

A Rural Math, Science, and Technology Elementary School Tangled up in Global Networks of Practice

By: [Heidi B. Carlone](#), Sue Kimmel, Christina Tschida

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Abstract:

This is an ethnographic study of a newly created math, science, and technology elementary magnet school in a rural community fiercely committed to cultural preservation while facing unprecedented economic instability brought on by massive loss of manufacturing jobs. Our goal was to understand global- and community-level contexts that influenced the school's science curriculum, the ways the school promoted itself to the community, and the implicit meanings of science held by school staff, parents and community members. Main sources of data were the county's newspaper articles from 2003 to 2006, the school's, town's, and business leaders' promotional materials, and interviews with school staff, parents, and community members. A key finding was the school's dual promotion of science education and character education. We make sense of this "science with character" curriculum by unpacking the school and community's entanglements with historical (cultural preservation), political (conservative politics, concerns for youth depravity), and economic (globalization) networks. We describe the ways those entanglements enabled certain reproductive meanings of school science (as add-on, suspect, and elitist) and other novel meanings of science (empathetic, nurturing, place-based). This study highlights the school as a site of struggle, entangled in multiple networks of practice that influence in positive, negative, and unpredictable ways, the enacted science curriculum.

Keywords: Ethnography | Rural science education | Globalization | Cultural studies | Character education

Article:

Science education research is overwhelmed by a historical emphasis on *individuals* and individual understanding. Recently, however, there has been a gradual move to understand how the learning context shapes what individual science students know and are able to do. Usually, the "relevant" context considered in such research is the *science classroom* such as the teacher's

knowledge and understanding, the nature of instruction and/or curriculum, and the discourse practices in the classroom. We are concerned about the overly narrow consideration of what counts as a relevant context in most of the science education literature. When we view science learning settings as separate from their neighborhood, community, state-level, national, political, and historical contexts, we mask the way these macro- and meso-level contexts are connected with one another and jointly produce certain (enabling, constraining, reproductive, transformative) meanings of science education. Such decontextualized and analytically detached accounts of *traditional* science education, for example, might perpetuate the ongoing blame game, where every major stakeholder (parents, politicians, media) blames one another for our failing science education system (Carlone and Webb 2006). On the other hand, ignoring these macro- and meso-level contexts with sites of science education *innovation* risks failure to recognize the enabling features of these contexts.

Broadening what counts as relevant contexts for science education will help us understand why we have the kind of science education we have, why reform is difficult, and why reform happens in unexpected places through novel means and methods. This understanding becomes critically important in this moment in history, given our increasingly globalizing world. Historically distinct boundaries are blurring. For example, we see the intertwining of popular culture, consumer culture, and school culture (Nespor 1997). Religious discourse also has crept into schooling discourse (Giroux 2005). Classrooms represent increasing cultural, linguistic, and racial diversity.

We also must understand interactions between science, science education, and their economic, political, and cultural contexts. Assorted politicians and pundits proclaim that the health of the US economy depends on scientific and technological creativity, yet science educators do not consider how a shifting economy impacts science education. While much of the recent discourse among science educators still represents a worry about science being positioned as authoritative and absolute, contemporary developments suggest that we should also acknowledge the deep-seated skepticism about and interference with science from radical Christian evangelicals. As Giroux (2006) and Grossberg (2005) have argued, the boundaries between science and government are becoming increasingly fuzzy. Finally, while a core group of science education scholars have pushed our examination of urban science education contexts, we have not yet done the same for rural science education, despite the fact there remains an equally deeply entrenched rural school problem in the US (e.g., Theobald 2005).

In this paper, we shift the lens from examining what actually happens in a school science classroom to understanding the global- and community-level contexts that enable and constrain the meanings of science promoted in and by a newly created rural math, science, and technology elementary school. Considering science education in the context of globalization means that we must analytically peel back the walls of the classroom, to view it as what Jan Nespor (1997) calls “a knot in a web of practices that stretch into complex systems beginning and ending outside the [classroom]” (p. xiii).

Our ethnographic study focuses on the Horizon School of Math, Science, and Technology's¹ attempts to bring greater focus on science in the elementary curriculum. The setting provides a rich opportunity for the study of interconnecting contexts or webs of practice. We began our ethnographic study just as the school opened in 2003, about the same time that residents of the county faced unprecedented economic instability brought on by drastic losses of manufacturing jobs. The principal and founding teachers deliberately chose a math, science, and technology focus for the school: "The reason that math, science, and technology were chosen [as the school's focus] is because they are particular areas that need attention in the county. It wasn't just chosen on a whim" (Principal, 2/28/03). What did a school of math, science, and technology mean to such a community? And, of particular interest to us was the way that science got positioned in such a context. So began our consideration of community-level context, which, as it progressed, got more complex with our increasing understanding of other relevant community-level and macro-level contexts.

Conceptual framework

We live in a global world system and no analysis of knowledge and learning will suffice that cannot take this into account. (Nespor 1994, p. 6)

Networks of practice

In this study, we understand the school and the science within the school to be tangled up in what Nespor (1997) calls "networks of practice." The concept of "network" implies "spatially dispersed elements that have been linked together over time" (Nespor 1994, p. 11). This means that, when we act and interact (i.e., participate in particular practices) in given spaces and times, we simultaneously connect with people and things in distant spaces and times. For example, as a student learns high school physics from a teacher using the best-selling textbook, with a fairly standardized curriculum scope and sequence and time-honored labs (i.e., with similar material resources and representations), she is simultaneously connecting with teachers, students, curricula, and scientific tools that are spatially and temporally removed from her. In this view, participation in local practices is never purely local; that participation is connected to larger networks of practice. Nespor (1997) suggests studying schooling not on its own terms but, instead, "as a point of entry to the study of economic, cultural, and political relations shaping curriculum, teaching, and kids' experiences" (Nespor 1997, p. xiii).

Because networks of practice are complex and fluid, we can ask novel questions about educational settings and their interconnections with multiple contexts. Nespor (1997) suggests, for example, "asking where the curriculum comes from and what happens to it as it moves through the school; how the school is connected to other schools and to the business world; and how kids understand their neighborhoods as well as the things they read and watch on television" (p. xiv). Elsewhere, he explained that an understanding of networks of practice help illuminate

how “world economies and global flows of culture shape and provide resources for everyday practice” (1994, p. 6).

For Nesper, the events and practices that occur within schools become intersections or knots where these larger, outside networks converge. To understand what happens within the school one must examine how the school is positioned within these multiple networks of practice. A community’s history, school system policies, economic realities, and sociohistorical meanings of education are all large structural concepts that shape the curriculum and how it is enacted within the school. Therefore, one cannot simply study the classroom by observing only what happens in the classroom. One must also look at the many networks of practice outside the walls, at both micro and macro levels, which influence classroom practices. Nesper says “the key to understanding education isn’t to be found in what happens *in* the classrooms or schools but in the relations that bind them to networks of practice extending beyond” (p. xiii, emphasis in original). Within the complex intersections of these networks, the meanings of school are contested, negotiated, and reinvented. Attempts at innovative reforms are a complex intersection of many threads or networks of practice that become tangled up with local and historical practices. Untangling these knots reveals not only the various threads but also the intricate ways they become connected and caught up in each other.

School as site of struggle

For us, one strength of understanding school as an intersection of various macro- and community-level networks of practice is that it helps define and explain Henry Giroux’s (2006) concept of schooling as a site of struggle. Because schools are caught in intersections of global networks of practice, one might assume that they serve critical roles in reproducing these global networks. Indeed, as Giroux (2006) argued, this is how early critical education scholars like Bowles and Gintis (1976) viewed schools—as sites of reproduction of the status quo. For example, working class students get exposed to a curriculum emphasizing rote skills and memorization to prepare them for working class jobs. Scholars like Willis (1977) made things a bit more complex by demonstrating how a group of working class boys, in their rejection of school’s practices and teachers’ knowledge, produced new meanings of schooling. At this point, schools were viewed as sites of reproduction or sites of resistance.

Yet, Giroux (2006) argued that even these views of schooling were too simplistic because they imply that schools operate at one of two ends of a spectrum; schools are either seen to reproduce or contest cultural domination. Instead, Giroux (2006) explained that viewing schools as sites of struggle means that “power is productive and... the axis isn’t simply between reproduction and resistance. It’s more about the complexity with which power works and the multilayered and contradictory identities that are taken-up. It’s about the production of particular ways of life” (p. 127). This means that studying schools is not simply about identifying “dominant ideological interests at work that serve to oppress teachers and students” (p. 127). Now, Giroux argues,

we need to ask how these interests function. How do they produce particular ways of life? Even more importantly, we need to consider how they're taken-up. Without considering the question of how they're taken-up, we assume that ideologies are absorbed by virtue of their existence rather than fought over continually. (p. 128)

In this view, we understand not only schools to be sites of struggle, but settings of science learning to represent sites of struggle. In such sites, "people are writing meaning, rather than simply receiving it" (Giroux 2006, p. 128). This view necessitates a privileging of community-level and macro-level contexts and highlights the political struggle over the meaning of science education.

Research site

Horizon School of Math, Science and Technology is a year round school and the first and only magnet or school of choice offered in this rural Southern county school district. The math, science and technology (MST) theme was selected after careful study because it was seen as a need in the community. Any student in grades kindergarten through fifth grade in the county may apply to attend and the school relies entirely on voluntary interest to fill its enrollment. Horizon opened in July 2003 as a year-round school. The enrollment is currently 270 with a teaching staff of 18.

The first author [Carlone] has been involved with the school since its inception providing in depth professional development for the staff in science education. During over sixty visits to the school, she engaged in collaborative professional development with teachers from grades three, four, and five between 2003 and 2004. The professional development consisted of co-planning, observing, coteaching, and de-briefing lessons for 6–8 weeks per year with each grade level team. Such close involvement with teachers established a level of comfort together that offered particular insights into teaching and learning at the school.

Data resources

The local newspaper, published twice weekly, became a major data source for this study. This is a newspaper that clearly celebrates community and particularly the children and their schools. Large full color photographs accompany front-page stories about area school students. Articles in the newspaper were either written by school staff, or were initiated by contact from school staff. As a magnet school, Horizon must promote itself to the community to attract and retain families. The newspaper serves as a primary vehicle for recruitment and publicity about the school. The way the school elected to portray and indeed, sell itself to the community through the newspaper was revealing and significant. We identified 73 articles about Horizon published between January 2003 and August 2 2006. These ranged from letters to the editor to announcements for kindergarten registration to full features about special visitors or programs in the school. The newspaper also offered us a lens to view the economic and cultural concerns and

celebrations that shaped the community context for a school of math, science, and technology as well as the meanings of science and schooling promoted by the school to the community.

We also conducted semi-structured interviews with the principal, six teachers (one from each grade level K-5), the school media specialist, two town historians, the town librarian, two community business owners, five parents, and a focus group of three other parents. Additional informal interviews were conducted with the principal, teachers, and parents at the school and at parent teacher association (PTA) meetings, an open house for parents of prospective students, and at the school's annual math fair. In addition, when we visited the community, we held informal conversations with newspaper staff and other community members recorded in researcher notes. Additionally, a survey was administered to all school teaching staff regarding science instruction, instructional priorities, types of curriculum materials, and instructional goals related to science.

Numerous artifacts related to the school and community were collected. Artifacts from the school included brochures and other promotional materials including the school and district web sites, photographs both inside and outside the school, and miscellaneous documents related to programs at the school. Promotional materials about the town and the county from web sites, a state tourism magazine, state and county census data, and brochures filled out our emerging picture of the community. These artifacts are only identified generically in our results section so that we may protect the school and community's identity.

Data analyses

Our data analysis and data collection became an iterative process as we cycled between data collection and conversations about those data. Beginning with the interview data, we began to list emerging assertions, eventually testing those assertions with a domain analysis (Spradley 1980) by identifying categories of cultural meaning. We identified 22 domains in this analysis (e.g., "ways of promoting the school"; "ways of doing science"; "characterizations of school"). In some cases, we further divided the included terms under a given domain into a taxonomy to get a better understanding of the nature of the domain. For example, under the "ways of doing science" domain, we had subcategories like "ways of exploring the outdoors" and "ways of using tools." We used the domains to identify emerging thematic assertions about the data. For example, one such assertion was, "Horizon celebrates the science that they do that occurs outside of the classroom and outside of the normal school curriculum." After generating an assertion, we turned to the newspaper articles to test out those assertions, looking in multiple ways for confirming and disconfirming evidence.

We went through the articles first to determine the primary focus of each article and assigned these as major topics. Each article had only one major topic assigned to it; for 73 articles there were 73 occurrences of major topics. Two researchers rated articles first independently and then together through discussion to reach agreement. In assigning major topics, we considered major

curriculum areas i.e., math, science, or physical education or initiatives such as character education, as well as general promotion of the magnet school, parent activities including fund raising and volunteering, student performances, and recognitions for student achievement. We passed through the newspaper articles numerous times and found that the major topics frequently appeared in other articles as a secondary focus. The occurrences of these major topics as secondary topics confirmed their importance. We passed through the articles several times again looking for these secondary occurrences of the major topics and counted these as minor topics. In the 73 articles we identified 121 occurrences of these secondary or minor topics. In other words, an article might have several secondary topics assigned to it. But a minor topic was only assigned once to each article. For example, science was a major topic in 7 articles and a minor topic in 16 articles for a total of 23 articles that mentioned science to some degree. A similar analysis was also done of the 179 photos and their captions. Character education and science emerged as two areas of particular interest, and we followed up with a componential analysis (Spradley 1980) for these articles. This meant that we looked across data sources (e.g., newspapers, interview transcripts, promotional materials) for multiple occurrences of themes to assess their robustness. Data from artifacts collected were used to triangulate our findings in the interviews and newspaper articles by providing evidence for community level meanings of domains and themes. We returned to the school site to gather photographic evidence for our findings and to interview the principal as a final member check on findings.

Modern-day Mayberry in the context of globalization

If you are traveling down Hwy 36 south, you may just miss this wonderful little place I like to call home. The town is Riverton, NC. It has virtually escaped the hustle and bustle of the modern world. It is basically a modern day Mayberry. Just this past Easter, we went “home” and went “downtown” for some shopping. We sat on the wooden benches outside the general store and we listened to bluegrass music being broadcast on the speakers throughout the two block shopping district. It was ever so much the charming vision you can imagine. Riverton does have a Kmart now... But why shop an every day mega store when you go home, when you can have the charm and the character of the good ol’ days? Don’t we all crave just a little bit of wanting things to be like they were when we were kids? Simple, innocent (for some) and full of sunny days with our families. Some things just don’t need to change with the times! (Letter to the editor, 8/1/03)

History

Riverton is a town that defiantly embraces its history. As you enter the town from the local highway, banners adorn each lamppost proudly displaying the town’s name and charter date (1873). The historic downtown shopping district, positioned adjacent to the junction of two major rivers used for river trade in the 1800s is full of the old-time charm described by the author of the letter to the editor above. The town clock, a primary symbol of Riverton, has been

refurbished and remains one of the few large clocks in the US operated by manual winding. The local library touts one of the “best genealogy libraries in the state” (Interview, town librarian, 3/5/05). Those who live in the town characterize it distinctly from neighboring towns by describing the importance of Riverton’s history to its citizens. For example, the town librarian explained, “I guess [the neighboring towns are] a little more home-townie and Riverton is (pause)—they are very aware of their *history* and they are very aware of the fact that they have been here since the early nineteenth century. They are very proud of their history” (3/5/05, her emphasis).

Local ways of doing business

Many shops are owned and run by local business owners who express a desire to preserve the “down home” (tourism magazine, 2006), “seemingly outdated traditions that benefited business for decades” (local newspaper, 2/25/05). For example, at a local, family-owned shoe repair and leather shop, the third-generation owner explains that his work is “much slower by hand,” but “worth the extra effort” (local newspaper, 2/25/05). One block west at a family-run furniture store, a father (Senior) and son (Junior) team pronounces proudly that they do business the old-fashioned way: “It’s about doing what makes the customer feel comfortable,” Junior said. “If that means writing tickets by hand instead of using a computer, that’s what we’ll do” (local newspaper, 2/25/05). “The Baby Boomer generation seems to be looking for a place to come and shop just like they did when they were kids,” Senior said (2/25/05).

A primary aspect of preserving their history is maintaining open, warm, and friendly neighborly ways. Nearly everyone we talked to, from the town historians (3/29/05; 6/9/05) to the town and school librarians (3/5/05; 3/11/05) to the local business owners (3/10/05) touted the friendly nature of the town as one of the unique and attractive characteristics of the town. These descriptions and sentiments seemed to go beyond just describing a typical small town in America. Most used “friendly” as one of the first descriptors of the town and explicitly juxtaposed the town’s friendly nature with other “small-towns”—“I believe we are welcoming to new and visiting folks. Most smaller towns are not as open as I believe we are” (Interview, town historian, 3/29/05). As visitors, we can attest to this warm and welcoming atmosphere.

Modern-day Mayberry in the face of economic uncertainty and instability

A shifting economy fueled by globalization has profoundly impacted North Carolina’s rural counties, particularly those dependent on manufacturing. Between 1990 and 2003 rural counties in North Carolina experienced a 27% drop in manufacturing. Many manufacturers closed or moved overseas, and between 2000 and 2003 there were over 60,000 layoffs in rural areas. Due to structural changes in the economy, less than half the laid off workers in 2002 were able to find another job within a year. Those who found jobs were often paid a lower wage, with one-third bringing home less than half their previous earnings (NC Rural Economic Development Center 2006).

Reynolds County was hit particularly hard and continues to reel from economic restructuring. The impact on Riverton is reflected, in part, in its declining population. Riverton was originally a tobacco town with trade promoted first by the rivers and later with the railroad. The 1920s were a boom era with the population swelling to an all time high of 3,300 (County Chamber of Commerce). After World War II, textile manufacturing grew to become a major employer. By April 2000 the population was 2,262, declining yet again by July 2005 to 2,221 (local newspaper, 6/05). The county estimates that during that same period, over 6,000 people lost their jobs (local newspaper, 6/05).

Job losses, mostly in manufacturing, are frequent headlines in the local newspaper. As the congressman representing the county described, “The plants didn’t just lay off a shift. The plant’s closed, the machinery is sold, the building is padlocked, those jobs aren’t coming back” (local newspaper, 2/1/06). Looking towards the future, the congressman echoes others in touting education and particularly the local community college as an answer to economic uncertainty. A presentation on that campus by futurist Ed Barlow was entitled “Preparing for a twenty-first Century Economy: Community Strategies for Wealth Creation” (12/1/06, regional newspaper). Exactly what that means for this community remains an open question expressed by the president of the county’s community college: “The county is still trying to identify where our future lies. Will it be in recreation, manufacturing, or biotech? We’re not really sure yet” (local newspaper, 8/24/05). In the midst of the county’s identity crisis, however, the town of Riverton tightly guarded their self-proclaimed “old-fashioned” ways of doing business. And, in many ways, those old-fashioned ways can be interpreted as a resource to contest perceived negative effects of globalization.

History as a resource to contest the perceived homogenization brought on by globalization

Some may ask why people in a town experiencing such economic turmoil would fiercely hold on to their business-related traditions. We argue that, not only does this protection of seemingly bygone ways of doing business make sense, it represents Riverton as a site of political struggle—struggle over the meaning of what counts as a “good life” and “good business” in the face of market fundamentalism pervading the current global context (Giroux 2005).

Globalization is a contested term and process in the academic and popular literature. For example, some argue that it will increase income inequality and benefit the few at the expense of the many (Shiva 2002); others argue that it will provide avenues to make more people wealthy (Friedman 2005). Some argue that globalization erases difference (Ritzer 2004); others argue that it will provide avenues for newfound diversity (Friedman 2005). The ways the people of Riverton engage with this issue displays a concern that they will lose what makes them unique and that concern has prompted them to promote and preserve their traditional ways of life, knowledge and ingenuity. They have seen and experienced jobs, goods, and people moving out of the county and country while large corporations elbow out smaller businesses, local customs, and traditional knowledge.

Pink (2005) argued that, economically, the world is moving away from an information age that is logical, linear, and dominated by business people, lawyers, and doctors toward a conceptual age that will be “high concept” and “high touch” with qualities such as empathy, playfulness, big-picture understandings, and creativity needed for economic success. More and more automation has allowed us not only to automate and export manufacturing, but also has provided algorithms for repetitive cognitive decision-making in practices associated with medicine and accounting, among others. Such automation makes it easier to off-load and outsource these jobs to computers and other countries (Friedman 2005). Historic milltowns like Riverton must now re-define themselves in a way that capitalizes on their residents’ unique resources. So, what cannot be outsourced? We now understand what Riverton residents already know—their local, traditional knowledge and creativity can be considered promising economic resources and a way to push back against the perceived homogenization brought on by globalization. One might be able to distill the same moonshine in South Africa, for example, but it would not have the same cachet as moonshine distilled in the foothills of North Carolina, with its particular folklore and NASCAR (National Association for Stock Car Auto Racing) association. One might be able to obtain a leather saddlebag for one’s motorcycle made in China, but it would not hold the same value as the custom-designed saddlebags that Chris Sullivan (pseudonym) designs at his fourth-generation family custom leather shop in historic downtown Riverton. This way of thinking about Riverton’s resources are also consistent with Pink’s (2005) arguments about thriving economically in this conceptual age: “[I]t’s no longer enough to create a product that’s reasonably priced and adequately functional. It must also be beautiful, unique, and meaningful” (p. 33).

The business owners and customers in downtown Riverton are aware of their unique resources. Some residents explicitly frame their traditional knowledge and ways of doing business as resources for contesting the perceived homogenization brought on by globalization. For example,

Small local shops can survive and thrive if they just provide products and services that people can’t find with large chain stores (Leather shop owner, 2/25/05).

In a lot of ways, we’re still doing business the way [the original owner] did when he first opened the store [44 years ago] and it still works (Senior, furniture store owner, 2/25/05).

There are a lot of people in this fast-paced world that still expect to receive one-on-one personal service (Junior, furniture store owner, 2/25/05).

Why shop an every day megastore when you... can have the charm and character of the good ol’ days? (Letter to editor, 8/1/03).

A woodworking instructor at the local community college puts his finger on the ways local business people, artists, and craftspeople must re-define their roles given the changing global context.

We need to lead the world in customization and technology if we're going to remain a player. We have to be very creative in determining what to make, how to make it and where to market it... Ideally, [we] will combine old-world techniques with new technology to serve a niche market (10/6/04).

It is clear that some residents and leaders in Riverton and Reynolds County are hopeful about thriving economically in the future, as illustrated with the catch phrase "A new day is dawning" displayed prominently in the county's promotional materials (1/07). But, this success cannot come at the cost of abandoning their cultural and historical values, a tension well represented in this section of the county's mission statement: "... to empower our citizens to pursue a high quality of life, while preserving rural character" (county promotional materials, 1/07). The county recognizes itself and gets recognized and applauded by others as one that is successfully preserving its way of life: "It's nice to know... that as much as the county is looking to the future, it hasn't forgotten its past" (tourism magazine, 2006).

These tensions between the old and the new enable some contradictory notions of progress. "Moving forward," as implied by the perceived context of globalization, means making everything faster ("fast-paced world"), more standardized ("an every-day mega store"), and less personal. Riverton contests these meanings by drawing on local knowledge and history as resources. Town residents also draw on their legacies as hard workers and people of faith to maintain this way of life. While the macro-level network of globalization may be partially contested by Riverton, other aspects of the macro-level context, like conservative politics, buttress Riverton's efforts to maintain its history.

Modern-day Mayberry in a context of conservative politics

Touting the Protestant work ethic

Local residents define themselves and get portrayed in the paper and other promotional materials as "hard workers," ready to retool and work hard to get retrained in new professions. A US representative, on a visit to Riverton, was quoted in the local newspaper:

Reynolds County has smart people [who] are willing to work hard. They may not have gone far in school, that's particularly true in areas that have had a traditional manufacturing economy where people could go from the school to the mill and didn't need to graduate from school it seemed at the time. But they're certainly willing to work hard, and they want to learn. (2/1/06)

The local newspaper, politicians, and business leaders are careful to portray the local workforce as hardworking and willing to learn new skills if necessary: "Hundreds grab opportunity offered by the government to retrain and upgrade their skills" (3/18/05, local newspaper). This "ready and available" workforce is also touted in local promotional materials which boast that the county has "8,000+ manufacturing workers, ready to go" (2006). In the same promotional

materials, local business leaders characterize the local workforce in ways that marry the workforce's good work ethic and good character:

“We found RC to have... a workforce with *good values*.” (General Manager of prominent business in the county, our emphasis)

“Take a conveniently accessible location, a *diligent and loyal workforce*, and local leaders willing to do what it takes to bring in growing companies and you've got a winning combination.” (CEO of Manufacturing Company, our emphasis)

And, from the county government's professed philosophy (2007):

As employees of Reynolds County, we will foster innovation and teamwork; encourage administrative decision-making at the point-of-service; implement policy as set by policy makers; and deliver services with *integrity, compassion, and fairness*. (our emphasis)

Riverton's economic history, first as a tobacco town and then as a manufacturing town, shapes residents' meaning and value of hard work. Their beliefs align with what Max Weber (1958) characterized as the Protestant work ethic in *The Protestant ethic and the spirit of capitalism*. Weber described the Protestant belief that hard work and success in earthly pursuits signaled spiritual deliverance and eternal salvation. This lesson from early Protestant leaders sought to address anxiety about whether and how one might gain access to heaven. In other words, hard work would lead to material success, and that material success signaled that a person was destined for the afterlife. He argued that this ethic accounted for Protestant groups' success in European capitalism because it inextricably linked “spiritualism and materialism and suggest[ed] that hard work is itself a virtue” (Smagorinsky and Taxel 2005, p. 79). The Protestant work ethic implies that “work sustains the individual, who can attain a better life through diligent effort” (Smagorinsky and Taxel 2005, p. 79). Today, the religious aspects of the Protestant work ethic may have diminished, but the idea that hard work demonstrates one's personal and community worth remains vibrant in Riverton.

Importance of community, religion, and moral values

Despite the uncertain state of the economy, Riverton, as described by its citizens, as “a good place to live” and “a good place to raise a family” (e.g., library assistant, 2/23/05; town librarian, 3/5/05; town historian, 3/29/05). While the county faces population decline and economic instability, many are committed to staying put (town librarian, 3/5/05; town historian, 3/29/05). Promotional materials (1/07) for the county extol its virtues as follows:

There is a place where... small town charm and close-knit communities flourish.

There is a place where... neighbors know each other's names.

There is a place where... good life and good business go hand in hand.

That place is... Reynolds County.

“Good” people, defined by most citizens of Riverton are those who are caring, friendly, upstanding citizens—those who take care of their neighbors and “look out for one another” (assistant to the school librarian, 2/23/05). Our newspaper analysis uncovered quite a few letters to the editor thanking someone for behaving as a Good Samaritan. Religion is an important part of the “good” citizens’ daily lives; Protestant (primarily Baptist) churches form the backbone of the community.

Depending on whom you ask, there is a concern in the town and county about the eroding moral values of today’s youth. This concern partially manifests itself through worry about the place of morals and values in schooling. In February 2004, the county’s school board members “spent less than 10 min” on the decision to allow framed posters of the national motto “In God We Trust” in public school classrooms (local newspaper, 2/25/04). A local resident requested permission to hang these posters in local schools as part of a nationwide effort launched by the American Family Association, a nonprofit organization designed to hold companies accountable for whether they are “attacking” traditional family values. The resident explained, “Putting the motto in schools is a way to restore a small part of history, revive patriotism and show God’s role, since our history is so rich with Christian influence” (local newspaper, 2/25/04). National-level discourses of conservative politics, in many ways, enable the meanings of good life, good citizen, and good “young’un” produced in Riverton.

National-level conservative politics as resource for Riverton’s cultural stability

Riverton residents’ fierce hold on their “small town charm,” “close-knit community,” religious values, and Protestant work ethic reflect very nicely a national-level discourse that centers individuals’ morality and work ethic as primary solutions to society’s current woes (Smagorinsky and Taxel 2005). That is, conservative political discourse centers social and economic problems within individuals—their biologies and biographies—rather than within society’s structures. Implicitly, people get a message that, if they work hard and are good people, they will have a good life. Yet, these ideas, in the context of economic instability and uncertainty about the future, cause great anxiety. People in Riverton, for example, were faithful attendees of their weekly religious services, were good community members, and worked extremely hard, but life was not necessarily good. They and their neighbors were still losing jobs and falling on hard economic times.

There are a few relevant outcomes inherent in the embrace of these conservative beliefs. First, this fear and uncertainty about the future, as some cultural studies scholars (e.g., West 2004) have argued, triggers an embrace of authoritarian and fundamentalist discourses that promise security and predictability. For example, the US has seen a sharp increase in evangelical Christian church membership and religious fundamentalism (e.g., Lerner 2006). Second, along with a turn toward authoritarian discourses, there is also a heightened worry about our youth’s

morality. Contemporary alarms about morality, values, and character, especially regarding America's youth, are nothing new—they are persistent aspects of US history (Smagorinsky and Taxel 2005). Hunter (2000), in fact, argued that every US generation for at least the past two centuries has framed the depravity of youth as an urgent, unprecedented problem.

Such concerns about children's character and morality beg attention to school's role in addressing the problems. Indeed, "deliberate intervention in the behavior and character of students is a central if not dominating theme in the history of public schooling in the United States" (Purpel 1997, p. 141). Powerful academic theoreticians and conservative political rhetoricians (e.g., William Bennett, Lynn Cheney, Thomas Lickona) have spearheaded and/or endorsed a version of character education that is based on authoritarian perspectives and underlying assumptions about human nature (as flawed and needing correction) and human character (that there is a single, objective, universally valid notion of human character) (Smagorinsky and Taxel 2005). In their study of character education proposals funded by the United States Department of Education's Office of Education Research and Improvement (OERI), Smagorinsky and Taxel (2005) found that, overwhelmingly, proposals from the "Deep South" reflected these conservative perspectives about character, morality, and values. In addition, the proposals from the Deep South posited schools as agents of stability and cultural preservation, perpetuated a view of youths as depraved, professed a yearning for the "good old days," and touted the value of hard work for the achievement of a better life (i.e., the Protestant work ethic). The character education movement in general, but especially in the Deep South, instantiates religious doctrine in its rejection of postmodernism and relativism and the "belief in moral decay and the abandonment of cherished truths" (Smagorinsky and Taxel 2005, p. 155).

There are clear parallels between the conservative discourse at the national level, in the character education movement in the Deep South, and in the ways Riverton residents promote and make meaning of their town's history. Riverton residents do not demonize youth in the ways we see in the dominant national discourse, but they do profess a desire to "maintain" the good old days in the face of these "changing times" (local newspaper, 8/1/05). As has been the case through history, schooling is one way to maintain and perpetuate cultural stability (Reese 2005).

Horizon school of math, science, and technology in the contexts of modern-day Mayberry, globalization, and conservative politics

National conservative discourse about morality and youth depravity have implications for what schooling and science education can become, especially in a rural, southern town that defines itself and gets defined by others as one whose citizens are particularly moral and community-oriented. Schooling must be about, in part, developing "good" citizens and youth's morality. And, since Riverton has such great commitment to maintaining its rich historical traditions, schooling probably cannot stray too far from tradition. We should also remember that schooling must make sense within the larger economic context. So, schooling must be about preparing youth to contribute to Riverton's economic future.

These contexts simultaneously enable and constrain meanings of science education. In rural areas of the US, like Riverton, where Protestant religion and conservative politics shape people's values and beliefs, science may be looked upon skeptically (e.g., Grossberg 2005). And yet, Riverton recognizes science as a possible tool for improving their economic outlook as they posit the economic potential of industries related to biotechnology and conservation (local community college president, 8/24/05). This tension between skepticism about science and science as a tool for an improved future is an important knot in our case about Horizon School of Math Science and Technology as a site of struggle.

Science as “add-on” or “perk”

One *could* envision an elementary curriculum that positions science as the centerpiece, especially at a math, science, and technology (MST) elementary school. Other subjects, such as mathematics and literacy, could easily be taught via a science-centered curriculum. And, though science was taught much more often at Horizon than other elementary schools in the region,² our initial analysis of the articles in the local newspaper raised immediate questions. We noticed that Horizon did not promote or get promoted for their math, science, and technology (MST) instruction nearly to the extent we expected for a school that touted those subjects as its magnet focus (see Fig. 1).

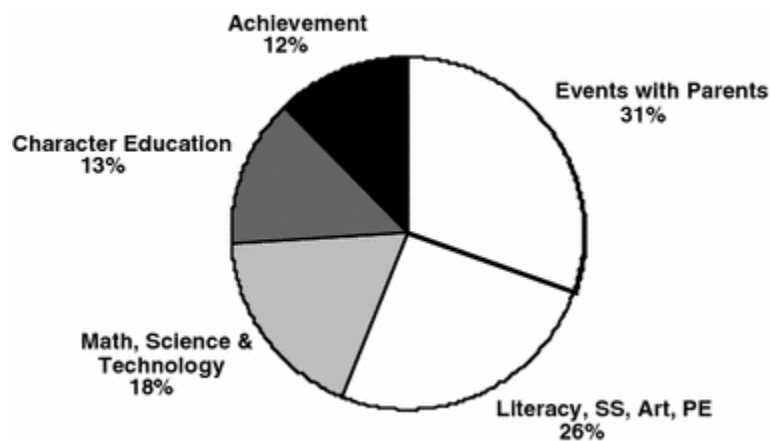


Fig. 1 Thematic analysis of all newspaper articles about Horizon, from 2003 to 2006

This graph (Fig. 1) illustrates our analysis of major themes included in the newspaper articles. To identify major themes, we read carefully each article about Horizon published between January 2003 and August 2 2006 ($n = 73$) and jointly decided on its major topic. So, for example, an article about a field trip to the coast was categorized as “math, science, or technology.” An article about a choral performance at the school for parents was categorized as “event with parents.” The analysis demonstrates that MST was promoted only 18% of the time, while other traditional schooling content (literacy, social studies, art, physical education) received significantly more exposure in the press (26% of the total articles). A central question raised by these findings was, “Why was a school with a MST focus getting more press for teaching and

learning of other content areas?” Other articles reinforced traditional definitions of schooling; for example 12% of the articles were about students’ outstanding academic achievement (e.g., honor roll; academic awards) and 13% of the articles focused on character education (e.g., descriptions of school-wide character education programs, canned food drives, perfect attendance awards, hurricane relief efforts). Events involving parent participation (parent volunteer efforts, art performances, and fundraising efforts) yielded 31% of the total articles, perhaps because the events that brought the parents to the school also brought the press.

On a closer analysis of the content of the newspaper articles, we discovered a strong theme of MST (and especially science and technology) positioned as an *enhancement* outside of the existing, standard, traditional, elementary curriculum.

We’re just focusing on math, science, and technology *a little more*. We’re *beefing up* the course of study. (Principal, local newspaper, 2/28/03, our emphasis).

Almost all of the 37 total photos depicted the students doing science outside of the normal curricular day (e.g., Friday science electives, field trips) or through participation in extracurricular competitive events (e.g., math fair, soil and water conservation poster competitions), tacitly positioning science as a perk of or add-on to the standard curriculum.³ In interviews, teachers and the media specialist noted the fieldtrips (science outside the normal school day) and the science Friday electives (science outside the normal school curriculum) as highlights of Horizon’s offerings that made it more of a “magnet” than other schools (Interviews with school media specialist, 3/11/05; 1st grade teacher, 5/4/05; 3rd grade teacher, 3/15/05; 4th grade teacher, 4/8/05). We also found it interesting that the most publicly celebrated space for doing science was the outdoor science classroom even though that was not necessarily where most science was taught. At the Open House, pictures of the science fieldtrips were prominently displayed in the front lobby (4/22/04). Even the school’s mission statement suggests that MST can “enhance” the standard curriculum: “...to empower a diverse family of lifelong learners to become...successful through real life experiences and enhanced knowledge in the fields of math, science, and technology...” (posted on school walls, 4/22/04). Parents took up this meaning of science as an add-on, too; nearly every parent interviewed noted the fieldtrips and science electives as attractive perks of the school’s curriculum and instruction.

This meaning of science as a perk or add-on occurred despite the principal’s and teachers’ desires to “integrate science into everything we do” (Principal, 2/28/05). Our purpose is to understand why science got defined in the ways that it did; why *this* meaning of science (as add-on) and not *another* meaning of science (as central)? How and why did this happen? We pose a few interpretive explanations, drawing on what we know about Horizon’s multi-layered contexts.

Science as suspect

There were multiple ways that community members and potential parents viewed the “science” part of Horizon’s curriculum skeptically. First, the principal, Mrs. Perkins, had to work hard to

dispel widespread rumors that Horizon was the school for the “smart, white kids.” In part, this notion arose and was sustained because Horizon was the first school of choice in the district. Parents were not familiar with this notion of schooling; some even thought that it was a private school. The principal wrote an article entitled, *Fact vs. Fiction at Horizon Magnet School* (4/7/04) “to address myths” about Horizon. Her counter-myth statements included:

- Horizon is not a school for “only smart kids.”
- Horizon is a strong literacy school.
- There is no tuition to attend Horizon.
- Anyone in Reynolds County can attend Horizon.
- Horizon wants a culturally and racially diverse student population.

Four of the five myths about Horizon were about its purported exclusivity, and parents in the community were not the only ones who held and perpetuated these beliefs. Our informal conversations with neighboring teachers in the county supported these myths, for example: “They only take the smart kids”; “They’re our major competition with [end-of-grade standardized tests]” (5/13/05). Further illustrating Horizon as a site of struggle, parents and staff at the school seem to both promote and contest this perception of the school as elitist.

Parents who chose to send their children to Horizon cited multiple reasons for doing so, but more than one parent claimed that the math, science and technology (MST) focus at Horizon would attract “different kinds of kids.” For example:

Another reason I [chose Horizon] is because there are more high achievers here than [our previous school]—there are not so many discipline problems over here... What [Horizon teachers] have, they don’t have to wait on so many interruptions... they can go on with learning. (Parent A, focus group, 6/13/05)

My [fourth grade son] told [a friend who is a junior in high school] where he went to school at and told him that he went to Horizon and [the friend] said, ‘You over there with all them brainy kids?!’ (Parent B, focus group, 6/13/05)

In another interview, a parent explained how she would explain the school to a fellow parent:

First of all I just think it’s just a really fantastic school. I think everybody is really– like staff, other parents, and children– are sort of excited because it’s a different kind of school in this county. It is one of the few magnet schools. It’s the only one here in Riverton and you know year-round is one thing and it being you know math and science technology is sort of another highlight. (6/10/05)

Many teachers, but especially the founding teachers, acknowledged the elitism implied by a focus on MST. For example:

Teacher I think the reason we picked that theme is because we felt like people would want to have their children come to our school...

Heidi Why?

Teacher I don't know. I think for a certain socio-economic group of people high end, I think they realize the trends that are going in the world... (She went on to explain, though, that she thinks that the school would also benefit students from working class backgrounds and students with learning disabilities)

Heidi [later in the interview] How do you think this school is perceived by the community?

Teacher [No hesitation]. As the richest, Whitest, and brightest kids. I think when we put the math, science, and technology [in the school's name] it became identified as a private school. (Interview with 4th grade founding teacher, 4/8/05)

Nearly all the teachers, the principal, and some of the parents we interviewed expressed concern about the school's elitist reputation. The third grade teacher, for example, said, "We knew we were going to get the best and the brightest and all that but that's not what we wanted to portray to the community. We didn't want this to be this snobby school" (3/15/05). The teachers and parents at the school fought hard to challenge this elitist perception of Horizon in the community. During the recruitment period in the spring, they stood outside the local grocery store and K-Mart store, handing out brochures about the school and talking with parents. They called and actively recruited parents they knew in the community who had children with special needs. In their nearly weekly newspaper articles the first year the school opened, they were careful to show students of different races and ethnicities in photos. Still, 3 years after the school's opening, the "math, science, and technology" label was still perceived as problematic for recruiting diverse populations (Interview with principal, 2/23/05).

Further, the label "School of Math, Science, and Technology" problematically suggested to some community members that other traditional subjects like literacy and social studies were not taught or were not taught as well as they would be at other schools. In other words, perhaps the label connoted a meaning too far afield from sociohistorical meanings of "real" elementary schooling. As implied by the principal's counter-myth statement quoted above ("Horizon is a strong literacy school"), the staff had to work hard to educate community members about its curriculum.

Teacher That was a *very* (pause, with emphasis) *big* (pause, with emphasis) misconception in the beginning. Lots of parents, when we started asking people to come

to this school said, ‘Well, what about reading? Well, what are you gonna do about writing? What are you gonna do about social studies?’ (3rd grade teacher, 3/15/05, her emphasis)

Parent Our first response was, ‘If it is a school of math, science and technology, where does reading and social studies come in?’ (5/28/04, letter to editor in local newspaper)

Entanglements of science and schooling with larger networks of practice

Our curiosity about the ways Horizon promoted itself and got promoted in the newspaper piqued when we noticed significantly more articles about school subjects *other than* math, science, and technology, such as literacy, social studies, art, and physical education. Why was this? Horizon had to create a curriculum that was different enough to recruit students (and parents), but not so different or innovative that it was unrecognizable. We understand the suspicion or lack of vision about *centering* science within Horizon’s curriculum to be a function of the community-level and macro-level networks of practice that got tangled up with the meanings of elementary schooling at Horizon. These meanings include the history of elementary schooling as teaching the three R’s; modern-day authoritarian discourses about schooling emphasizing standardized curriculum and high stakes testing; and concern about a lack of respect for authority by youth were further knotted up with Riverton’s strong religious base, prideful history and yearning for the “good ol’ days.” These multi-layered, complex networks of practice bore down on Horizon’s curriculum to shape what counted as schooling and science. A school that placed science at the center of its curriculum would not flourish, or even make sense, given such contexts. So, while science, at Horizon, was a strong part of the curriculum—and, perhaps, much more of a centerpiece than it would be at other schools, it could never become *the* centerpiece.

In some ways, the meanings of science as add-on, perk, and elitist did not completely surprise us. Traditional schooling constitutes an incredibly strong network of practice. As Nespors (1994) reminds us, “It would be a mistake to emphasize the fluidity of the world without noting that it flows in very deeply worn channels.” Thus, everyday practices and accompanying meanings of schooling that fall too far outside of the network would be difficult to sustain. Understanding Horizon as a *site of struggle*, however, also suggests that meanings from larger, more powerful social, political, economic, and cultural contexts are not taken up without problem or straightforwardly resisted. Networks of practice and their constituent discourses can be taken up in different ways and in unusual combinations to be used as resources in everyday educational practices. Viewing Horizon as a site of struggle means that the outcomes, i.e., the meanings of schooling and science that emerge in everyday practice can be unpredictable and novel (Eisenhart 2001).

Novel outcome: science with character

The children not only learn math, science, reading and other necessary elements, but they learn behavior, manners, and caring. (letter to editor from parents, 5/28/04)

I want my children to learn all they can from books in school, but if I can send my children to school each day and know that they are also being taught the Golden Rule, I feel that I am one lucky parent. (letter to editor from parents, 5/28/04)

[The principal] told parents that their children will learn integrity, courtesy, honesty and manners – which brought applause from the bleachers (local newspaper article about Open House at Horizon, 5/28/03).

[I want to] help our kids be more comfortable with technology, more comfortable with the world we live in, and to act... *right*" (Interview with 4th grade teacher, 4/8/05, her emphasis)

An interesting trend turned up in the newspaper analysis; there were nearly equal number of articles that positioned science as a major theme ($n = 7$) as there were articles that had character education as a major theme ($n = 8$). When we examined the content of each article ($n = 73$) in depth to identify the number of times science (education) and character (education) were mentioned in articles identified under other major topics, this trend held up; science was incorporated 16 times in articles that were not explicitly about science and character education was mentioned 14 times in articles that were not explicitly about character education. Once we identified this initial trend in the newspaper analysis, it appeared again and again throughout our data—in interviews with parents, teachers, and the principal. We even began to notice this trend in the school's physical environment. For example, upon walking in the office we saw a large poster of a scientist's hand measuring a seedling accompanied by the following phrases: "We are good citizens. We follow rules. We are good neighbors. We protect the environment. We volunteer to help." The school's "dining hall," named such instead of a "cafeteria" to encourage students' good manners, was decorated with vases of brilliant flowers on each table. A closer inspection revealed that each vase contained a placard listing a different character trait (e.g., patience, responsibility, respect). Many other such character education/science education decorations adorned the school, emphasizing again and again these dual school foci.

The dual emphases represented the kind of novel outcome we hinted at in the previous section. Why was a school of math, science, and technology promoting itself and getting promoted as a character education school? Why science education and character education together? On the face of it, these two subjects seem incommensurate.

Our understandings of Horizon's community-level and macro-level contexts above help us make sense of its character education focus. Given its entanglements with networks of conservatism at the global level (with its discourses of youth depravity and concern for morals and values) and at the community level (a rural location with strong discourses about cultural stability and preservation), it makes sense that the Horizon principal and founding teachers felt the need to create and showcase their character education program. This was especially true since the school had to sell itself to community members, recruit enough students to stay open, and establish

enough parent buy-in so that they would spread the good word to others in the community to ensure strong future enrollment numbers. What parents would argue, after all, with a school that both prepares their children for the future, with enhanced learning in math, science, and technology, and promises, “their children will [also] learn integrity, courtesy, honesty and manners” (Quote from principal in local newspaper, 5/28/03)?

Our domain analysis of character education showed character education as a way to promote good students, good future workers, good citizens, and community (see Table 1). Horizon taught character, in part, with a “life skills” curriculum, whereby students learned different character traits (e.g., caring, cooperation, initiative, integrity, perseverance, responsibility) in a weekly character education class (7/15/05, newspaper article entitled *Character Counts*). There was a lot of attention to promoting good behavior and respect, and usually, these behaviors were rewarded concretely. If students were “caught being good,” they were entered into a lottery to win a bicycle at the end of the year. Each 9 weeks, a special assembly was held to recognize students with good behaviors and attitudes (Personal Best Award) and who show improvement in attitude and behavior (Kid With Character Award). Students were also awarded tokens for demonstrating the appropriate behaviors taught in the character education classes; classes with highest token totals were awarded with a party. “They’re responding to the incentives and to the feeling they get from doing something good for someone else,” the guidance counselor explained (local newspaper, 2/2/05).

Table 1 Articles about character education in the local newspaper, analyzed by domain

Domains	Reasons for character education	Ways of teaching “good character”	Characteristics of “good character”	Ways of doing “good character”
Included terms	Promoting good students Promoting good workers Promoting good citizens Promoting community	“Life skills” curriculum Micro-society External rewards Positive Action Kid with character Caught being good Attendance	Being on time Integrity Manners Patriotism Respect Responsibility	Canned food drives Cooking for and entertaining parents/grandparents Hurricane relief Proper dining etiquette and table manners “Salute to America” musical program Scouting

		awards		Student voting Quality work
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Parents literally applauded the character education focus at Horizon’s first Open House (5/28/03). Advertisements in the local newspaper to recruit new students touted equally the innovative curriculum and the “inviting,” “warm, friendly environment” using quotes from parents as evidence. Parents enthusiastically praised this aspect of Horizon, bringing it up without our solicitation in interviews, attributing their children’s good behavior, in part, to the character education work at the school. For example:

This year, [my son and I] were coming out [of the school] one day and I almost got on him because he was dragging coming out of the school... But I looked about and there was this boy carrying out a pumpkin and he couldn’t get his car door opened and hold the pumpkin. Allen opened the car door for him... to get in and then closed the door behind him... I didn’t tell him to do it. None of the teachers told him to do it. He just saw that that child needed [help]. (Focus group, 6/15/05).

According to the parents in the focus group interview, middle school teachers were able to spot Horizon students based on their good behavior.

Parent I have heard feedback from the middle school. They can tell which kids are coming from Horizon and which are coming from other schools

Heidi From what?

Parent The way they are interested in being there and the way they respect other people, their behavior, following rules. The teachers have told me that they just know which ones are the Horizon students. (Focus group, 6/15/05)

The emphasis on character education even creeps into newspaper articles with science as a major theme. For example, in the componential analysis illustrated in Table 2, we summarize each science-focused article, demonstrating that five out of the seven mention character education components.

Table 2 Componential analysis of science-focused newspaper articles

Article title	Summary of article	Inquiry/hands-on component	Character education component	Place-based science component	Science <i>outside</i> regular classroom

<p>“New learning gets down and dirty” (11/30/05)</p>	<p>Promotion of Horizon’s “unique” outdoor classroom as source of “hands-on,” “discovery” learning and an “area to sit down, relax, and enjoy all the beauty nature has to offer”</p>	X		X (local wildlife; enjoy nature)	X
<p>“Hands-on” (8/26/05)</p>	<p>Description of professional development designed to promote teachers’ understanding of inquiry-based teaching and “new science kits.” Showed photos of teachers observing local insects and other animals</p>	X		X (local animals)	X (outside normal school hours)
<p>“Of children and chicks” (5/11/05)</p>	<p>“[K]indergarten class at Horizon... became mamas and papas to 23 tiny chicks” as part of a 21-day science unit. Showed three, large photos of children with tiny, fluffy chicks</p>	X (Students had to turn eggs; incubated eggs)	X (Students learn to nurture, take care of “others”)	X (Chicks will “head off to a nearby farm to enjoy life in outdoors”)	
<p>“Back to nature” (5/6/05)</p>	<p>Describes a school-wide field trip to a nearby river; field trip was meant to “immerse students in a... curriculum that nurtures a lifelong respect for the relationships with our natural</p>	X (wetlands study of macro-invertebrates, plant i.d. walks, dissection, classification)	X (Re-enact Underground Railroad journeys; team-building challenges)	X (local river)	X (field trip during Spring Break)

	environment”				
“Fall enrichment coasting along for Horizon magnet school” (11/5/04)	Describes a school-wide field trip to the North Carolina coast, focusing on coastal environments, wildlife conservation, and human impacts on environment	X (wading in sound to study wildlife, human impact; measuring ort; wildlife i.d.; dissection)	X (“This course fell right in line w/the character education program used at Horizon”)	X (local coast)	X (field trip during Fall Break)
“Farming teaches magnet students real life skills” (8/4/04)	Describes school’s garden, the “crops,” students’ “harvesting,” and the research students do to learn about planting times, farming techniques, composting, and soil composition during Friday science electives	X (planting, harvesting, researching, baking, meal-planning)	X (taking care of others; feeding others)	X (“Farming is rich in this kind of curriculum”)	X (Class is part of the school’s Friday science electives)
“Horizon students visit [NC coast]” (5/19/04)	Describes school-wide field trip to the coast; a similar field trip to the one described in 11/5/04 article. Shows large picture of students role-playing “baby turtles trying to return to the ocean” and a student using “a net to capture and study marine life”	X (wading in sound to study wildlife and human impact; measuring ort; wildlife i.d.; dissection)	X (“Students were encouraged to use life skills such as patience, friendship, cooperation, [and] caring to complete tasks”)	X (local coast)	X (field trip during summer break)

As we also see in Table 2, hands-on science and/or inquiry-based science was a major component in every major science article. This trend held up even in articles that were not explicitly about science; in the 16 times science was mentioned in other articles, its hands-on and/or inquiry-based characteristics were showcased. We also know from our extensive, 3-year

work as resources for teachers' professional development in science education that all teachers and the principal were committed to inquiry-based instruction. This was a unique feature and selling point of Horizon; "We are innovative," its advertisements in the newspaper claimed, citing hands-on learning and "the very latest research-based teaching methods" as cornerstones of the school's philosophy. Horizon was the only school in the district to adopt kit-based curricula for all grade levels; the other schools in the district still used traditional textbooks.⁴ So, what do we make of this compelling dual inquiry-based/character education focus? In the next section, we argue for understanding these joint showcased enterprises as representative of Horizon as a site of struggle.

Entanglements and possibilities of science and schooling with larger networks of practice

Though inquiry-based science has been around since public school's inception (Rudolph 2002), it counters teacher-directed instruction that emphasizes science as a body of facts—i.e., the kind of science instruction that continues to dominate sociohistorical ways of doing school science (Carlone 2004). In many ways, inquiry-based instruction represents an unorthodox way of doing schooling, enabling more agency for students and less control for teachers. In our work with teachers and pre-service teachers, worries about students' behavior and losing control of students are the oft most cited reasons for not pursuing inquiry-based or even hands-on instruction. One of the Horizon teachers (a new teacher), indeed, mentioned this very thing in her interview:

I just think that making children under control and having them that focused on what you are doing [is important]. Because a lot of times, you know, you make a fun activity and kids will be like wild and all over the place... And in my grade [1st grade], it is easy to keep them under control because they are still, you know, love the teacher and they don't want to get in trouble. But then when you get in fifth grade they just don't care. (5/4/05)

We understand this struggle as representative of the age-old exchange paradigm of schooling explained by Willis (1977); teachers provide knowledge and certifications to students in exchange for politeness and respect from students. A focus on scientific inquiry potentially shifts the balance of power from teachers to students. One way to counter that shift would be, as Horizon did, to emphasize character education, which makes politeness, respect, attendance, and punctuality goals in and of themselves. Especially in this community, with a cultural ethic of farming and factory values, there are cultural and material resources to reproduce character education while reform-based science instruction represents an innovation and potentially a disruption to the prevailing paradigm.

We note here that character education, as enacted at Horizon, fell very much in line with traditional character education programs described and critiqued in Smagorinsky and Taxel's (2005) book, *The discourse of character education* and also heavily critiqued by Kohn (1997). In other words, Horizon teachers taught their students specific, pre-defined character traits in a didactic fashion and awarded individual students with extrinsic, often material rewards for

displaying “good character” behaviors. Good character was defined in an objective, universal, absolute fashion, rather than as “a function of conditions that people face in their cultural milieus, historical time periods, and particular circumstances” (Smagorinsky and Taxel 2005, p. 34). In Kohn’s (1997) view, this kind of character education does not have anything to do with facilitating children’s moral or social growth; it just makes it easier to control students.

But, we had to wonder, did adopting a reform-based stance toward science teaching offer anything to character education at the school? We do have tentative evidence that some students were taking up identities that represented more transformative meanings of “student” than the prototypical exchange paradigm would imply. In other words, we did see some cracks of transformative potential; places where students combined their agentic roles as inquiry-based learners and their received good character roles in novel ways using cultural and material resources from their families, community, school, character education, and inquiry-based science education to do so. For example, one recent article, “Students Helping Students” (July 28 2006), stood out in our minds as distinct from the numerous other character education articles we encountered. This article featured two students (third and fourth graders) who organized a food drive at the school to restock a local food pantry. They clearly recognized and engaged with a local problem—emptying shelves at a food pantry and a family who lost their home in a fire: “I thought that I should try to do something about making sure families like that didn’t have to go hungry,” one of the students said. “I talked to my mom about it and she talked to [Celia’s] mom.” The two students got together, created a proposal, and made an appointment with the principal to share their plan. “I was really impressed. I was also moved by how sensitive they were to the needs of children who didn’t have enough to eat.” The actions and responses of the adults from the outset were to honor the problem, provide resources to develop a plan of action, and hold the students accountable first to their principal who was struck by their empathy, a character education norm.

We’ve had food drives before, but the others were more perfunctory. The way the girls presented this one really touched everyone’s hearts. We realized we were doing this food drive because two kids chose to put something like this together when they could have been spending their afternoons at the pool or outside playing with their friends. That made it mean a whole lot more to everyone.

The girls wrote letters home, created flyers and posters for the school and community and appeared on the school’s in house broadcast to promote the food drive. They contacted the food pantry’s director and made arrangements for him to pick up the boxes of food. These actions gave them recognition and established accountability to the school community and beyond. Clearly they were provided with the resources needed to create these products, contact people, and broadcast within the school as well as receive newspaper coverage for their effort. What is perhaps most telling about their actions are how they inspired other students. As the principal noted “It’s been amazing the number that have come to me with ideas for projects they wanted to

do. The lesson seems so much stronger when it comes from two of our students like this. That's what makes this food drive so different from others we've had in the past."

The difference is what struck us. The lesson, in this case, was student-led, locally situated, and evidence of student agency to identify a problem, investigate and plan a solution, and receive the needed resources and recognition to productively follow through with the plan. No incentives were offered these young students; their motives seem genuinely altruistic. They resist quantifying their goals, "We didn't really set a goal. We just want to collect as much food as we can," said one. "We just want people that are hungry to have enough to eat, just like we do," stated the other. They effectively engaged others who not only responded by bringing in food but engaged others: "It sort of started a domino effect." They were productive in developing the food drive and ultimately collecting box loads of food.

These girls' actions, in our view, provide evidence of a small crack of transformative possibility, whereby students take initiative and adults recognize their authority and provide resources for them to do so. These girls, who were given authority to ask questions, identify problems, and construct explanations in their science classes, may have seized the opportunity to act in similar ways in a new situation, with a different kind of a problem. It could be evidence that these students were beginning to internalize a reform-based way of learning introduced in science, which acted as a resource for other everyday practices. It would be hard to envision teaching in a reform-based way in one subject and not have it spill over into other areas of the elementary curriculum. In this case, the reform-based practices influenced the meaning of character education.

Science with character, then, represents a novel outcome at Horizon, one with transformative potential. The students at least partially contested their roles as *receivers* of character education tenets to enact a more *participatory* character education. Scientific practices could be construed as resources for this contestation. Interestingly, a closer look at the kind of science promoted at/by Horizon may have also shaped and been shaped by this ethos of empathy and caring. In the next section, we explain the high-touch, nurturing, and place-based science promoted at Horizon.

Novel outcome: high-touch, nurturing, place-based science

Horizon's science, as portrayed in the local newspaper, was caring, nurturing, environmentally based, and capitalized on the community and state's natural resources and history as a farming community. The outdoor classroom, beautifully landscaped, boasts a small butterfly garden, multiple, hand-built and/or locally purchased birdhouses, a fossil pit with fossils shipped in from the North Carolina coast, a worm bin and compost pile, a creek bed to attract local reptiles and amphibians, and "an area to sit down, relax, and enjoy all the beauty nature has to offer" (local newspaper, 11/30/05). In addition, there are two other nearby natural areas—one for bat houses and one with eight large garden plots. As the principal asserted about the outdoor classroom,

“Authentic learning makes a much greater impression on students as opposed to the detached relationship they sometimes have from just reading in a textbook” (11/30/05).

Horizon’s science is depicted in direct opposition to the detachment of prototypical science. In the newspaper photos of science we never saw stereotypical child scientists in lab coats or goggles with test tubes. The scientific tools shown were shovels, watering cans, or nets but most often, a pencil or a hand. Science in the photographs is kindergarteners clutching warm and fuzzy baby chicks, students holding the legs of their partners as they lean over the side of a bridge to collect river specimens, or families planting in a garden. In drawing on a history of education related to farming, the school also engages in a historical struggle to “preserve certain values” (Kliebard 2004) associated with rural life. Thus, we find it interesting that the science at Horizon was not only portrayed as “high touch” in the sense of hands-on but also “high touch” in the sense that Pink (2005) references as including the ability to empathize.

This empathetic science was portrayed again and again in the newspaper’s photos and stories about Horizon’s science. For example, two separate articles showed and explained students role-playing as baby sea turtles to find their way to the ocean to understand the confusion caused by human lights (5/19/04; 11/5/04). One student said, “I found a grocery bag floating and pulled it out. These bags kill leather back sea turtles “(11/5/04). Much of the science portrayed was about “taking care.” “Just in time for Mother’s Day... [Ms. Dobb’s] kindergarten class became mamas and papas to 23 tiny chicks,” and after a week in the classroom those chicks were “heading off to the farm to enjoy life in the outdoors” (5/11/05). In another article, a parent volunteer is applauded for capturing and saving a gerbil and her babies (12/19/03). “Employees from the school’s Florist Shop tend to plants each morning,” captioned a photo of students in aprons with watering cans (1/28/04). A florist shop involves not only caring for plants but also providing plants or flowers to care for others.

Horizon’s principal, the teachers, and the newspaper celebrated place-based and environmental science. For example, in the paper, students were shown collecting specimens from a river or sound; families planting in the garden, and teachers and students building terrariums. Habitats including birdhouses, birds’ nests, bat houses, and igloos were constructed and flowerpots were decorated in a lesson on Greek pottery (2/6/04). Students annually participated in a Soil and Water Conservation poster contest because, “creating posters that focused on the environment was right up their alley” (2/25/04).

Children cooking (11/24/04), a basket of harvested vegetables (8/4/04), pet food measures (3/18/05), and baby chicks (5/11/05) were among the many instances when the science celebrated at Horizon drew on the community’s history of farming. A young boy shows his father a weather project (8/19/05) and reminded us of the importance weather plays in agriculture. Children learn about how mixtures change as they participate in preparing a Thanksgiving breakfast for their parents (11/24/04). An art project involves drawing a life-sized outline of the body and gluing organs in appropriate places (10/26/05). Taking care of

one's nutrition and health were also of primary concern when the family farm relied on the daily labor of family members. The third grade class's math fair project investigating the old wife's tale about babies being born on a full moon also drew on local folklore (6/25/04).

Local cultural, geological, and geographical resources were depicted as sources for and enhancements of science instruction. In one of the first articles introducing the school, the principal said, "The community, in essence, will further teach children how to integrate math, science, and technology" (2/28/03). Indeed, farming was highlighted as a strong resource for the school's curriculum in one article entitled "Farming teaches magnet students real life skills" (8/4/04). In the article, the principal explained, "Our goal is to show students how to apply information to real life situations and skills. It's what teaching and learning is all about" (8/4/04).

Entanglements of high-touch science with larger networks of practice

Horizon's celebration of high-touch science and community values can be understood as a contestation of prototypical school science and a distinct form of enculturation. Aikenhead (2006), in explaining a humanistic school science, argued

[T]he most fundamental question for cultural relevance is not so much "Relevance to whom?" "Relevance to what?" or "Who decides?" but rather "Relevance to which enculturation process?"—enculturation into students' local, national, and global communities (one facet of humanistic perspective in school science advanced by this book), or enculturation into a scientific discipline (the pipeline's status quo). (p. 47)

Horizon's science, promoted by faculty, principal, and newspaper, was in direct opposition to what Aikenhead (2006) called "pipeline science," which focuses on preparing students for future science courses and developing certain (often narrowly defined) kinds of scientific knowledge and skills. It is important to mention here that these humanistic forms of science represented how science got promoted and publicized, not necessarily what happened in everyday school scientific practice. Even so, we argue that the fact that this form of humanistic science was *celebrated* represents a small victory for contesting alienating forms of science perpetuated in and by pipeline science ideologies that predominate current discourses about science education. And, in understanding the strength of science and schooling as networks of practice, we also have further evidence to view Horizon as a site of struggle.

High-touch science as representative of Horizon as a site of struggle

Nespor's (1994) explanation of science's tightly bound network of practice helps us appreciate even more Horizon's celebration of high-touch, empathetic science as an ongoing accomplishment. In his study of a college physics curriculum, Nespor (1994) found its narrow focus, standardized technologies (e.g., curriculum, discourse practices, inscriptions), marginalization of alternative activities and identities, and consistent cultural practices across space and time stabilized it as a network of practice. When networks like physics can travel

across space and time, weakening links between the actors and other potential networks (e.g., non-physics), the network gains strength and stability. School science, dominated by a pipeline ideology (Aikenhead 2006), can be interpreted as a fairly stable network of practice, with its prototypically narrow curriculum, transmission models of instruction, cookbooks labs, and tacit privileging of dry, technical rational discourse (Carlone 2004). And, while we might see pockets of reform-based science instruction, prototypical school science practices still produce the dominant, taken-for-granted meaning of school science, creating a formidable, tightly bound network of practice (Carlone 2004). Alternative cultural practices (and meanings) of school science, like the one promoted at Horizon, must contend, in some form or another, with this tightly bound network.

Not only does science's tightly bound network of practice work against the promotion of a different kind of science, but so does *school's* ever-more tightly guarded network of practice, buttressed by current national and state-level emphasis on high-stakes testing. In parallel with national-level authoritarian discourses, school curricula are becoming increasingly standardized (Giroux 2005). Tyack and Cuban (1995) term the enduring, taken-for-granted features of "real school" the "persistent grammar of schooling." Despite waves of reform, school practices have remained remarkably consistent for well over a century, with elementary schools labeled as "the guardians of tradition" (Reese 2005), as they have been portrayed as particularly resistant to change. The contemporary focus on accountability with high stakes testing in reading and mathematics promulgated most emphatically by No Child Left Behind continues the legacy of focusing the elementary curriculum on those tested subjects perhaps with the "unintended consequences" of minimizing other subjects including social studies and science (Jones et al. 2003).

Given these incredibly strong and stable networks of practice, we must examine the cultural resources Horizon drew on to contest such networks. In many ways, this kind of empathetic, place-based science makes sense, given what we know about Horizon's nested contexts. First, we could interpret the school's dual emphasis on character education and science education as influential in shaping Horizon's promoted meanings of science. And, of course, Riverton's rich history of celebrating good, neighborly ways lends itself to a high-touch, empathetic science. We can also pull back a bit to understand the history of rural education as a resource for this kind of science curriculum.

When the principal stated, "Farming is rich in this sort of curriculum" (8/4/04), she drew on a history of vocational agriculture that grew specifically from a rural, farming culture. Kliebard (2004) traced how this curriculum evolved into a more project or activity based curriculum that was integrated rather than divided into discrete subjects, was relevant to students' experiences, and was hands-on. From the start, Horizon publicized itself as a school where "you have hands-on experience integrating with the learning and the kids enjoy that" (11/21/03).

In showcasing farming as a resource for the curriculum, the principal touched on a debate that has occupied American education for at least a century about the role of vocational education in schools. Vocational training grew out of a Manual Training Movement that aimed to “redress the imbalance between the essentially literary, humanist curriculum and the handwork that was a mark of modern life” (Kliebard 2004, p. 112). Vocational education evolved into two forms: industrial and agricultural, with the latter as an “effort to preserve certain values associated with rural living in the face of a new society” (Kliebard 2004, p. 130). Rural areas historically promoted vocational agriculture because it was tied specifically to the student’s home life on the farm and as such it was of immediate relevance and interest to the student.

As the history of education reminds us, one of the most enduring resources of this rural past were its values not only of hard work but also of empathy and caring. To follow Pink’s (2005) argument that we are now entering a conceptual age requiring high touch and empathy, Horizon may be positioned to move into a future where such qualities become an economic resource as well. Interestingly, as Reynolds County tries to define its economic future in conservation, tourism and recreation with the local river as centerpiece, or biotechnology using farming backgrounds as resources, the high-touch, empathetic science at Horizon makes real sense.

What counts as legitimate science education and schooling?

We began this paper by arguing for a broader consideration of what counts as “relevant context” in studies of science learning. As we see from the Horizon case, an explicit study of context lets us know that there are possibilities and real limits on what gets counted as legitimate science and schooling. This kind of study helps explain what science and schooling are allowed to become and what they are not allowed to become. The Horizon case provides some good news: historically enduring networks of practice do not always predominate. For example, while we may have strong legacies of traditional, dry, detached, laboratory science predominating school science’s history and contemporary, national-level, authoritarian discourses that tug on science’s curriculum to become ever-more standardized, Horizon shows us that this legacy and these oppressive discourses are not destiny. A different, empathetic, place-based science was celebrated at Horizon, as they drew on various school-based resources (like a character education curriculum, an outdoor classroom, environmental education fieldtrip opportunities), community-based resources (like the town’s celebration of its history as a caring community and promotion of rural values), and even alternative global resources (like a Christian ethic of care).

But, Horizon was not allowed, in its current context to become *any* kind of school, to promote *any* kind of science. Schools do not take up resources from their choice of networks without problems, nor do they straightforwardly resist oppressive networks to create something entirely new. The cultural productions enabled in given contexts must be, in some ways, tied adequately enough to existing networks to be recognizable. For example, in this context, at this time, Horizon was only able to position science at the margins, even though they professed a desire to center science in the curriculum.

Another key here is that the meanings produced are situated in given points in time and space; even networks themselves are fluid. Nesor (1994) reminds us:

Networks expand, contract, and shift configuration over time, and even the most stable and predictable of them are constantly being reappropriated and redefined by the nature of the flows that animate them... Understanding those flows, however, isn't just a matter of understanding 'individual' trajectories but of understanding the ongoing social activities that enmesh the entire network (the social and economic forces that shape a society of drivers). (p. 12)

We are heartened by these theoretical implications, which make the process of cultural production unpredictable, exciting, and full of possibility.

We argue that a broader consideration of context allows for a more robust understanding of *possibility* in science education. With globalization dissolving boundaries in our economy, cultures, and schools, we have to look at the science education classroom as one with permeable boundaries, influencing and being influenced by global networks of practice. Traditionally, reform has been understood by what we need to “put into” the classroom (e.g., a knowledgeable teacher, a supportive administrator, the appropriate resources, a collaborative faculty, adequate time) to achieve “success” (often defined in a standardized, top-down manner). Perhaps, more recently, scholars might even look outside of the school to take into account the ways national-, state- or district-level standards and standardized assessments constrain science education reform. And yet, when we understand schooling on its own terms, without an account for context, we miss a critical aspect of explanations about why things are done the ways that they are. We psychoanalyze the explanations so that individuals get blamed and credited for creating certain science learning environments.

In this study, we examine the problem of reform from a different perspective—arguing that there are multiple networks of practice currently influencing, in positive, negative, and unpredictable ways, what we do in the classroom. These networks are not placed there by *someone* or some mandate or some system—they are *there* already. We need to understand better these networks and the ways they enable and constrain reform.

We acknowledge and respect science education research that acknowledges the presence of outside networks of practice or discourses (e.g., racism, sexism, elitism of science), but many of these studies talk about their oppressing effects on settings. While such studies and perspectives offer important insight and incisive criticism, they are limited in their ability to provide us with new visions about the future. This study, in contrast, highlights some novel outcomes of global and community-level entanglements. It highlights possibility.

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Footnotes

1 All names (of the school, town, county, and people) used in this paper are pseudonyms.

2 The teacher survey results showed that every teacher at Horizon taught science at least 2 days per week and, in some cases, every day of the week, a finding that we can validate with our

extensive visits to the school. Horizon's efforts to prioritize science in the elementary curriculum represent a strong opposition to science's marginalized place at other elementary schools in the region. Our knowledge about local elementary schools is based on our collective experience working in the local schools: as an elementary teacher (Tschida), principal (Tschida), librarian (Kimmel), facilitator of professional development (Carlone), and as teacher educators in a school-based Professional Development School teacher education program (Carlone and Tschida). See also Jones et al. 2003.

3 Only eight of the 37 total photos of students doing science showed science being done within the normal school day, as part of the normal curriculum.

4 While kit-based programs may not necessarily represent "innovative" instruction to science education reformers, Horizon's use of kits does represent a significant contestation in this local school district. The principal worried extensively about the decision to adopt kits, wondering what "parents would say when kids from other schools walked off the buses with bright, shiny new science books and their students, from the science magnet school, didn't have textbooks" (Fieldnotes, 3/7/05).