C. B. (2004). A critical introduction to useful works about rural life and education. *Journal of Education Finance, 29*(3), 257-272.

Howley, C. B. (2003a). *Making education research behave: Reflections from the rural lifeworld* (Occasional Paper No. 5).University Park, PA: Center on Rural Schools and Communities, Pennsylvania State University. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED512640

Howley, C. B. (2003b). Understanding mathematics education in rural context. *Educational Forum, 67*(3), 215-224.

Howley, C. B. (2002a). *Research about mathematics achievement in the rural circumstance.* (Working Paper No. 4). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED471921

Howley, C. B. (2002b). *What is our work? Planning a future understanding of mathematics education in rural context—a prolegomenon.*(Occasional Paper No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED471917

Howley, C. B. (2001). Understanding the circumstances of rural schooling: The parameters of respectful research. In S. Henderson (Ed.), *Understanding achievement in science and mathematics in rural school settings* (pp. 16-21). Lexington, KY: Appalachian Rural Systemic Initiative. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED467507

Howley, C. B., (Ed.), with Belcher, J., Britt, D., Brown, V., Buckner, B., Fugitt, J., Granade, S., Green, C., Jones, S., Kenady, K., Mayes, C., Music, L., Nichols, S., Ratliff, M., Schlesinger, P., Smith, N., Smith, R., Waggoner, D., & Zelkowski, J. (2006). *Proceedings of the Third ACCLAIM Research Symposium* (Occasional Paper No. 14). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495030

Howley, C. B., & Eckman, J. M. (1997). *Sustainable small schools: A handbook for rural communities*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. Retrieved from http://www.eric.ed.gov/ERICWebPortal/contentdelivery/ servlet/ERICServlet?accno=ED402136

Howley, C. B., & Gunn, E. (2003). Mathematics achievement in the rural circumstance. *Journal of Research in Rural Education, 18*(2), 86-95.

Howley, C. B., & Harmon, H. L. (2000). *Small high schools that flourish: Rural context, case studies, and resources*. Charleston, WV: AEL, Inc. Retrieved from http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED447997

Howley, C. B., & Howley, A. (2004, September 24). School size and the influence of socioeconomic status on student achievement: Confronting the threat of size bias in national data sets. *Education Policy Analysis Archives, 12*(52). Retrieved February 14, 2009, from http://epaa.asu.edu/epaa/v12n52/

Howley, C. B., Howley, A. A., & Hopkins, T. (2005). *Does place influence mathematics achievement outcomes? An investigation of the standing of Appalachian Ohio school districts* (Working Paper Series 23). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED484787

Howley, C. B., Howley, A. A., Howley, C. W., & Howley, M. D. (2006). *Saving the children of the poor in rural schools* (Working Paper No. 28). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495031

Howley, C. B., Howley, A., & Huber, D. (2005). Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature. *Journal for Research in Rural Education, 20*(7). Retrieved from www.jrre.psu.edu/articles/20-7.pdf

Howley, C. B., Johnson, J., & Petrie, J. (2011). Consolidation of schools and districts: what the research says and what it means. *National Education Policy Center*. Retrieved from http://www.eric.ed.gov/PDFS/ED515900.pdf

Howley, C. B., Theobald, P., & Howley, A. (2005). What education research is of most worth? A reply to Arnold, Newman, Gaddy, and Dean. *Journal of Research in Rural Education, 20*, 18.

Huber, D. S., Howley, A. A., & Howley, C. B. (2004). *Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature* (Working Paper No. 22). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495025

Hursh, D. (2008). *High-stakes testing and the decline of teaching and learning: The real crisis in education*. Plymouth, UK: Rowman & Littlefield.

Inverness Research Associates. (2001). *Setting the foundation for reform: The work of the Rural Systemic Initiatives*.

Jacobs, J. (1984). *Cities and the wealth of nations: Principles of economic life*. New York: Random House.

Johanningmeier, E.V. (2010). A Nation At risk and Sputnik: Compared and reconsidered. *American Educational History Journal*, *37*(2), 347-365.

Jones, S. (2008). *The question of learning equity between online and onsite undergraduate mathematics courses in rural Appalachia* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/SJonesDissertation.pdf

Kilborn, P.T. (2005, June 1). The five-bedroom, six-figure rootless life. *The New York Times*. Retrieved July 21, 2011 from: http://www.nytimes.com/2005/06/01 /national/class/01ALPHARETTA-FINAL.html?adxnnl=1&pagewanted =print&adxnnlx=1311281575-LjOt9lf5Zaf6PyeVQY+dfg

Killeen, K., & Sipple, J. (2000). *School consolidation and transportation policy: An empirical and institutional analysis*. Randolph, VT: Rural School and Community Trust.

Klein, R. (2007). *Educating in place: Mathematics and technology* (Working Paper No. 38). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED500472

Klein, R. (2008). Educating in place: Mathematics and technology. *Philosophical Studies in Education, 38, 119-130.*

Kunstler, J. H. (1993). *The geography of nowhere: The rise and decline of America's man-made landscape*. New York: Simon and Schuster.

Larson, W., & Howley, A. (2006). *Leadership of mathematics reform: The role of high school principals in rural schools* (ACCLAIM Monograph No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/ contentdelivery/servlet/ERICServlet?accno=ED498435

Lee, J. (2003). Evaluating rural progress in mathematics achievement: Threats to the validity of "Adequate Yearly Progress." *Journal of Research in Rural Education*, *18*(2), 67-77.

Lee, J. (2003). *Evaluating rural progress in mathematics achievement: Is Adequate Yearly Progress feasible, valid, reliable, and fair?* (Working Paper No.11). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/ contentdelivery/servlet/ERICServlet?accno=ED475060

Lee, J. (2006). Tracking achievement gaps and assessing the impact of NCLB on the gaps: an in-depth look into national and state reading and math outcome trends. *Civil Rights Project at Harvard University*. June 1, 2006; Available from: ERIC, Ipswich, MA. Accessed July 29, 2011.

Lipka, J., & Adams, B. (2004). *Culturally based math education as a way to improve Alaska Native students' math performance* (Working Paper No. 20). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED484849

Long, V., Bush, W. S., & Theobald, P. (2003). *Place value: The rural perspective* (Occasional Paper No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED478060

Lowe, J. (2000). International examinations: the new credentialism and reproduction of advantage in a globalizing world. *Assessment in Education*, *7*(3). 363-377.

Lubienski, S. T. (2006). *Reflections from a working-class scholar who resists and embraces scholarship in mathematics education* (Working Paper No. 32). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495027

Lucas, D. (2005). *A rural community's perceptions of the importance of math and math education in Appalachia* (Monograph No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-publications/M01Lucas.pdf

Lucas, D. M., & Fugitt, J. (2007). *The perception of math and math education in the rural Midwest* (Working Paper No. 37). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED498062

Lucas, D., & Fugitt, J. (2009). The perceptions of math and math education in *Midville*, Illinois. *The Rural Educator, 31*(1), 38-54.

Mahoney, C. R. (2003). *Mathematics education in rural communities: A mathematician's view* (Working Paper No. 12). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED474124

Mayes, R. (2004). *Review of distance education literature* (Occasional Paper No. 6). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

McGatha, M., Bush, W. S., & Thorn, D. (2005). *Becoming a leader in mathematics: A study of leaders' professional development experiences, awareness, beliefs, and attitudes* (Working Paper No. 26). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED494989

Meier, D. (1995). *The power of their ideas: Lessons for America from a small school in Harlem*. Boston: Beacon Press.

Mellon, S. (2002). *After the smoke clears: struggling to get by in rustbelt America*. Pittsburgh: University of Pittsburgh.

Miller, B. A., & Hahn, K. J. (1997). *Finding their own place: Youth in three small rural communities take part in instructive school-to-work experiences*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED413122

Mills, J. I. (2008). A Legislative Overview of No Child Left Behind. *New Directions for Evaluation*, (117), 9-20.

Moses, R., & Cobb, C. (2001). *Radical equations: Civil rights from Mississippi to the Algebra Project*. Boston: Beacon Press.

National Center for Education Statistics. (2002). *Local education agency (school district) universe survey, longitudinal data file: 1986-1997* [Data file; district statistics reported on p _ computed from data]. Retrieved May 29, 2003 from: http://nces.ed.gov/ccd/ccd12yragency.asp

Nelson, K., Simonsen, L., & Swanson, E. (2003). *Research issues for mathematics education in rural communities: Focus on Native Americans* (Working Paper No. 13). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED478056

Nichols, S. (2010). *Perceptions and implementation of the Ohio Academic Content Standards for Mathematics among middle school teachers* (Unpublished doctoral dissertation). Ohio University, Athens.

Olsen, B., & Sexton, D. (2009). Threat rigidity, school reform, and how teachers view their work inside current education policy contexts. *American Educational Research Journal, 46*(1), 9-44.

O'Malley, K. et al. (2009). *Review of states' growth models developed under US ED growth model pilot program, 2005-2008*. ASR-SCASS paper, Washington, DC: CCSSO. Retrieved from http://www.ccsso.org/Resources/Publications/Guide_to_United_States_Department_of_Education_Growth_Model_Pilot_Program_2005-2008.html

Osei-Kofi, N. (2005). Pathologizing the poor: A framework for understanding Ruby Payne's work. *Equity and Excellence in Education, 38*(4), 367-375.

Orfield, G., &Yun, J. (1999). *Resegregation in American schools*. Cambridge, MA: Harvard University, Civil Rights Project.

Owens, S.K. (2010). *Professional development: a case study of Mrs. G* (Unpublished doctoral dissertation). University of Louisville, Kentucky. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/SKOwensDissertation.doc?attredirects=0&d=1

Passmore, S. (2002*). Education and smart growth: Reversing school sprawl for better schools and communities*. Retrieved from http://www.fundersnetwork.org/learn/education_and_growth/

Pendarvis, E. (2005). *Research on teacher learning communities: Implications for professional development for mathematics teachers in rural schools* (Working Paper No. 25). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495028

Perkinson, H. (1995). *The imperfect panacea* (4th ed.) New York: McGraw-Hill.

Perry, C. (2007). *Motivation and attitude of preservice elementary teachers toward mathematics: is rural relevant?* (Unpublished doctoral dissertation). University of Louisville, Kentucky. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/CPerryDissertation.pdf

Plank, D. N., & Dunbar, C., Jr. (2007). Michigan: Over the first hurdle. In F. M. Hess, & C. E. Finn Jr. (Eds.), No remedy left behind: lessons from a half-decades of NCLB (pp. 202–222). Washington, DC: AEI Press.

Podmolik, M.E. (2010, August 24). Chicago area home sales plunge in July: despite significant price declines, housing market dries up after federal tax credit ends. *Chicago Tribune*. Retrieved July 21, 2011 from: http://articles.chicagotribune.com/2010-08-24/classified/ct-biz-0825-home-sales—20100824_1_median-sales-price-record-low-mortgage-rates-single-family-homes

Popkewitz, T. (2007). *Cosmopolitanism and the age of school reform: Science, education, and making society by making the child*. New York: Routledge.

Popkewitz, T. (2004). The alchemy of the mathematics curriculum: Inscriptions and the fabrication of the child. *American Educational Research Journal, 41*(1), 3-34.

Powell, W. (1988). Institutional effects on organizational structure and performance. In G. Lynne (Ed.), *Institutional patterns and organizations: Culture and environment* (115-36). Cambridge, MA: Ballinger.

Powers, A., & Duffin, M. (2003). *An evaluation of the Community-Based School Environmental Education project (CO-SEED)*. Retrieved from http://www.antiochne.edu/anei/download/56_02_03_co_seed_eval_web.pdf

Ratliff, M. (2011). *Preservice secondary school mathematics teachers' current notions of proof in Euclidean geometry* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/RatliffMichaeldissertation.pdf

Ravitch, D. (2011). *The death and life of the great American school system: How testing and choice are undermining education*. New York: Basic Books.

Rice, C. (2007). *Comparing recent high school graduates placed in developmental and college-level mathematics courses* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/CRiceDissertation.doc

Sassen, S. (1996). *Losing control? Sovereignty in an age of globalization*. New York: Columbia University Press.

Schlechty, P. C. (2008). No community left behind. *Phi Delta Kappan, 89*(8), 552-559.

Schmidt, M. (2004). *Rural roots, urban harvest, and giving back to the land* (Occasional Paper No. 8). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED486404

Schoenfeld, A. H. (2006). What doesn't work: The challenge and failure of the What Works Clearinghouse to conduct Meaningful reviews of studies of mathematics curricula. *Educational Researcher*, *35*(2), 13-21. Retrieved from http://www.aera.net/uploadedFiles/Publications/Journals/Educational_Researcher/3502/03ERv35n2_Schoenfeld.pdf

Schultz, J. E. (2002). *Mathematics education in rural communities in light of current trends in mathematics education* (Working Paper No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED471918

Schumacher, E. F. (1973). *Small is beautiful: Economics as if people mattered*. London: Blond & Briggs.

Schwartzbeck, T. D., Redfield, D., Morris, H., & Hammer, P. C. (2003). *How are rural school districts meeting the teacher quality requirements of No Child Left Behind?* Charleston, WV: Appalachia Educational Laboratory.

Scott, J. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven: Yale University Press.

Shaker, P. S., & Heilman, E. E. (2008). Scapegoating public schools. School Administrator, 65(6), 27-29.

Shelton, J. (2005). *Consequential learning: A public approach to better schools*. Montgomery, AL: New South Books.

Sherman, J. (2006). Coping with rural poverty: economic survival and moral capital in rural America. *Social Forces*, *85*(2), 891-913.

Sherwood, T. (2001). *Where has all the "rural" gone: Rural education research and current federal reform*. Randloph, VT: Rural School and Community Trust.

Silver, E. A., & Castro, A. M. (2003). *Mathematics learning and teaching in rural communities: some research issues* (Working Paper No. 14). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED475059

Skovsmose, O. (1994). *Towards a philosophy of critical mathematics education*. Dordrecht, NE: Kluwer.

Sloan, M. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors*. Unpublished doctoral dissertation, University of Georgia, Athens. (AERA Rural Education SIG dissertation award winner, 2007)

Sloan, M. H. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors* (Working Paper No. 35). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495024

Smith, A. (1776). *The Wealth of Nations*. Edited by Edwin Cannan. Published by The Modern Library, Inc. Printed 1937. New York: Random House, Inc.

Smith, R. (2010). *The impact of secondary mathematics methods courses on preservice secondary teachers' beliefs about the learning and teaching of mathematics* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.

Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/SmithRonaldAugust2010Dissertation.pdf

Smith, V. (2009, December 20). *Violence next in mountaintop mining battle? more active protests lead to online threats, throat-slitting gesture*. Retrieved from http://www.msnbc.msn.com/id/34492139/ns/us_news-environment/t/violence-next-mountaintop-mining-battle/

Sobel, D. (2004). *Place-based education: Connecting classrooms and communities*. Great Barrington, MA: The Orion Society.

Spence, B. (2000). *Long school bus rides: Their effect of school budgets, family life, and student achievement*. Charleston, WV: Appalachian Regional Education Laboratory.

St. John, M., Helms, J., & Smith, A. (2008). *Findings from Inverness Research Associates evaluation of the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics* (Working Paper No. 39). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED512643

Stigler, J. W., & Hiebert, J. (1999). *The teaching gap.* New York: The Free Press.

Stiglitz, J. (2002). *Globalization and its discontents*. New York: W.W. Norton.

Stockard, J. (2011). Increasing reading skills in rural areas: An analysis of three school districts. *Journal of Research in Rural Education, 26*(8). Retrieved from http://jrre.psu.edu/ articles/26-8.pdf

Stockard, J. (2010). An analysis of the fidelity implementation policies of the What Works Clearinghouse. *Current Issues in Education, 13*(4). Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=EJ907003

Taylor, M., Ferrell, B., Hopkins, T. (2007). Professional development for mathematics teachers: A team approach. *Mathematics Teacher*, *100*(5), 362-366.

Theobald, P. (2009). *Education now: How rethinking America's past can change its future*. Boulder, CO: Paradigm.

Theobald, P. (2005). *Representing rural context in doctoral-level math education courses: A guide for mathematics education professors* (Occasional Paper No. 12). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED485731

Theobald, P. (1997). *Teaching the commons: Place, pride, and the renewal of community*. Boulder, CO: Westview.

Theobald, P., & Howley, C.B. (2011, April). *Deconstructing "best practice": An examination of what is "best" in the discourse surrounding rural schooling*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Timar, T., & Tyack, D. (1999). *The invisible hand of ideology: Perspectives from the history of school governance*. Denver, CO: Education Commission of the States. (ERIC Document Reproduction Service No. ED433609)

Tyack, D. (1974). *The one best system*. Cambridge: Harvard University Press.

Tye, B. B. (2000). *Hard truths: Uncovering the deep structure of schooling*. New York: Teachers College Press.

Valencia, R. R., ed. 1997. *The evolution of deficit thinking: Educational thought and practice.* London, England: Falmer.

Wall, M., & Luther, V. (1988). *Schools as entrepreneurs: Helping small towns survive*. Lincoln, NE: Heartland Center for Leadership Development.

Wanich, W. (2006). *Place-based education in the United States and Thailand: With implications for mathematics education* (Working Paper No. 33). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED495019

Waters, M. S. (Ed.). (2005). *A mathematics educator's introduction to rural policy issues* (Monograph No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED491046

Waters, M., Howley, C., & Schultz, J. (2008). An initial research agenda for studying rural mathematics education. *Journal of Appalachian Studies, 14*(1&2), 125-144.

Waters, M., Howley, C., & Schultz, J. (2004). *An initial research agenda for rural mathematics education* (Working Paper No. 16, Revised). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics. Retrieved from http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED498099

Webb, N. L. (1999). *Alignment of science and mathematics standards and assessments in four states* (Research Monograph No. 18). National Institute for Science Education. Madison, WI: University of Wisconsin-Madison, National Institute for Science Education.

Weber, E. (1976). *Peasants into Frenchmen: The modernization of rural France, 1870-1914*. Stanford, CA: Stanford University Press.

Weiss, I. R., Pasley, J. D., Smith, P. S., Banilower, E. R., and Heck, D. J. (2003). *Highlights report, looking in the classroom: A study of K-12 mathematics and science education in the United States.* Chapel Hill, NC: Horizon Research.

Weisman, A. (1998). *Gaviotas: A village to reinvent the world*. White River Junction, VT: Chelsea Green Publishing Company.

Williams, J. H. (2005, April 23). Cross-national variations in rural mathematics achievement: A descriptive overview. *Journal of Research in Rural Education*, *20*(5). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/20-5.pdf

Williams, R. (1973). *The country and the city*. New York: Oxford University Press.

Williams, R. (1989). *The politics of modernism*. London: Verso.

Winters, J. (2003). *Development of the Research Initiative website: Input from focus groups* (Occasional Paper No. 4). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

Zancanella, D. (2008). Seeing like a teacher. *English Education, 40*(3), 166-173.

Zars, B. (1998). *Long rides, tough hides: Enduring long school bus rides*. Randolph, VT: Rural School and Community Trust.

Zelkowski, J. (2008). *Important secondary mathematics enrollment factors that influence the completion of a bachelor's degree*. (Unpublished doctoral dissertation). Ohio University. Retrieved from https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertatioins/JZelkowskiDissertationAbstractOnly.pdf

APPENDICES

Appendix A: Table of ACCLAIM works replaced by later versions

Earlier versions	Later versions
02.05. Howley, C. B. (2002). *Research about mathematics achievement in the rural circumstance.* (Working Paper No. 4). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	03.12. Howley, C., & Gunn, E. (2003). Mathematics achievement in the rural circumstance. *Journal of Research in Rural Education, 18*(2), 86-95.
03.02. Bickel, R., & Howley, C. W. (2003). *Elementary math achievement for rural development: Effects of contextual factors intrinsic to the modern world* (Working Paper No. 15). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	03.03. Bickel, R., & Howley, C.W. (2003). Math achievement and the development of poor, rural areas: Effects of contextual factors intrinsic to the modern world. *Educational Foundations, 17*(4), 83-105.
03.07. DeYoung, A. J. (2003). *The social construction of rural mathematics: conjectures, contradictions and a few hypotheses.* (Working Paper No. 7). Athens, OH: ACCLAIM Research Initiative.	03.08. DeYoung, A. J. (2003). *The social construction of rural mathematics: Final report to ACCLAIM.* (Working Paper No. 17). Athens, OH: ACCLAIM Research Initiative.
03.15. Lee, J. (2003). *Evaluating rural progress in mathematics achievement: Is Adequate Yearly Progress feasible, valid, reliable, and fair?* (Working Paper No. 11). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	03.16. Lee, J. (2003). Evaluating rural progress in mathematics achievement: Threats to the validity of "Adequate Yearly Progress." *Journal of Research in Rural Education*, *18*(2), 67-77.
04.07. Huber, D. S., Howley, A. A., & Howley, C. B. (2004). *Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature* (Working Paper No. 22). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	05.06. Howley, C., Howley, A., & Huber, D. (2005, June 1). Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature. *Journal for Research in Rural Education, 20*(7).
04.11. Waters, M., Howley, C., & Schultz, J. (2004). *An initial research agenda for rural mathematics education* (Working Paper No. 16, Revised). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in	08.08. Waters, M., Howley, C., & Schultz, J. (2008). An initial research agenda for studying rural mathematics education. *Journal of Appalachian Studies, 14*(1&2), 125-144.

Mathematics.	
06.04. Gruenewald, D. (2006). *Resistance, reinhabitation, and regime change* (Working Paper No. 30). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	06.05. Gruenewald, D. (2006, August 2). Resistance, reinhabitation, and regime change. *Journal of Research in Rural Education, 21*(9). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/21-9.pdf
06.07. Howley, A., Gholson, M., & Pendarvis, E. (2006). *How talented rural students experience school mathematics* (Working Paper No. 29). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	06.08. Howley, A., Pendarvis, E., & Gholson, M. (2006). How talented rural students experience mathematics. *Journal for the Education of the Gifted, 29*(2), 123-160.
06.11. Larson, W., & Howley, A. (2006). *Leadership of mathematics reform: The role of high school principals in rural schools* (ACCLAIM Monograph No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	07.04. Howley, A., Larson, W., Adrainaivo, S., Rhodes, M., & Howley, M. (2007, May 17). Standards-based reform of mathematics education in rural high schools. *Journal of Research in Rural Education, 22*(2). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/22-2.pdf
06.13. Sloan, M. *Mathematics education in rural Georgia: Social, political, and economic factors*. Unpublished doctoral dissertation, University of Georgia, Athens. (AERA Rural Education SIG dissertation award winner, 2007)	06.14. Sloan, M. H. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors* (Working Paper No. 35). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
07.06. Klein, R. (2007). *Educating in place: Mathematics and technology* (Working Paper No. 38). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	08.06. Klein, R. (2008). Educating in place: Mathematics and technology. *Philosophical Studies in Education, 38, 119-130*.
07.07. Lucas, D. M., & Fugitt, J. (2007). *The perception of math and math education in the rural Midwest* (Working Paper No. 37). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.	09.02. Lucas, D., & Fugitt, J. (2009). The perceptions of math and math education in *Midville*, Illinois. *The Rural Educator, 31*(1), 38-54.

Appendix B: ACCLAIM's Theoretical Framework

Theoretical Framework
for the Appalachian Collaborative Center for
Learning, Assessment, and Instruction in Mathematics (ACCLAIM)
revision of 09.17.03

Précis

ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The Center addresses the mission through efforts to (1) understand the rural context as it pertains to learning and teaching mathematics; (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people; and (3) improve the professional development of mathematics teachers and leaders in and for rural communities.

Theoretical Framework

The following statement abstracts the theoretical framework for the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM). ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. It is informed by a number of more extensive works (e.g., Bush, 2002; DeYoung, 2002; Howley, 2002a, 2002b; Schultz, 2002).

The mission addresses local organizational ability to (1) understand the rural context as it pertains to learning and teaching mathematics and (2) articulate (in written works) the meaning and utility of that learning *in, for, and by rural people*. Such inquiry - and particularly the habits and dispositions of such inquiry - is relevant to developing a capacity for realizing better, or truer, mathematics education in rural places.

Ideally, developing important mathematical processes within the rural context involves:

- modeling the features of natural and social existence (in mathematical terms);

- solving problems (in a mathematical mode);

  --manipulating the language, symbols, and conventions of mathematics as needed for problem-solving;

  --understanding the mathematical concepts and practicing the mathematical skills that underlie problem-solving;

- reasoning inductively from data and deductively from assumptions; and,

- knowing oneself mathematically (engaging in mathematics historically, culturally, and personally, with consideration for both the cognitive and affective domains).

Promoting such mathematical processes will hypothetically allow ACCLAIM to embed mathematical meaning within rural contexts.

Contextual features, however, such as mandated testing, available textbooks, inadequate funding, and the expectations and experiences of rural parents influence what actually happens in mathematics classrooms in rural schools (Campbell & Silver, 1999; Schultz, 2002).

Sadly, professional educators and researchers too often regard context as a *deficiency* from which students and their communities ought, somehow, to be rescued. This observation is particularly salient in the case of rural and urban settings. Too often, rural school leaders, rural teachers, and rural students themselves end by "blaming the victim." They presume an inherent cultural inadequacy accounts for their improper difference from the mainstream. And too often, researchers fail to challenge the stereotype and the distorted thinking that accounts for it.

Alternatively, context can represent a contradictory lifeworld (Habermas, 1987) potentially filled with meaning and interest that are *deeply relevant* to learning and teaching mathematics. In this regard, rural context is as complex, meaningful, and interesting as other contexts. A system of schooling responsive to rural issues can potentially help students and teachers realize the variety of meaningful mathematics latent in the lifeworlds of rural places.

We believe that future research into mathematics education in rural places should:

5. describe the salient relationships between mathematical knowledge and rural context;

6. examine rural schools as they serve or subvert the development of mathematical knowledge and expertise within the rural lifeworld;

7. examine hypotheses about the place occupied by mathematics knowledge in and (prospectively) *for* rural communities; and,

8. elaborate theories of, and knowledge about, "pedagogy of place" for mathematics education in rural schools.

Although, from this vantage, it is premature to set and pursue an *explicit research agenda*, individual ACCLAIM scholars bring questions from their established intellectual commitments relevant to ACCLAIM's research mission, for instance:

- How does educational *scale* (classroom, school, district, state size) influence mathematics learning and teaching?
- What intellectual significance do typical rural parents attach to mathematics and to mathematics education in rural schools and what are the implications for rural school improvement?
- How does rural context, particularly Appalachian rural context, affect beliefs about, attitudes toward, and performance in mathematics?
- How does rural context, particularly Appalachian rural context, affect the nature of instruction, teacher preparation, and teacher development in mathematics?
- What characterizes effective professional development teams in mathematics education in rural schools and how can such effectiveness be cultivated and sustained?
- What policies would enable a pro-community mathematics education friendly to rural places?

The challenge to place mathematical knowledge in rural context is so sharp it has very seldom been attempted (Howley, 2001). Indeed, the challenge of such work may be greater in *conceptual* than in practical terms because rural areas around the globe, and throughout recorded history, have long played subservient economic, cultural, and (certainly) intellectual roles to very powerful urban, imperial, and now, cosmopolitan prerogatives (see, e.g., Inverness Research Associates, 2001; Jacobs, 1984; Williams, 1973, 1989).

Perhaps the difficulty lies not only with the challenge, but also with the lack of forces dedicated to addressing it. While there have been strong advocates on behalf of "underrepresented" groups—including women, people of color, and urban people—it is more difficult to identify such leadership on behalf of rural populations, both inside and outside the academy (DeYoung, 1991; Schultz, 2002).

Mathematics is increasingly recognized as the liberating and transcendent knowledge that it really is. We believe that everyone can grasp such knowledge to the intellectual, political, and practical benefit of the common good.

We also maintain that mathematics – as powerful an intellectual tool as writing and reading (see Moses and Cobb, 2001) – can help articulate and activate alternative rural futures better than it so far has. Surely mathematical thinking can be used to offer one interpretation of what the necessary work might be.

Appendix C: Background Information

a) Conception of Mathematics

Our view is that mathematics is internally developed and externally immanent. To speak more plainly, physical reality has quantities, dimensions, and relationships that can be precisely described in mathematical terms (and that is the case whether those terms are understood or not), but how those mathematical terms are arrived at varies from culture to culture. Mathematics is the product of human attempts to make sense of external relationships in the physical world (cf. Bush, W.S., 2002, p. 7).

b) Research on Rural Education Prior to ACCLAIM

According to Waters, Howley, & Schultz, the National Science Foundation deemed research in rural education a "previously undefined area" at the time of negotiations to fund the ACCLAIM project (2004, p. 6). Their review of education research indexed by the Educational Resource Information Center (ERIC) database between 1985 and 2001 showed that such an assessment ("previously undefined") was particularly legitimate for rural mathematics education. Of 5,000 resources indexed under terms related to research on mathematics education, only 47 works were indexed under terms related to education in rural locales. Of these works, 27 were evaluation reports, and 20 were research studies. As the following excerpt makes clear, the research studies were limited and flawed:

> 1. The studies use samples from rural schools, but take no account of context;
> 2. The studies provide scant descriptions of the rural settings, and often none at all;
> 3. The studies conceptualize topics and events as immune from contextual influences;
> 4. The studies fail to address or even define recognizable rural issues;
> 5. The studies report findings that have no connection to the rural contexts of the studies, and
> 6. The studies (therefore) draw no conclusions relevant to rural practice, policy, or research.
> (Waters, M., Howley, C., & Schultz, J., 2004, pp. 9-10)

It is remarkable to find so little research even tangentially relevant, much less effective, in examining how mathematics education functions in rural areas, and how contextual factors affect its functioning. An education system that seeks to serve its students well has an interest in the existence of more quality research on this topic, but you would not know it from the premier journals of education.[50,51,52] To put this in

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[50] "What rural life is… seldom—if ever—make[s] it onto the pages of the *American Educational Research Journal*, *Educational Evaluation and Policy Analysis*, the *Journal of Teacher Education*, or the *Journal of Research in Mathematics Education.* In fact, only one of these high-profile outlets… has ever called for such research. …the last one mentioned" (Howley, C.B., 2003, p. 4- *Making education research behave: Reflections from the rural lifeworld*).

[51] "In an editorial calling attention to the lack of research in mathematics education in rural settings, the editor of the *Journal of Research in Mathematics Education (JRME)* noted "there has been precious little

perspective: prior to ACCLAIM, there were 20 research articles, mainly of low quality, relevant to how mathematics is taught to the 30.3% of all students in the U.S. who go to school in a rural or small town – 41.9% of all schools, and 63.7% of all districts (Hoffman, 2002; National Center for Education Statistics, 2002).

We may add that this neglect seems particularly acute from the standpoint of educators in Appalachia, where – out of a population of 23 million people – 42% live in rural areas (Perry, C., 2007, p. 73). ACCLAIM – with its Appalachian as well as rural focus[53] – has worked to remedy this state of affairs. If the ERIC database is any guide to the total production of education research on the subject of rural mathematics (and we presume that it is), then it would appear that the Center has conducted more context-specific research on this topic than all education researchers, combined, in the fifteen years (beginning of 1985 to the end of 2000) prior to its existence.

c) Definition of rural

One of the recurring issues throughout the ACCLAIM literature is the question of how best to define 'rural.'[54] This is unsurprising, given that classifying the locale or locales studied is a prerequisite for all qualitative and quantitative research conducted by ACCLAIM. A common answer for how to classify what counts as 'rural' (presumably because it is convenient), is that 'rural is what the U.S. Census locale code[55,56,57] or CCD code[58] says it is.' Though we always respect the old standby of arguing from authority – and though, in this case, the authority is often a good place to start – the fact remains that criteria used for identifying rural areas on a nationwide basis are not infallible. For

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research on teaching and learning mathematics in these places," although one in five children (over 12 million) reportedly lived in rural areas… He disclosed that *not a single manuscript* out of 400 submissions during his term as editor had dealt explicitly with mathematics teaching and learning in rural settings." (Waters, M., Howley, C., & Schultz, J., 2004, p. 5).

[52] The following is the full citation for this notable exception: Silver, E. (2003). Attention deficit disorder [editorial]. *Journal for Research in Mathematics Education*, *34*, 2-3.

[53] "Although Appalachian locale in Ohio is distinguishable from rural locale, 78 of the 125 [*'counties in'? Or 'school districts in'? Probably the latter, but look it up*] Appalachian Ohio are classified as rural by the National Center for Education Statistics" (Howley, C. B., Howley, A. A., & Hopkins, T., 2005, p. 35).

[54] Indeed, the difficulty of defining it may have a role in the scarcity of research on the topic (Hatfield, L. L. 2003, p. 6-7).

[55] "The U. S. Census Bureau defines a rural area as one that is not urban. "Urban" is defined as either an urbanized area or places with populations of 2,500 or more outside urbanized areas. An urbanized area is a place and its adjacent densely settled surrounding territory that together have a minimum population of 50,000… Rural is defined as a place with fewer than 2,500 people, or a place with a ZIP code designated as rural by the Census Bureau" (Alfonso, Z., & Long, V., 2005, p. 11).

[56] "These [locale] codes were developed by the U.S. Bureau of the Census in the 1980s and they use definitions from the federal Office of Management and Budget (OMB)" (Perry, C., 2007, p. 92).

[57] "In May 2006, NCES revised its locale code system. The new system includes 12 codes called urban-centric locale codes. Revisions were made to reflect changes in the U.S. population and allow more precision in describing an area. For example, the new codes include a category for small cities, and they separate rural areas into three groups depending on their distance from an urban area. According to NCES (http://nces.ed.gov) the percent of schools in cities and the percent of schools in rural locales did not change much with the new codes" (Perry, C., 2007, p. 93).

[58] "To classify the rural/non-rural status of school districts more precisely, Elder (1992) created a district-level file that uses local codes from the CCD Public School Universe file" (Alfonso, Z., & Long, V., 2005, p. 11).

instance, one of the authors was surprised to discover that the high school from which he graduated – attended by approximately 1,400 upper middle class students from the suburbs – was considered 'rural' on the basis of its locale code, presumably because there happened to be farmland nearby. Meanwhile, a new housing development has been built across the street, complete with an artificial pond. Designations using the Census or CCD code are not the final word in accurately classifying locale.

But what information do we use to nuance the designations of the Census or CCD codes? Do we rely on the self-identification of those who live there? This is not faultless, either. One paper found, "Teachers we called "rural" did not necessarily refer to themselves that way, and sometimes even teachers from the same town did not agree on whether or not to call themselves rural" (Heaton, R., Smith, W., Kromminga, R., & Hartman, D., 2008, p. 4). The account of the teachers, who could not agree on the nature of the locale in which they taught, implies that different people have different views of rural areas. As DeYoung seems to indicate, a more differentiated classification of rural areas may be helpful:

> Gjelten (1982) offers an alternative typology consisting of five rural community types: rural communities on the immediate fringe of urban areas; those located farther out, but still within commuting distance to metro work places and thus partly composed of city out-migrants who commute to work; stable (usually farm related) rural communities; those previously dominated by extractive industries (logging and mining) now in decline; and finally, isolated communities far removed from transportation corridors.
>
> (DeYoung, A. J., 2003, p. 17)

The new CCD locale codes are more nuanced than formerly (Perry, C., 2007, p. 93), but rural areas are still defined based on their distance from metropolitan areas. Economic realities[59] and population numbers provide data, in addition to 'remoteness,' that is useful in classifying rural areas.[60] Regardless of classification or method, the fact remains that there is no consensus on the definition of the term 'rural' itself (Coladarci, 2007). Many of the ACCLAIM researchers have relied to varying degrees on measures such as Census and CCD codes, self-identification, and classifications such as Gjelten's.

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[59] Though rural areas are usually viewed as poorer, there is at least one instance of disagreement mentioned in the ACCLAIM literature – as noted by Sloan, Loveless (2003) concluded that rates of students living in poverty are actually lower in rural areas than elsewhere (2006, p. 4).

[60] It is worth noting that though rural areas in the nation as a whole have a high degree of racial homogeneity – their populations are often mostly white – this is not a defining characteristic of all rural areas in the U.S. Sloan notes the differences between the national average and Georgia: "Nationally, the percentage of minority students enrolled in rural schools is only 8%… In Georgia, however, 26.4% of rural students are minorities, and rural school districts have high levels of poverty…" (Sloan, M. H., 2006, p. 4).

Appendix D: Numerical Codes for ACCLAIM Works Listed in Table 2, Alphabetized by Year

2002

-02.01. Appalachian_Collaborative_Center. (2002). *Theoretical framework for the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics* (Occasional Paper No. 1b). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-02.02. Bush, W. S. (2002). *Culture and mathematics: An overview of the literature with a view to rural contexts* (Working Paper No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-02.03. DeYoung, A. J. (2002). *Dilemmas of rural life and livelihood: Academics and community.* (Working Paper No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-02.04. Howley, C. B. (2002). *What is our work? Planning a future understanding of mathematics education in rural context--a prolegomenon.* (Occasional Paper No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-02.05. Howley, C. B. (2002). *Research about mathematics achievement in the rural circumstance.* (Working Paper No. 4). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-02.06. Schultz, J. E. (2002). *Mathematics education in rural communities in light of current trends in mathematics education* (Working Paper No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

2003

-03.01. Arnold, M. L. (2003). *Mathematics teaching and learning in rural contexts: A social systems perspective* (Working Paper No. 5). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.02. Bickel, R., & Howley, C. W. (2003). *Elementary math achievement for rural development: Effects of contextual factors intrinsic to the modern world* (Working Paper No. 15). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.03. Bickel, R., & Howley, C.W. (2003). Math achievement and the development of poor, rural areas: Effects of contextual factors intrinsic to the modern world. *Educational Foundations, 17*(4), 83-105.
-03.04. Bickel, R., Howley, C.W., & Maynard, S. (2003). "No Child Left Behind" in poor, Appalachian school districts: Confronting contextual factors in the modern world. *Journal of Appalachian Studies, 9*(2), 321-340.
-03.05. Bush, W. S. (2003). *Bridging the gap between culture and mathematics: the Appalachian perspective* (Occasional Paper No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

-03.06. Cooney, T. J. (2003). *Mathematics teacher education in rural communities: Developing a foundation for action* (Working Paper No. 6). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.07. DeYoung, A. J. (2003). *The social construction of rural mathematics: conjectures, contradictions and a few hypotheses.* (Working Paper No. 7). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.08. DeYoung, A. J. (2003). *The social construction of rural mathematics: Final report to ACCLAIM.* (Working Paper No. 17). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.09. Glascock, C. H. (2003). *The principal as instructional leader: A position for enhancing mathematics learning in rural schools* (Working Paper No. 8). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.10. Harmon, H. L. (2003). *Interdisciplinary research for teaching and learning mathematics in rural schools: Considerations for creating a mathematics and vocational education research agenda* (Working Paper No. 9). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.11. Hatfield, L. L. (2003). *Up the back holler, down the dusty road, cross the windy prairie: Issues, perspectives, and strategies for research in the crisis of improving mathematical education of rural youth* (Working Paper No. 10). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.12. Howley, C., & Gunn, E. (2003). Mathematics achievement in the rural circumstance. *Journal of Research in Rural Education, 18*(2), 86-95.
-03.13. Howley, C.B. (2003). *Making education research behave: Reflections from the rural lifeworld* (Occasional Paper No. 5).University Park, PA: Center on Rural Schools and Communities, Pennsylvania State University.
-03.14. Howley, C. (2003). Understanding mathematics education in rural context. *Educational Forum, 67*(3), 215-224.
-03.15. Lee, J. (2003). *Evaluating rural progress in mathematics achievement: Is Adequate Yearly Progress feasible, valid, reliable, and fair?* (Working Paper No. 11). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.16. Lee, J. (2003). Evaluating rural progress in mathematics achievement: Threats to the validity of "Adequate Yearly Progress." *Journal of Research in Rural Education*, *18*(2), 67-77.
-03.17. Long, V., Bush, W. S., & Theobald, P. (2003). *Place value: The rural perspective* (Occasional Paper No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.18. Mahoney, C. R. (2003). *Mathematics education in rural communities: A mathematician's view* (Working Paper No. 12). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.19. Nelson, K., Simonsen, L., & Swanson, E. (2003). *Research issues for mathematics education in rural communities: Focus on Native Americans* (Working

Paper No. 13). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-03.20. Silver, E. A., & Castro, A. M. (2003). *Mathematics learning and teaching in rural communities: some research issues* (Working Paper No. 14). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

2004

-04.01. Beach, B. W. (2004). *Ponderings of a rural mathematics educator on others' perceptions of the teaching and learning of mathematics in rural areas* (Occasional Paper No. 9). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.02. Eglash, R. (2004). *Black chaos, white trash: Order and disorder at the intersection of mathematics and culture* (Occasional Paper No. 7). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.03. Hackenberg, A. J., & Mewborn, D. S. (2004). *Questioning assumptions: A critical pedagogical perspective on mathematics teaching and learning in rural places.* (Working Paper No. 18). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.04. Howley, C., & Howley, A. (2004, September 24). School size and the influence of socioeconomic status on student achievement: Confronting the threat of size bias in national data sets. *Education Policy Analysis Archives, 12*(52). Retrieved February 14, 2009, from http://epaa.asu.edu/epaa/v12n52/
-04.05. Howley, C. B. (2004). *Ten precepts about the circumstance of rural education* (Occasional Paper No. 11). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.06. Howley, C. (2004). A critical introduction to useful works about rural life and education. *Journal of Education Finance, 29*(3), 257-272.
-04.07. Huber, D. S., Howley, A. A., & Howley, C. B. (2004). *Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature* (Working Paper No. 22). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.08. Lipka, J., & Adams, B. (2004). *Culturally based math education as a way to improve Alaska Native students' math performance* (Working Paper No. 20).
-04.09. Mayes, R. (2004). *Review of distance education literature* (Occasional Paper No. 6). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.10. Schmidt, M. (2004). *Rural roots, urban harvest, and giving back to the land* (Occasional Paper No. 8). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-04.11. Waters, M., Howley, C., & Schultz, J. (2004). *An initial research agenda for rural mathematics education* (Working Paper No. 16, Revised). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

-04.12 Coladarci, T. (2004). Reflections at 35,000 feet: An open letter to the ACCLAIM doctoral cohort. (Occasional Paper No. 5). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics Education.

2005

-05.01. Alfonso, Z., & Long, V. (2005). *Graphing calculators and learning styles in rural and non-rural high schools* (Working Paper No. 24). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.02. Belcher, J., Britt, D., Granade, S., Powell, L., & Schlessinger, P. (2005). *Bus routing algorithms: application to a rural school district* (Working Paper No. 27). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.03. Bush, W. S. (2005, July 11). Improving research on mathematics learning and teaching in rural contexts. *Journal of Research in Rural Education*, *20*(8). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/20-8.pdf
-05.04. Hopkins, T. (2005). Gender issues in mathematics education in Tennessee: Does rural school locale matter? (Doctoral dissertation, University of Tennessee, 2005). *Dissertation Abstracts International*, *65*, 3315. (AERA Rural Education SIG dissertation award winner, 2005)
-05.05. Howley, C. B., Howley, A. A., & Hopkins, T. (2005). *Does place influence mathematics achievement outcomes? An investigation of the standing of Appalachian Ohio school districts* (Working Paper Series 23). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.06. Howley, C., Howley, A., & Huber, D. (2005, June 1). Prescriptions for rural mathematics instruction: Analysis of the rhetorical literature. *Journal for Research in Rural Education, 20*(7).
-05.07. Lucas, D. (2005). *A rural community's perceptions of the importance of math and math education in Appalachia* (Monograph No. 1). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.08. McGatha, M., Bush, W. S., & Thorn, D. (2005). *Becoming a leader in mathematics: A study of leaders' professional development experiences, awareness, beliefs, and attitudes* (Working Paper No. 26). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.09. Pendarvis, E. (2005). *Research on teacher learning communities: Implications for professional development for mathematics teachers in rural schools* (Working Paper No. 25). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.10. Theobald, P. (2005). *Representing rural context in doctoral-level math education courses: A guide for mathematics education professors* (Occasional Paper No. 12). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-05.11. Waters, M. S. (Ed.). (2005). *A mathematics educator's introduction to rural policy issues* (Monograph No. 2). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

-05.12. Williams, J. H. (2005, April 23). Cross-national variations in rural mathematics achievement: A descriptive overview. *Journal of Research in Rural Education*, *20*(5). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/20-5.pdf

2006

-06.01. Anderson, R. (2006). *Factors contributing to rural high school students' participation in advanced mathematics courses* (Working Paper No. 34). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.02. Best, C. (2006). *Community college students' perceptions of their rural high school mathematics experience* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-06.03. Civil, M. (2006). *Working towards reform in mathematics education: Parents', teachers', and students' views of "different"* (Working Paper No. 31).
-06.04. Gruenewald, D. (2006). *Resistance, reinhabitation, and regime change* (Working Paper No. 30). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.05. Gruenewald, D. (2006). Resistance, reinhabitation, and regime change. *Journal of Research in Rural Education, 21*(9). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/21-9.pdf
-06.06. Heaton, R., Smith, W., Kromminga, R., & Hartman, D. (2008). *Understanding the meaning of rural within a middle school mathematics professional development and research project in Nebraska* (Working Paper No. 40). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.07. Howley, A., Gholson, M., & Pendarvis, E. (2006). *How talented rural students experience school mathematics* (Working Paper No. 29). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.08. Howley, A., Pendarvis, E., & Gholson, M. (2006). How talented rural students experience mathematics. *Journal for the Education of the Gifted, 29*(2), 123-160.
-06.09. Howley, C. B., (Ed.), with Belcher, J., Britt, D., Brown, V., Buckner, B., Fugitt, J., Granade, S., Green, C., Jones, S., Kenady, K., Mayes, C., Music, L., Nichols, S., Ratliff, M., Schlesinger, P., Smith, N., Smith, R., Waggoner, D., & Zelkowski, J. (2006). *Proceedings of the Third ACCLAIM Research Symposium* (Occasional Paper No. 14). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.10. Howley, C. B., Howley, A. E., Howley, C. W., & Howley, M. D. (2006). *Saving the children of the poor in rural schools* (Working Paper No. 28). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.11. Larson, W., & Howley, A. (2006). *Leadership of mathematics reform: The role of high school principals in rural schools* (ACCLAIM Monograph No. 3). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.12. Lubienski, S. T. (2006). *Reflections from a working-class scholar who resists and embraces scholarship in mathematics education* (Working Paper No. 32). Athens, OH:

Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.13. Sloan, M. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors*. Unpublished doctoral dissertation, University of Georgia, Athens. (AERA Rural Education SIG dissertation award winner, 2007)
-06.14. Sloan, M. H. (2006). *Mathematics education in rural Georgia: Social, political, and economic factors* (Working Paper No. 35). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-06.15. Wanich, W. (2006). *Place-based education in the United States and Thailand: With implications for mathematics education* (Working Paper No. 33). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

2007

-07.01. Anderson, R. (2007). Mathematics, meaning, and identity: A study of the practice of mathematics education in a rural high school (Portland State University, 2006). *Dissertation Abstracts International*, *68*. (AERA Rural Education SIG dissertation award winner, 2007)
-07.02. Boyd, B. (2007). *Effects of state tests in Ohio on assessment practices in mathematics education* (Unpublished doctoral dissertation). University of Louisville, Kentucky.
-07.03. Gregory, J. (2007). *Presentation software and its effects on developmental students' mathematics attitudes* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-07.04. Howley, A., Larson, W., Adrainaivo, S., Rhodes, M., & Howley, M. (2007, May 17). Standards-based reform of mathematics education in rural high schools. *Journal of Research in Rural Education, 22*(2). Retrieved February 14, 2009, from http://jrre.psu.edu/articles/22-2.pdf
-07.05. Howley, A., Howley, C. B., & Helm, V. (2007). *Reform of secondary mathematics education in high-performing rural schools* (Working Paper No. 36).
-07.06. Klein, R. (2007). *Educating in place: Mathematics and technology* (Working Paper No. 38). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-07.07. Lucas, D. M., & Fugitt, J. (2007). *The perception of math and math education in the rural Midwest* (Working Paper No. 37). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-07.08. Perry, C. (2007). *Motivation and attitude of preservice elementary teachers toward mathematics: is rural relevant?* (Unpublished doctoral dissertation). University of Louisville, Kentucky.
-07.09. Rice, C. (2007). *Comparing recent high school graduates placed in developmental and college-level mathematics courses* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.

2008

-08.01. Fugitt, J. (2008). *Does the grade level at which algebra I is completed affect future mathematics performance?* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-08.02. Gleason, J., Belcher, J., Britt, D., & Savich, P. (2008). Incorporating a critical pedagogy of place in the mathematics classroom: Rural school busing. *Journal of Teaching and Learning, 5*(2), 23-36.
-08.03. Green, C. (2008). *The Annenberg rural challenge ten years later: looking for a place for mathematics in a rural Appalachia place-based curriculum* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-08.04. Howley, A., Howley, C., Burgess, L, & Pusateri, D. (2008). Social class, Amish culture, and an egalitarian ethos: Case study from a rural school serving Amish children. *Journal of Research in Rural Education*, *23*(3). Retrieved from http://jrre.psu.edu/articles/23-3.pdf
-08.05. Jones, S. (2008). *The question of learning equity between online and onsite undergraduate mathematics courses in rural Appalachia* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-08.06. Klein, R. (2008). Educating in place: Mathematics and technology. *Philosophical Studies in Education, 38, 119-130.*
-08.07. St. John, M., Helms, J., & Smith, A. (2008). *Findings from Inverness Research Associates evaluation of the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics* (Working Paper No. 39). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-08.08. Waters, M., Howley, C., & Schultz, J. (2008). An initial research agenda for studying rural mathematics education. *Journal of Appalachian Studies, 14*(1&2), 125-144.

2009

-09.01. Howley, C. (2009). Critique and fiction: Doing science right in rural education research. *Journal of Research in Rural Education*, *24*(15). Retrieved January 5, 2010, from http://jrre.psu.edu/articles/24-15.pdf
-09.02. Lucas, D., & Fugitt, J. (2009). The perceptions of math and math education in *Midville*, Illinois. *The Rural Educator, 31*(1), 38-54.

2010

-10.01. Howley, A., Howley, C., Klein, R., Belcher, J., Howley, M., Tusay, M., Clonch, S. Perko, H., Foley, G., Pendarvis, E., Miyafusa, S., & Jimerson, L. (2010). *Community and place in mathematics instruction in selected rural schools* [ACCLAIM Monograph No. 4]. Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.
-10.02. Nichols, S. (2010). *Perceptions and implementation of the Ohio Academic Content Standards for Mathematics among middle school teachers* (Unpublished doctoral dissertation). Ohio University, Athens.

-10.03. Owens, S.K. (2010). *Professional development: a case study of Mrs. G* (Unpublished doctoral dissertation). University of Louisville, Kentucky.
-10.04. Smith, R. (2010). *The impact of secondary mathematics methods courses on preservice secondary teachers' beliefs about the learning and teaching of mathematics* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.

2011

-11.01. Howley, A., Howley, M., Camper, C., & Perko, H. (2011). Place-based education at Island Community School. *The Journal of Environmental Education, 42*(6), 216-236.
-11.02. Howley, A., Showalter, D., Howley, M., Howley, C., Klein, R., & Johnson, J. (in press). Challenges for place-based mathematics pedagogy in rural schools and communities in the United States. *Children, Youth, and Environment*. Manuscript accepted March 10, 2011.
-11.03. Ratliff, M. (2011). *Preservice secondary school mathematics teachers' current notions of proof in Euclidean geometry* (Unpublished doctoral dissertation). The University of Tennessee, Knoxville.
-11.04 Corbett, M. (2011). A companion to the film, Putting Mathematics Education in Its Place (Working Paper No. 41). Athens, OH: Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.

2012 and in-progress

12.01 Wilson, Z., & Howley, C. (2012). *Going further: A roadmap to the ACCLAIM research opus*. Athens, OH: Ohio University

12.02 Authorship suppressed. (2012***).*** *Stretching to survive: District autonomy in an age of dwindling resources*. (manuscript submitted for publication)

12.03 Klein, R., Johnson, J., Hitchcock, J., Howley, A., Howley, C., & Showalter, D. (2012). [Report of national survey of community connections in rural mathematics education practice] instrument-design and data collection on-going

12.04 Showalter, D. (2012). [Report of interviews with ACCLAIM doctoral particpants] data collection complete; data analysis on-going

Appendix E: Evaluation Chart for High-Scoring Theoretical Works

	a.1.	a.2.	a.3.	a.4.	b.1	b.2.	Score
02.01.	1	1	1	1		1	5/6
02.03.	1	1		1	1	1	5/6
02.04.	1	1	1	1	1	1	6/6
03.05.	1	1	1	1		1	5/6
03.06.	1	1	1	1	1	1	6/6
03.09.		1	1	1	1	1	5/6
03.12.	1	1	1	1	1	1	6/6
03.13.	1	1		1	1	1	5/6
03.14.	1	1	1	1	1	1	6/6
03.17.	1	1	1	1	1	1	6/6
04.03.	1	1	1	1	1	1	6/6
04.06.	1	1		1	1	1	5/6
05.03.	1	1	1	1	1	1	6/6
05.06.	1	1	1	1	1	1	6/6
05.09.		1	1	1	1	1	5/6
05.10.	1	1	1	1		1	5/6
05.11.	1	1	1	1	1	1	6/6
06.12.		1	1	1	1	1	5/6
06.15.	1	1	1	1	1	1	6/6
08.02.	1	1	1	1		1	5/6
08.08.	1	1	1	1	1	1	6/6

Appendix F: Glossary of Key Concepts

This glossary does not offer definitive or synoptic definitions, but rather characterizations based on the outlook of ACCLAIM's theoretical framework and the usages of the works sponsored by the Center. Each characterization is thus one interpretation of the concept. Moreover, each is connected to a broad related literature despite the absence of the citations to the numerous relevant scholarly works. The point here is not scholarship and definition, but the need to gloss these terms for readers on this "roadmap" monograph. To that end, each gloss also characterizes critique relevant to or inherent in the concept.

Best practice: A set of behaviors and related constructs (1) identified by education researchers and professional organizations, (2) prescribed sometimes in education policy documents, and (3) claimed often by professional development providers as universally "best" for achieving valued ends. The critique problematizes the idea of "universally best" and also the varied commitments under-girding production of such "bests."

Deficiency models of rural and Appalachian life: Systems (including discipline-based systems like education and professional systems like schooling) of engaging rural people and cultural institutions based on a metropolitan, national, or global cultural preconception of (1) rural inferiority and (2) comparative blindness to and ignorance of rural assets and affordances. Deficiency models operate broadly to diminish the worth of most minority populations (based, for instance, on the dominant valorization of skin color, affluence, language, or distance from the center of political and economic power). The critique problematizes the teleology of the systems and their assumptions.

Instrumental aims of education: The view of educational purpose that represents economic utility as the *superordinate aim* not only for schooling, but for education overall; on this view, human purpose itself is more economic than social. One critique is that such narrowness constricts and marginalizes the intellectual and cultural aims of education.

Cosmopolitanism: The ideology appropriate to globalization, in which the cultural, economic, and political paragon is the *world-class city*. The ideology informs schooling and professional conceptions of education partly via practices considered universally best to secure the instrumental aims of education and, in rural places, deficiency models of rural existence. The critique interrogates the relationship of rural, regional, national, international, and global existence, often contrasting localism with cosmopolitanism. (Note: a nearly opposite usage is also in play; cf. Appiah,

A Platonic view of mathematics: The view that mathematics embodies a universal template for truer, higher knowledge, a truth reflected in the structure of nature. Critique tends to understand mathematics as a social and cultural creation and to argue for a less idealistic and more practical version of math education, one that a much wider audience would find accessible.

Education reform: According to Bierce (1911), "A thing that mostly satisfies reformers opposed to reformation." In math education, one motive for *reformation* is *how little* math *so many student*s learn, *ever*. More particularly, math education research is an applied field, with the applications supposed to assist practice in some fashion. ACCLAIM researchers engage the concept variously. Critique, as *The Devil's Dictionary* suggests, centers on the puzzling want of reformation given so much reform.

Constructivist learning theory: Constructivism comes in many forms, and ACCLAIM researchers both embrace and problematize the concept. Constructivist learning theory constitutes the received wisdom in the academic field of mathematics education (cf. "platonic view," above). Critiques of constructivism are implicit in some works, rather than explicit, largely on the insight that constructivist outlooks are a foundation of both reform *and* conventional wisdom.

Progressive education: Generally associated with the social meliorist strand in American schooling—the idea that schools should contribute to increasing social equality. Critique centers on the fact that social inequality is increasing in the United States and that schooling is a principal sponsor of such rising inequality (see "reform," "constructivist learning theory," and "platonic view," above).

Perspectives on social class: The American concept of class rests on a continuum of status; status differs by degree, not by kind (e.g., low, middle, high). A European, Marxian, view understands classes as qualitatively different (e.g., proletariat, bourgeoisie). The critique claims that the American model obscures rising inequality and its implications for schooling and citizenship. The Marxian outlook, however, has traditionally found it difficult to trace the evolution of the qualitatively different classes that supposedly constitute society.

Middle-class theory: In American sociology, the theory that a proportionally numerous middle-class undergirds equality of educational and economic opportunity and outcomes (see "perspectives on social class," "progressive education," and "education reform.") Critique sometimes distinguishes between a petit-bourgeois (local small business owners) and a corporate "middle-class." Another critique doubts a salutary

middle-class influence, largely on the insight that middle-class norms dominate schooling nearly everywhere in America, to the detriment of poor and working class families and cultures.

Schooling as a cultural and value-embedded enterprise: Both anthropology and sociology inform this concept. Schooling, on this view, is an institution created by humans—and by other institutions—for various non-neutral ends. The critique embedded in such outlooks doubts the representations of schooling as a neutral technology for facilitating masterful learning and teaching. The question for such an outlook is whose cultures and whose values direct schooling—and, of course, with what variability.

Schooling and education: The object of "the field of education" appears overwhelmingly to be schooling. Many writers, however, distinguish *schooling* from *education*. The critique involves the insight that one can be much-schooled and little-educated (see "reform," "constructivist learning theory," "progressive education," and "schooling as a cultural enterprise").

Place-based education: Education, or even schooling, founded on place has in view the importance, first, of a *land ethic* and, second, of local community. The exact pedagogy of "place-based education" is therefore necessarily inventive rather than prescribed or scripted. Whether or not place-based education is amenable to "standards-based teaching and learning" is a red herring. It is and it isn't. The critique involves the insight that local rural schools serve as extraction industries for the removal of talent from rural communities.

Critical pedagogy: Theorizing about instruction, derivative of the outlook of critical theory, which is not a theory at all, but an elaboration of critique against the hegemony of neoliberal economic and cultural formations (see "schooling as a cultural enterprise," "perspectives on social class," and "education reform"). One fundamental critique of "critical theory" is the absence of critique in most education research; for instance, the term does not figure substantively in the AERA guidelines for conducting education research. One critique of critical theory (and thus of critical pedagogy) is that its suspicion of empirical research is excessive.

Rural variability: Because rural places exist as small-scale endeavors, and because they are so numerous, they exhibit arguably greater variation than might be expected; differentiation of rural areas, sometimes according to one typology or another, and as opposed to thinking of all rural areas as the same. The critique problematizes the prevalent tendency to characterize "rural" as undifferentiated, backward, and deficient or idyllic and superior, but in a largely impractical way (see "best practice," "deficiency models," "cosmopolitanism").

Agrarianism: The ideology of small-scale family farming and productive land stewardship, especially sustainable stewardship. The embedded critique is the view that corporate agriculture and land-use practices have undermined American democracy—and not only farming, land stewardship, and rural community (see "best practice," "cosmopolitanism," "middle-class theory," "schooling as a cultural enterprise," "place-based education," and "rural variability").

Communitarianism: The ideology of community, in some forms locally focused (e.g., Theobald, 1997), but in others globally or nationally focused (e.g., Etzioni, 1998).

In the context of rural concerns, the related critique interrogates not only individualism, but corporatism and gigantism in general; “the good” features in both conceptions as more important than “the right” or “the best” (see also “best practice,” “deficiency models,” “instrumental aims of education,” and “cosmopolitanism”).