
EMPIRICAL RESEARCH

How to Go Green: Creating a Conservation Culture in a Public High School Through Education, Modeling, and Communication

Chelsea Schelly

University of Wisconsin-Madison, Madison, Wisconsin, USA

Jennifer E. Cross

Colorado State University, Fort Collins, Colorado, USA

William Franzen

SAGE 2 Associates, Denver, Colorado, USA

Pete Hall and Stu Reeve

Poudre School District, Fort Collins, Colorado, USA

This case study examines how energy conservation efforts in one public high school contributed to both sustainability education and the adoption of sustainable behavior within educational and organizational practice. Individual role models, school facilities, school governance and school culture together support both conservation and environmental education, specifically through the application of principles from behavior theory, including modeling commitments, values, expectations, and behaviors. In addition, role models with the traits of charismatic leaders can be especially instrumental. In this school, communication is the thread connecting the multiple aspects of modeling, helping to create the synergistic relationship between conservation efforts and environmental education. This study demonstrates that conservation efforts, when modeled successfully in a public school setting, can simultaneously and synergistically meet the goals of conservation and sustainability education.

Keywords *energy conservation, environmentally responsible behavior, public schools, sustainability education, teaching through modeling*

INTRODUCTION

Public awareness of the economic costs and environmental impacts of energy consumption, specifically the impact of carbon emissions on global climate change, has stimulated individuals and organizations to consider strategies for reducing energy consumption. Public schools are an ideal location for energy conservation measures; schools can reduce their energy use by 20–30% with a variety of behavioral and operational strategies (United States Environmental Protection Agency, 2009). In 2008, schools in the United States spent an estimated \$8 billion on energy (U.S. EPA, 2009). As publicly funded institutions with a constant eye on the budget, reducing utility bills would enable schools to dedicate more resources to their core mission: education.

Recently, several initiatives have called on school districts to develop new strategies to reduce energy consumption, build and maintain “green” buildings, and engage students in education for environmental sustainability (Karliner, 2005; The Cloud Institute for Sustainability Education, 2009; U.S. Green Building Council, 2009). While some have called for school buildings that teach about environmental sustainability (Orr, 2006; U.S. Green Building Council, 2009) others have called for a paradigm shift in education where “sustainable education” engages students in a holistic practice of transformative learning focused on myriad forms of sustainability, including environmental (Sterling, 2001).

This case study examines the synergy between energy conservation activities and sustainability education in a large (over 1,700 students) public high school, Rocky Mountain High School (hereafter Rocky Mountain). The actual names are being used at the request of the school and the Poudre School District as part of its commitment to serve as a community leader in sustainability and to foster sustainability in other organizations (Poudre School District, 2010).

The broader study began by asking the questions “How did one school surpass its peers to create record-setting energy conservation?” and “How can the conservation and education practices at one school be replicated at others?” Through an interpretive research process, we found that participants described learning through various forms of modeling and through a culture shift in the school that parallels Sterling’s (2001) definition of sustainable education. In this article, we examine how sustainable education and energy conservation efforts at one public high school were mutually supporting and synergistic.

BEHAVIOR CHANGE, EDUCATION, AND SUSTAINABILITY

Embracing sustainable behaviors in the daily activities of a school requires the support of organizational culture. Organizational culture includes the shared values, norms, and practices in an organization (Hill & Jones, 2008). In public school districts, principals play a significant role in creating school culture and may establish values and norms that are different from the district more generally (Deal, 1999). Schools face the same stumbling blocks as any other organization attempting to create an organizational culture that values sustainability. Many change efforts fail because organizations do not attend to the multiple facets required to successfully enact change:

1. not creating a sense of urgency,
2. failing to create a guiding coalition,
3. failing to create a compelling vision,

4. under-communicating the vision,
5. allowing obstacles to stop the vision,
6. failing to create small wins,
7. declaring victory too soon, and
8. failing to institutionalize change in organizational culture (Kotter, 1996).

Each of these eight barriers can prevent even the most necessary changes from occurring.

Attending to just one of these errors, failing to adequately communicate the vision, is itself a multi-faceted effort. Successful communication to promote behavior change involves repeated communication through various media, including face-to-face encouragement and use of all types of organizational communications from e-mail to newsletters to visual media (Cialdini, 1993; Kotter, 1996). Successful communications also include a variety of messages targeted to particular audiences (Grimm, 2006). Some of the messages needed to support change include changing knowledge, developing a sense of efficacy, concrete suggestions for action, acknowledging and rewarding effort, and information about what others are doing, i.e., social norms (Cialdini, 2007; Grimm, 2006; Kotter, 1996; McKenzie-Mohr, 2000).

Thinking about energy conservation more specifically, two research traditions examine strategies for fostering environmentally responsible behavior. First, behavioral researchers have explored the predictors of individual behavior generally (e.g., Bamberg & Möser, 2007; Bamberg & Schmidt, 2003; Diekmann & Preisendörfer, 2003; Hines, Hungerford, & Tomera, 1987), and more specifically at interventions aimed at promoting environmentally responsible behavior (e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2005; Abrahamse, Steg, Vlek, & Rothengatter, 2007; Guagnano, Stern, & Dietz, 1995; McCalley & Midden, 2002). Among those who study environmentally responsible behavior, some (e.g., Barr, Gilg, & Ford, 2001; Tonglet, Phillips, & Read, 2004; Vining & Ebreo, 1992) suggest a strong relationship between attitudes and behavior, while others contend that behavior can change without corresponding changes in attitudes (Siero, Bakker, Dekker, & Van Den Burg, 1996).

Second, research on behavior change in organizations has found that one of requirements of successful efforts to create organizational change for sustainability is the articulation of a clear vision based on values that are linked to behaviors and strategies (Doppelt, 2003; Kotter, 1996). Creating a vision that encourages behavior change does not require changing individual attitudes; rather, a values-based vision creates buy-in because it can transcend different political attitudes (Crompton, 2008; Cross, Byrne, & Lueck, 2010) and provide a link between desired action and common goals (Doppelt, 2003; Kotter, 1996). Values, which are more central to the self and which transcend situations (Rokeach, 1973), are more predictive of behavior than attitudes and can be a key component of articulating a vision that engages people in environmental programs (Doppelt, 2003; Schultz & Zelezny, 2003; Stets & Biga, 2003).

The role of environmental education in promoting environmentally responsible behavior is the topic of much debate, and a large body of research on environmental and/or sustainability education is focused on environmentally responsible behavior within an educational setting (and with educational aims). For decades, scholars and educators have argued that environmental educators must do more than simply teach about the environment, but must prepare citizens with the knowledge and skills needed to actively address the world's environmental concerns (The Cloud Institute for Sustainability Education, 2009; Short, 2010; see also the Tbilisi Declaration, UNESCO/UNEP, 1977). Theoretical models of sustainability education suggest that it must

move beyond the three historic types of environmental education—education about, in, and for the environment (see Lucas, 1972)—to shift the educational paradigm so that educational systems address intertwining social, economic, and environmental issues in a holistic and multi-dimensional way (Foster, 2001; Sterling, 2001; Tilbury, 1995; see also the Tbilisi Declaration, UNESCO/UNEP, 1977).

Within environmental education, there is also debate about how best to encourage environmentally responsible behaviors. Some research indicates that environmental education can positively affect knowledge of (e.g., Ballantyne, Connell, & Fien, 1998; Bogner, 1998; Dimopoulos, Paraskevopoulos, & Pantis, 2008) and attitudes toward (e.g., Hsu & Roth, 1999; Wilson & Tomera, 1980) conservation issues for both teachers and students. However, others argue that knowledge and attitudes are not adequate to shape actual behavioral practices (Pooley & O’Conner, 2000), and that educators should instead focus on changing beliefs (about science, the environment, or efficiency) in order to shape environmentally responsible behaviors. Past research and case studies suggest that education entwined with action is an invaluable means of encouraging behavioral change (Dias, Mattos & Balestieri, 2004; Heimlich & Ardoin, 2008; Alliance to Save Energy, 2010).

Other researchers have examined the importance of the full spectrum of environmental educational experiences. Environmental education is not limited to classroom activities or formal curricula but also includes school practices and extra-curricular experiences (Smith-Sebasto, 1995; Tilbury, 1995; Tung, Huang, & Kawata, 2002). In fact, students learn as much from the actions of their reference groups (e.g., parents, peers, teachers) and the practices of their schools as they do from formal curriculum (Berryman & Breighner, 1994; Higgs & McMillan, 2006; Pintrich & Schunk, 2002). Further, a sense of self-efficacy (or the ability to meaningfully contribute) can motivate student involvement and engagement, encouraging students to apply their education to personal behavioral choices (Bandura, 1977; Pajares, 1996; Schunk, 1991). Environmental education is less effective when school cultures and practices contradict classroom curriculum, and is enhanced when curriculum is mirrored in praxis, such as through school policy, architecture—David Orr (1994) writes on “architecture as pedagogy”—and governance (Higgs & McMillan, 2006).

Sustainability education involves several key principles, including the important role of modeling. According to research on teaching sustainability education, there are four identified sources of modeling that significantly shape student perceptions and behavior—individual role models, facilities and operations, governance, and school culture (Higgs & McMillan, 2006). First, individual role models (such as teachers) can model environmentally responsible behavior for others (Higgs & McMillan, 2006). Relying on organizational literature, we expand upon the concept of individual role models as used by Higgs and McMillan (2006) by indentifying charismatic leaders, who model desired behavior as well as inspiring and motivating others to engage in behavior change (Conger & Kanungo, 1987; Conger, Kanungo, & Menon, 2000; Leithwood & Jantzi, 1999; Weber, 1935/1968). Leithwood & Jantzi (1999) have suggested that charismatic or transformational leadership in a school setting can come from persons outside of formal administrative positions.

Second, school facilities and operations can contribute to conservation aims and serve as an educational tool. School operations include all the work necessary to keep a school functioning, from maintenance and repairs, to grounds work, cooking, and cleaning. Environmental education need not come solely from course curriculum; “buildings have their own hidden curriculum that

teaches as effectively as any course taught in them” (Orr, 1994, p. 113). The material surroundings in a school environment, as well as the physical operations of the school, can be used to model sustainability education (Higgs & McMillan, 2006).

Third, school governance can influence the success of sustainability education efforts (Higgs & McMillan, 2006). School governance refers to the administration and decision-making within a school and how such administration and decision making is accomplished. Several authors have noted the value of student participation in school leadership and governance (Levin, 1998; Wallin, 2003). Considerations of shared or participatory school governance often focus on neighborhood involvement (Fung & Wright, 2003) or the perspectives of school administrators (Blase & Blase, 1999), yet participatory governance may also engage traditionally unempowered staff, such as custodians, and students, to model sustainability education. Participation in school decision making by students and non-administrative staff can serve as a tool and reinforcement mechanism for sustainability education.

Finally, school culture, which is “manifested through the school’s rituals, traditions, buildings, programs, instructional methods, and extracurricular activities” (Higgs & McMillan, 2006, p. 47), can play a key role in sustainability education. School culture is an important venue through which environmentally responsible behavior can be modeled and learned. The work of Higgs and McMillan (2006) reveals how actions and routines that support social, economic, and environmental sustainability within schools enhance sustainability education by modeling both values and action in a holistic school culture. Further, Stephen Sterling (2001) argues that “Sustainable Education” should not be a simply add-on the curriculum, but rather a cultural shift, seeking synergy between all aspects of education: ethos, curriculum, pedagogy, management, procurement and resource use, architecture, and community linkages.

RESEARCH METHODS

Case Selection

Poudre School District (PSD), located in Fort Collins, Colorado, enrolls about 25,000 students and includes four traditional high schools, each enrolling between 1,200 and 1,800 students. This study examines energy conservation and sustainability education at one of these high schools, Rocky Mountain. The study was prompted after Rocky Mountain reduced its electrical energy consumption by 50% between 2001 and 2007. PSD asked researchers to explore what factors contributed to Rocky Mountain’s successful conservation and sustainability education efforts and if those factors could be replicated elsewhere, such as in other district schools.

The school district initially adopted a commitment to sustainability in building design and maintenance in 2000, and all four public high schools in the district have seen incremental decreases in electricity use since. In the year 2000, the superintendent wrote a letter titled, “Ethic of Sustainability,” which began by stating, “Poudre School District is committed to being a responsible steward of our natural resources and believes that public education should provide leadership in developing an ethic of sustainability in all of its practices” (Poudre School District, 2005). Since that time, the district has built six high-performance buildings with Energy STAR scores of energy performance in the top 6% of K–12 schools, as well as the first LEED Silver school in Colorado and the first school to receive LEED for Schools Gold Certification in the

nation (Hooker & Margheim, 2008). Since the Ethic of Sustainability was articulated in 2000, the Operations Department has focused on building sustainable schools and developing sustainable building maintenance and operations procedures. In 2006, Operations established a Sustainability Management System and has since issued annual sustainability reports (Poudre School District and The Brendle Group Inc., 2006).

In 2001, following the implementation of centralized controls for heating and air conditioning, all schools saw reductions ranging from 15% to 21% (Schelly et al., 2011). Between 2002 and 2007, typical year-to-year decreases range from 1% to 6% (Schelly et al., 2011). However, following a remodel project at Rocky Mountain, completed in 2004, the school achieved record year-to-year reductions in 2005, 2006, and 2007. During these years, the decreases at other high schools ranged from -4% to 12%, with an average of 3.4% (Schelly et al., 2011). Corresponding with electricity conservation, Rocky Mountain reduced water consumption (spending \$7,522 less in 2007 than 2006) and natural gas costs (spending \$8,978 less in 2007 than 2006), generating \$40,378 in total operations savings between 2006 and 2007 (Reeve, 2008). The other high schools in PSD, in contrast, have benefitted from the changes initiated by district level operations and facilities but have not initiated school-level conservation efforts on the same level as Rocky Mountain. These differences in energy conservation practices prompted the study.

Study Design

Case study research is one form of qualitative research in which researchers investigate an issue within a bounded system or context, and are designed to offer rich, empirical descriptions of particular instances of a phenomenon (Creswell, 2007; Yin, 2003). Case study research is differentiated from other methods of data collection because it is not so much a methodological choice, but rather a choice of what is to be studied, and typically involves the collection of a variety of data sources (Stake, 2005; Yin, 2003). In this study, one high school reduced its electricity consumption to a level that was not thought possible by the district-level facilities and operations staff, and they wanted to learn what happened in this school that could be replicated in other schools. This type of research question (*how* did one school outperform others?) is ideally suited to case study research where the purpose of study is to discover what can be learned from a particular case or cases (Eisenhardt & Graebner, 2007; Stake, 2005).

Data Collection

Case study research is characterized by the collection of data from a variety of sources, which typically include documents (audio and visual media), archival records, interviews, direct observations, and physical artifacts (Stake, 1995; Yin, 2003). This study involved collecting qualitative data from focus groups and individual interviews as well as content analysis of school documents and observations of the school environment. Teachers, staff members, and students participated in focus groups, which were conducted in homogenous groups (students, teachers, staff, and administrators) within the school. Researchers designed and organized the focus groups based on consideration of how different groups within the school might use energy or engage in sustainability education. For example, one focus group was comprised exclusively of students in the environmental club; another involved only teachers who used the building after

school hours (e.g., for athletics, clubs, rehearsals). Participants were recruited by administrators at their school and asked to voluntarily participate in a research project on the topic of energy conservation.

The original study included two schools (Rocky Mountain and another high school serving as a comparison case), and involved nine focus groups, lasting approximately one hour each. Of the meetings held at Rocky Mountain, one included administrative and staff members, one included students, and one included teachers. Not all focus groups adhered to the standard 6 to 12 participants in each group because some unique groups had larger or smaller numbers of members (Krueger & Casey, 2000). In addition, the environmental science teacher and the principal were interviewed because of their leadership roles in the school's sustainability education and conversation efforts. Interviews and focus groups were recorded, transcribed verbatim, and coded for emergent themes.

Data Analysis

Like many qualitative methodologies, case study research is an iterative process in which the researcher begins with questions about an issue or phenomenon, but refines them and develops new questions during data collection and data analysis (Yin, 2003). In this case study, the original research question asked was, "What organizational and individual factors contributed to the substantially greater improvements in energy conservation at one high school than another in the same district?" The first round of coding—called initial coding or "open" coding (Charmaz, 2001; Strauss & Corbin, 1990)—revealed various themes related to modeling and sustainability education from the focus groups, interview data, and document analysis.

In the second stage of coding, researchers developed focused codes and began to fit them into a conceptual framework (Charmaz, 2001; Lofland, Snow, Anderson, & Lofland, 2006). The open codes gave rise to three new research questions:

1. Does energy conservation modeling in large public high schools include the same elements identified by Higgs and McMillan (2006) in schools with a focus on sustainability education?
2. How compatible are the efforts to build and maintain green schools with the educational mission of schools? and
3. Who learns from energy conservation efforts in schools?

RESULTS

The results of this research suggest that energy conservation efforts are more than compatible with environmental education; they can actually be an integral component of sustainability education. The four categories of modeling identified by Higgs & McMillan (2006)—individual role models, school facilities and operations, school governance, and school culture—were all apparent in this study. In addition, this study suggests the significance of each of the four means of modeling well as interactions between them and the importance of communication in contributing to conservation behaviors and sustainability education.

Individual Role Models

At Rocky Mountain, participants described three types of role models: administrators, teachers, and student leaders. The principal, the environmental studies teacher, and the students in the environmental club were all described not only as role models, but also as charismatic leaders (inspiring others to change) and educators (people who taught others about sustainable behaviors).

Principal. The principal of Rocky Mountain is personally committed to environmental values for reasons related to conserving environmental resources, educating students to be responsible citizens, and being a good steward of public funding. The principal originally pursued conservation within the school as a means of economic savings and as a way to demonstrate fiscal responsibility to the community, which approved funding for school renovations the year he became principal. The principal served as an individual role model for teachers, staff members within the school, and district-level personnel, as well as being identified as a charismatic leader. One teacher said, “*you could tell that [the principal] had been the one who really got this thing going . . . and that he was taking a very strong leadership position in that.*”

Teachers. According to other teachers, students, the principal, and humbly admitting it even himself, the environmental studies teacher models environmentally responsible behavior for both students and other teachers. The teacher started a student-run recycling program long before the current principal was hired and before energy conservation became a priority in the school district. Others describe him as being an inspiration because of his dedication to educating both students and teachers on conservation issues. Students found the environmental science teacher exceptionally inspiring, saying that he taught them two key things—the importance of environmentally responsible behavior and that they could make a positive difference in the world through their actions.

Teachers spoke of the environmental science teacher as an important role model and motivator for their own behavioral change. One described the teacher as the “*lead jammer*” and said that his charismatic leadership is very important in successfully motivating behavioral change. Another said,

I sit there and if I’m like “should I shut off my computer or not?” I’m like “what would [the environmental studies teacher] do?” And I think that does good because we do have that person who did actually say “hey listen, there are ways in which we can change things and make things better.”

In response to this comment, another teacher said,

I would like to echo on that too. Having a cheerleader is good for the group, you know, because you get busy, you forget, you know, you get lax and then somebody comes along and says “hey, let’s make sure we stay on this.” I think that’s necessary because otherwise you kind of drift.

Teachers said that e-mail reminders about turning off lights and computers helped to both educate and motivate them.

Other teachers at Rocky Mountain also aim to serve as role models for students. One teacher said, “We try to model good behavior for students and how we present ourselves to students. And I think they pick up on that.” Another said that the majority of staff is “on board” to participate in the energy conservation efforts of the school, and thus also serve as role models for students and

for one another, which motivates behavior change as well as increasing a sense of school pride for students. One teacher said,

I think [the students] take a lot of pride in the school, and any way that they feel like they can continue that in any form or shape they're going to stay on board with it. And I think the other piece of it is . . . that the staff is all buying in, I don't know very many staff who don't buy into this. So they're getting that reflection one from the staff because there's a lot of pride in the school and the kids want to do whatever they can to continue that.

Peers. Students also serve as role models for one another. Teachers felt that students in the environmental science club (a small group of approximately 15 students, who are described as “very motivated”) modeled environmentally responsible behavior for other students. One teacher said,

The kids in the environmental club are really instrumental in spreading the message, you know, to the school—to the student body, and I think that a huge piece of the puzzle is the kids in the environmental club. A group of kids that are committed to the cause, so to speak, and they go out and do things that are very visible to the rest of the student body. So the idea that it's the students in the environmental club running these projects, I think that's meaningful to the other students.

Students echoed this teacher's statement. Because of responses they had received from administrators, teachers, and other students, students involved in the environmental studies club were aware of and inspired by their role as leaders.

School Facilities and Operations

The school district's commitment to sustainability influences facility construction, maintenance and operation, and research participants said that the district's commitment to sustainability efforts was instrumentally supportive in school-based conservation efforts. The district's commitment to sustainability applies not only to new construction, but also to all aspects of maintenance, facility operations, and remodeling of existing schools. In 2004, when Rocky Mountain was remodeled, a space was built for recycling, designed not only to facilitate responsible resource use, but also to educate students about the recycling program and its importance. This feature of the school is one example of how the building facility and its operations can serve an educational function.

As will be discussed below in terms of participatory school governance, the custodians at Rocky Mountain changed their daily routine so that lights are turned on just before school begins every day and turned off right after school each day, cleaning the school with only the security lights. According to the environmental science teacher at Rocky Mountain, the custodians deserve “90 percent of the credit” for the school's energy conservation. In addition to a change in custodial practices, replacing classroom lights and overhead projector lights (with CFLs) and automating shut-off in the computer lab helped reduce classroom energy use.

School club activities have also contributed to energy conservation and education goals. The local utility partnered with the school district to encourage student groups to take up an energy conservation action. The result was the “Thanks a Watt” campaign, where students placed signs above light switches reminding teachers, students, and staff to turn off the lights when they leave the room. These small signs in each room are one of the ways in which buildings can model environmental values and suggest appropriate behaviors. While we cannot judge the direct

effectiveness of such reminder signs, they represent a cultural commitment to sustainability that permeated individual awareness and action. New teachers in the building described these signs as one of the noticeable differences in school culture between Rocky Mountain and other schools in the district. Another communication strategy relying on visual cues involves the trash and recycling containers. The art club participated in painting trashcans with various images and colors, but the recycling bins all look the same, making it easier to identify the appropriate receptacles for waste in the hallway.

Course offerings are another example of how a school's operations demonstrate a commitment to sustainability. The environmental science class at Rocky Mountain is an Advanced Placement (AP) class, intended for motivated students interested in potentially receiving college credit through high school classes. While this class often has low enrollment in comparison to other courses offered at Rocky Mountain because it is an Advanced Placement course, it is continually offered because of the school's commitment to environmental education and because the class is the official sponsor of the environmental club (which requires a sponsoring course). Both the environmental club and the course are responsible for many of the conservation efforts throughout the school, including coordination of the recycling program and the hosting of a conference on climate change held each year for high school students across Colorado.

Through facilities design, operations, school clubs, and course offerings, Rocky Mountain models a commitment to energy conservation, responsible resource use and fiscal management, and environmental sustainability. Facility operations and practices create the opportunity for learning to occur among all stakeholder groups, from teachers to students, students to students, custodians to teachers, students to teachers, teachers to teachers, and so on. The daily routines and features of a building (custodial practices, automated shut off systems, and clearly marked trash and recycling bins) not only contribute to energy and resource conservation, they also serve a key educational function by communicating the school's commitment to conservation.

At Rocky Mountain, architecture does indeed act as pedagogy, as do operations and facilities management, demonstrating the core cultural values of the school community. Both the built environment of the school and the cultural codes operating within it serve as educational tools. When a new student or teacher inquires about the practices (for example, asking why there are so many lights off), those in the school communicate the value (financial and environmental) of conservation and well as the school's commitment to sustainability education.

School Governance

Administration at both the school and the district level support the conservation and educational goals of Rocky Mountain through participatory school governance, informally but intentionally integrated into the school's culture. For example, when the district, the schools, and the city originally began having meetings regarding energy conservation, the principal of Rocky Mountain invited the head custodian to participate. The current principal involved the custodians as active participants in the school's commitment to energy conservation through both participation in administrative meetings and responsibility for decisions in custodial practices; the head custodian was thus empowered to independently contribute to the school's conservation aims by managing and changing custodial practice. The head custodian expressed that because he had been attending meetings and had been treated like an integral part of the school's operations, he gained a new

feeling of responsibility not experienced when working in other schools and felt empowered to initiate changes in the custodial routines.

Once the custodians were empowered to change their routines, they began teaching teachers how they could contribute to energy conservation efforts. For example, they asked coaches and gym teachers to leave the gymnasium lights off if they were taking students outside. This change in behavior required re-educating people about energy efficient practices. Some teachers had been taught years before that the best way to treat the gym lights was to turn them on and off as little as possible, thus their routine was to turn them on first thing in the morning and leave them on all day, even when the gym was not being used or being used intermittently. The custodians explained the current lights were not like the old ones that required time to heat up. The custodians also suggested that the gym lights did not need to be turned on at all just to take roll, that the emergency lighting was sufficient for this purpose. While the custodial routines modeled sustainable behavior and contribute to energy conservation, the custodians also contributed to the culture of sustainability through the sharing of information. This opportunity for modeling would not have arisen except for the participatory governance practices adopted at Rocky Mountain.

It is not only teachers and custodians who participate in decision-making. Students are also involved, which often expands the educational impact of various school activities. For example, Rocky Mountain began receiving rebates from the Operations Services in 2004 in reward for their energy conservation. School administrators chose to give the money to the environmental club for their essential role in conservation efforts throughout the school. The club chose to spend the money to purchase a block of wind power for the school during the month of April to promote Earth Day. Now, wind energy is purchased every April and because the school uses less energy each year, it powers the school for almost two months instead of one. This participatory governance structure expanded the impact of conservation efforts on environmental education because the students used the incentive to expand environmental awareness. The shared governance structures also aid conservation efforts by inspiring students and expanding their sense of efficacy. As one teacher at Rocky Mountain said,

The environmental club came up with this idea of really marketing using clean energy and to have the city and then the school district come in and—then they have a party, they gave us a little trophy of a wind turbine. The kids themselves know that they had made a difference and it was widely publicized.

Participants commented on the value of opportunities for involvement and decision-making. As one teacher said,

If you're really passionate about something . . . the school gives you an opportunity to actually do something. You can actually make the conscious effort like you are doing at home, but now you're doing something that other people, the next generation is watching you care. It's watching you make that sacrifice. And I think that is critical and especially in this building . . . the kids are actually doing it too. So it's this whole entire environment right now where we're together and we're actually making an investment in our future.

Participatory school governance can empower individuals to participate and model behavior for others while also serving as an educational tool and facilitating other educational opportunities.

School Culture

By all accounts, Rocky Mountain has created a school culture that embraces conservation as a part of its operational and pedagogical goals. In one 2007 issue of the school newspaper, there are four articles on topics related to the environment (Curtis, 2007a; Curtis, 2007b; Curtis & Merrill, 2007; Kessler, 2007). One teacher said in a focus group that an overwhelming majority of both students and teachers were environmentally aware and trying to do their part around the school. Another said,

I think it's been something that we've been pretty conscious about for quite a while. I can't put probably an exact number of years, obviously it's got to be around seven, eight years. I would think that we've really been working hard on it. And it kind of crescendoed, I think, and it is continuing to just grow each year that we're here.

Another commented how energy conservation efforts are part of a larger commitment to responsible resource (financial and environmental) use, saying, "it's really just lifestyle change and resource management is what we're really talking about, more than just energy."

The principal consciously facilitated the creation of a conservation culture at Rocky Mountain through two slogans: "the Lobo Way" and "Care and Repair." The Lobo is the school's mascot, and the Lobo Way is the school's brand for its behavioral code. The principal sees environmental conservation as first and foremost about education, and explained that he engaged students in energy conservation "under the auspices of the Lobo Way." Care and Repair is in itself a way to reduce consumption by caring for and repairing existing equipment rather than needing to buy new products. Based on this code, students and teachers know that the expectation within the school is to care for existing equipment and repair things when possible. It also promotes a culture of conservation more generally, as well as saving the school money. Care and Repair, for the principal, is a way to articulate behavioral expectations that helped students and teachers embrace conservation. These two school mottos help to define and maintain a holistic approach to a conservation culture.

The environmental science teacher at Rocky Mountain recognized the necessity of changing individual mind-sets (which are a part of a collective culture, such as that within a school) when he said, "We [referring here to people in general] don't like to change our habits. It's hard to get people do to things differently," yet changing collective habits is an essential part of changing a school culture. "Recycling and turning off the lights are very different things, but they are part of a mindset, a mind-set that says you can affect change." The two mottos, "Care and Repair" and the "Lobo Way" give teachers, staff, students, and administrators language to use to describe their collective values and commitments to conservation and environmental and economic sustainability.

Communication: A Fifth Component of Success

In addition to the four aspects of modeling discussed above, a fifth element, communication, was continually mentioned as being an integral component of Rocky Mountain's success in energy conservation. Four distinct types of messages—behavioral expectations, knowledge, energy and resource use data, and conservation accomplishments—were described as contributing to a conservation culture by all groups of participants. As discussed above, behavioral expectations were

communicated in a variety of ways, through interpersonal communication as well as through signs like the “Thanks a Watt” cards above light switches. Knowledge was also communicated through various means. The environmental studies course was a primary source of knowledge for students, inter-personal communication (e.g. the custodians re-educating teachers about gym lights) was used to educate fellow staff, as were communication media such as email, announcements, and school newsletters.

Communication appears to be an important thread linking the conservation and educational goals. Focus group participants across all categories (teachers, students, and staff) at Rocky Mountain consistently expressed the importance of receiving information about their energy use and the outcomes of their actions. In the district, the Energy Manager sends electronic energy reports to each school multiple times a year (Reeve, 2008) and then it is left to staff in the school to disseminate that information. At Rocky Mountain, this information about energy conservation efforts is regularly shared with students, teachers, and staff through posters and graphs on display in the school as well as emails, newsletters, and the school newspaper. The graphs of energy savings helped teachers and students alike understand what they have accomplished. As one teacher stated, “[the posters] made it easier . . . made a lot of sense to people when you put a dollar amount to it.”

In addition, the school newspaper and parents’ newsletter reported on the school’s success, and daily school announcements shared information about the rebates and the purchase of wind power. Communication about the impact of conservation efforts is both educational and inspirational. As one teacher said, the purchasing of wind power was also used to widely publicize the school’s success in energy conservation,

I think there’s a general building excitement too when we hear that—get the e-mail, that we’ve saved this much money and bought this much wind power. I think people get excited about it.

DISCUSSION

Environmental educators and proponents of green schools alike recognize the need for transformation of schools as part of a larger social change required to address global environmental issues (Green Schools Initiative, 2010; Sterling, 2001; Tilbury, 1995). Schools are the focus of sustainability efforts because they are both extremely important sites of learning and significant consumers of natural resources. This case study illustrates how conservation efforts (directed at energy and resource use) can directly address environmental sustainability and support environmental education through modeling. Rocky Mountain embodies several of the recommendations made by the Green School Initiative, such as “pursuing green building and maintenance practices, changing their resource consumption patterns” as well as “teaching students to be stewards of their communities, the earth and its resources” (Karliner, 2005, p. 3).

The successful conservation program at Rocky Mountain is perhaps best described as holistic and synergistic. The broader study was initiated because the energy savings that occurred at Rocky Mountain exceeded any hopes or expectations of the district-level facilities staff. In an effort to understand how Rocky Mountain had achieved such substantial energy conservation and complementary activities—such as increasing recycling and reducing waste—it became apparent that environmental education efforts at the school both contributed to and benefitted from the energy conservation efforts. One of the primary findings of this case study is the synergistic

effect of each of the aspects of modeling described by Higgs and McMillan (2006) along with the communication efforts regarding behavioral expectations and accomplishments. Through a holistic effort, supported by the commitment to sustainability at the district level, conservation efforts were enhanced by and simultaneously modeled sustainability education.

Each of the four aspects of modeling—individual role models, facilities and operations, participatory school governance, and school culture—did not stand alone, but each was enhanced by one or more of the other aspects. For example, individual leaders became inspirational role models because they were empowered through leadership and governance structures to engage in new behaviors and empower others. Not only did individual leaders inspire teachers, staff, and students to engage in more environmentally responsible behaviors, but school activities also expanded opportunities for leadership and inspiration. New research (Arnold, Cohen, & Warner, 2009) demonstrates the inspirational role of collective events such as conferences. The state-wide climate change conference is foremost an educational event for attending students, but it also augments the role of the environmental club as an educational leader.

In addition, myriad communication messages and media enhanced each of four means of modeling. The school facilities and operations modeled environmentally responsible behavior and education for sustainability through physical design, posted signs, and energy routines (i.e., using only emergency lighting before school hours). David Orr states, “We have not thought of academic buildings as pedagogical, but they are” (1994, p. 114). A walk through Rocky Mountain reveals the numerous ways that the building does communicate environmental values—the recycling center, the “Thanks a Watt” signs above switches, and the clearly marked waste and recycling bins. These examples may seem simple, even trite, but simple changes to building practice at Rocky Mountain—when communicated effectively—impacted school culture and further shaped behavioral change. The operations of the school became an educational tool and source of multi-directional learning, as students, teachers, and other groups learned from and modeled for one another.

Participatory governance also helped the dual goals of conservation and education by enhancing a sense of both individual and group efficacy. Giving staff members and students ownership in and responsibility for decisions made throughout the school enhances efficacy, and a sense of efficacy has been found to differentiate those who act in response to their environmental concern and those who do not in both an individual and a group context (Bamberg & Möser, 2007; Ellen, Wiener, & Cobb-Walgren, 1991; Gamba & Oskamp, 1994; Lubell, Vedlitz, Zahran, & Alston, 2006; Lubell, Zahran, & Vedlitz, 2007). A sense of efficacy was one of the most apparent themes in the focus groups, as participants from students to custodians expressed the idea that their actions matter and make a difference.

Organizational culture change occurs through the synergistic efforts of many people in various positions in the organization, from students to top administrators (Kotter, 1996; Starik & Rands, 1995). School culture at Rocky Mountain has embraced energy conservation as a school value as well as a source of pride, ownership, responsibility, and expectation. In turn, each incoming class of students is exposed to this culture, and educated on the importance of environmentally responsible behavior as well as their role in conservation. The conservation culture at Rocky Mountain serves both the conservation and the educational goals of the school. School culture is, as this research suggests, an essential component in creating a successful conservation program that is both a mechanism of environmental education and a catalyst for the development of a holistic conservation culture.

The synergy of conservation and education efforts, as successfully modeled through the four aspects and the interactions between them, helped to effectively shape ‘constellations of behaviors’ (Heimlich & Ardoin, 2008) with regard to environmentally responsible behavior, heightened through communication. Interpersonal and written forms of communication were important tools for both education and behavior change related to sustainable behaviors. Myriad communication methods functioned as educational tools at Rocky Mountain. Various communications (e.g., face-to-face discussions, e-mail, announcements) were described as teaching new information about methods for reducing unnecessary energy use. Posters, e-mails, and newsletter articles that reported conservation successes in tangible terms (dollars and the size of their carbon footprint) helped school members to understand the value of conservation efforts and feel rewarded for their efforts (Grimm, 2006). Communication about the success of energy conservation efforts served dual purposes, expressing the school’s commitment to energy conservation efforts as well as describing the impact of their collective behaviors. This feedback reportedly increased an individual’s sense of efficacy and inspired continued action, which is consistent with research on communication tools for encouraging and supporting behavioral change (Cialdini, 1993; Grimm, 2006). Many change efforts fail because the vision, goals, and successes are under-communicated and they fail to create short-term wins (Kotter, 1996); the conservation culture at Rocky Mountain thrives in part because of the numerous channels of communication utilized. Communication efforts are key components of environmental education and environmental action as the messages model values, behavioral expectations, and report on successful efforts which then inspire and reward new behaviors.

CONCLUSION

While Higgs and McMillan (2006) focus on modeling within small, nontraditional schools, this research suggests that environmental education and conservation can occur in large public schools in the context of a district committed to sustainability. Poudre School District, which includes Rocky Mountain, has embraced energy conservation as integral to both educational and fiscal goals, monitoring their sustainability successes across many departments (Poudre School District, 2010). A comprehensive energy conservation effort can be a tool for behavior change and conservation, sustainability education, as well as organizational change, by employing the four aspects of modeling in order to teach students, teachers, and staff alike about environmental conservation, sustainability, and environmentally responsible behavior. The findings from this case study suggest that energy conservation programs in schools offer a means of teaching environmental education through modeling, and that conservation and education have a synergistic relationship. Further, these findings suggest that such programs have the potential to catalyze an organizational paradigm shift, moving schools towards a holistic approach to sustainability education.

Of course, this research is limited by its very nature as a single case study. While individual cases can offer rich descriptions, answer how and why questions, and provide propositions for new theory, they also tend to propose more complex theories than can be validated by examination of a wider variety of cases (Eisenhardt & Graebner, 2007; Flyvbjerg, 2006). This case study suggests that environmental conservation and sustainability education can be pursued in tandem through a synergistic program based on modeling through leadership, facilities and operations, participatory

school governance, school culture, each augmented and sustained through consistent, effective communication. However, other empirical cases may reveal that fewer components can also produce an equally substantial reduction in energy conservation. Without other cases, we cannot compare the relative importance of any of the individual details of this case such as signs over light-switches or engagement of custodial staff. Future research should examine a wider variety of cases—degrees of conservation and types of sustainability efforts—in order to develop theories about the school-level and district-level efforts that contribute to a variety of sustainability efforts in schools.

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