




Green Schools: An Examination of Practices and Possibilities in Alabama

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ABSTRACT

Green schools are schools that reduce environmental effects, improve the health and performance of students, and increase sustainability literacy. Green schools reinforce optimal learning aligned with resource efficiency and minimal pollution. This study implemented a descriptive survey research design to assess the extent to which green school practices are being applied in a three-county region of central Alabama. Survey results revealed inconsistent availability of green school practices at participating schools. Survey implications point to a need for more focused emphasis on green school practices and collaboration between schools, school faculties, and local education agencies.

Keywords: green schools, environmental education, sustainability

INTRODUCTION

As society focuses on environmental sustainability, schools are an important focal point. The educational program, physical place, and organization culture of a school or school system can contribute greatly to the health of students and efforts to promote environmental sustainability and address the challenges of environmental accountability. Recognizing the potential positive impact of schools, The Center for Green Schools states that

“all students deserve the opportunity to be educated in healthy environments that are conducive to learning” (Barr et al., 2014, forward).

To this end, a green school movement is underway.

Green schools are schools that reduce environmental impact, improve the health and performance of students, and increase sustainability literacy (Center for Green Schools, n. d.). In recognizing the importance of these practices and the body of literature documenting the positive impacts green practices have on students, there is a worldwide green school movement. Such school buildings provide clean fresh air, an appropriate temperature, and abundant natural lighting while limiting unwanted noise. They also maximize building efficiency, minimize pollution, and teach students the importance of environmental sustainability (Gordon, 2010).

The Center for Green Schools developed criteria to assist educators and others working toward creating

“healthy and efficient school environments to drive transformation” (Barr et al., 2014, forward).

In 2011 the United States Department of Education launched the Green Ribbon Schools award program to identify progress, if any, made in sustainability. In the United States, there are pockets of success and key principals have been identified which have led to integration of sustainability into the organization of a school or a school system. Chan (2013) noted that there is not a consistent strategy or process utilized by schools or school systems as they seek to create green school policies or to implement green school practices, and research is limited related to the presence of green school practices present in schools and factors that contribute to or hinder the implementation of these practices.

The objective of this study was to identify the extent to which green school practices are being implemented by public schools in a three-county region of central Alabama. This study utilized a descriptive survey research design to answer the following research question:

What green school practices are being implemented by public schools in a three-county region of central Alabama?

The National Green School Designation

U.S. Department of Education Green Ribbon Schools (ED-GRS) is a school sustainability initiative. This award of recognition is a federal communications and outreach tool. ED-GRS hopes to encourage green school practices across the board by recognizing institutions

“that reduce environmental impact and costs, improve the health and wellness of schools, students, and staff, and provide effective environmental and sustainability education” (U.S. Department of Education, 2022).

Combined progress in all three of these areas, known as pillars, serves as the basis for recognition.

The award honors a small number of schools each year and promotes them as exemplars to communicate practices and resources that all schools can employ. In doing so, ED-GRS Green Strides provides a means for schools to collaborate and connect with resources used by honorees across the three pillars of the award (U.S. Department of Education, 2021).

Green Schools in Alabama

Alabama Green Ribbon Schools (AL-GRS) is an initiative of the Alabama State Department of Education to recognize local institutions which establish green school practices. The AL-GRS format aligns with the three pillars established by ED-GRS reducing environmental impact and costs; improving the health and wellness of schools, students, and staff; and providing effective environmental and sustainability education (U.S. Department of Education, 2022).

REVIEW OF LITERATURE

A green school is the result of a conscientious process of planning, design, and construction that examines a school building's performance over its life cycle. Green school buildings provide clean fresh air, an appropriate temperature, and abundant natural lighting while limiting unwanted noise. They also maximize building efficiency, minimize pollution, and teach students the importance of environmental sustainability (Gordon, 2010).

Noting the importance of the school environment, the National Academy of Sciences (National Research Council, 2006) estimates that about a fifth of the U. S. population spend large amounts of time in a school each day. A healthy school environment benefits staff and students who can perform to the best of their potential because of an optimal working environment.

Teaching

In alignment with the National Research Council publication, “A framework for K-12 science education: Practices, crosscutting concepts, and core ideas” (National Research Council, 2012), the goal of Alabama's K-12 science standards is the achievement of scientific and engineering literacy by all students. A scientifically literate individual is a person

“who has a foundation in scientific knowledge, a technological understanding of problem solving, and the ability to design scientific solutions” (Alabama Department of Education, 2015, p. 3).

Alabama's science standards call for the infusion of a global science perspective into Alabama's curriculum through a study of the three dimensions of science, which include

“scientific and engineering practices, crosscutting concepts, and disciplinary core ideas” (Alabama Department of Education, 2015, p. 3).

Green school practices support the expectations of these and other rigorous educational standards.

Green schools which frequently incorporate STEM (science, technology, engineering, and mathematics) education, have been shown to improve standardized test performance, promote the development of critical thinking in students, and promote team skills (Berto, 2014). Kerlin et al. (2015) found that the physical features of a green school offer opportunities for cross-disciplinary learning coupled with technology education, science, and community service education.

Archie (2003) also found teacher impacts in schools incorporating curriculum frequently seen in green schools including high levels of enthusiasm. Archie (2003) also noted teachers were likely to incorporate innovative teaching strategies into their curriculum.

Involvement in green school practices gives relevance to the goal of ensuring that Alabama students, having completed their K-12 experience, are informed science citizens and prepared for the next phase of life.

Academics

There is a growing body of evidence revealing the positive effects and benefits of green school initiatives. These benefits include

“support for environmental education and environmental literacy, academic excellence, including higher test scores and development of 21st century skills such as teamwork, applied project-based learning, and problem-solving” (Coyle, 2020, p. 376).

Green school environments have been shown to have a positive impact on student academic achievement (Dyment, 2005; Ghent et al., 2014). Ghent et al. (2014) found that students enrolled in Maryland schools identified as green schools achieved higher math and English language arts standardized test scores than students enrolled in schools not identified as green schools.

Archie (2003) identified benefits in schools utilizing multidisciplinary teaching units incorporating environmental themes like those frequently seen in green schools. These benefits included increases in student motivation and better academic performance.

According to the National Environmental Education Foundation (2022), the benefits of environmental education include increased student motivation for learning, improved critical thinking and teamwork skills, advanced teaching techniques, and added relevant and self-directed learning. When environmental education is included in the curriculum of a school, teachers also notice an equalizing of opportunities for academic success among students of different socioeconomic and cultural backgrounds (National Environmental Education Foundation, 2022).

In addition to the importance of the curriculum of a green school, the physical environment is also important and has been shown to provide students with positive benefits. Barrett et al. (2015) summarized research related to the impact of physical classroom features on academic progress. Key design features identified as having a positive impact on students' academic progress include the air quality of the school, classroom temperature, and availability of natural light in the classrooms. Attention to each of these design elements is noted as a feature of green schools (United States Environmental Protection Agency, 2010).

Student Mental Benefits

Green schools are recognized as healthy environments for children benefiting the physical health and mental health of children. Numerous studies have identified green school benefits to students' mental health. Berto (2014) noted several benefits when students engage with nature, as students often do in green schools. Experience with nature was identified as valuable to students when feeling psychological stress. Exposure to natural environments was also found to elicit a calming response in students, reduce mental fatigue, and aid in the recovery of psychological stress. Yang et al. (2019) found that green spaces around schools were correlated to lower incidences of symptoms of attention deficit hyperactivity disorder (ADHD). Similarly, Dymont (2005) noted improvements in student behavior for students in green school environments as well as increases in student enthusiasm and engagement. Green spaces also have been shown to improve the quality and quantity of physical activity in elementary school children (Dymont & Bell, 2008).

Fiscal Benefits

Local school leaders are often motivated by the enriched student learning environments supported by sustainability initiatives. In addition to such benefits for teachers and students, fiscal benefits are also noted for schools. Berger (2017) noted that decisions to move schools in a green direction are often motivated by cost savings sustainability programs offer. Green schools often notice lower utility bills with schools with savings of \$1,000 a year on water bills alone.

As indicated in the National Research Council (2006) report, "Green schools: Attributes for health and learning", failing to plan effectively will result in substantial costs across several areas. These costs may range from noise that causes auditory distractions to design, color, and lighting that deter from the learning environment. However, more strategic planning may lower costs for operation and maintenance while providing a more productive learning environment (National Research Council, 2006).

Kats' (2006) study found the potential savings of greening schools to be 20 times as high as the cost involved in going green. It quantifies direct savings through energy and water costs, improved teacher retention, and lower health costs. The amount saved would provide for the salary of an additional teacher. The report also suggests indirect savings not quantified by the study. It is imperative that schools and school systems become aware of these green school practices and include them as part of the strategic planning process for school improvement.

METHOD

The objective of this study was to identify the extent to which green school practices are being implemented by public schools in a three-county region of central Alabama. This study utilized a descriptive survey research design to answer the following research question:

What green school practices are being implemented by public schools in a three-county region of central Alabama?

Research Design

A descriptive survey research design was utilized for this study. Descriptive survey research is often utilized to describe behaviors, thoughts, attitudes, and attributes of a representative sample at a given point in time and place (Dillman et al., 2014). School administrators from public schools in a three-county region of central Alabama were surveyed to assess the presence of green school practices in their schools via an Internet survey. A web or mobile survey is an appropriate method of capturing data from many sources where e-mail is the easiest way to communicate (Dillman et al., 2014).

Participants

Participants for this study were administrators from public schools in the three-county region of central Alabama. The sample was purposive based on the proximity of the school systems to the home university of the researchers. Research participants were selected based on their ability to respond to survey items as school administrators are likely to have a thorough knowledge of school curriculum, school facilities, and school or district policies.

Researchers generated a list of all public elementary, middle, and high schools in the three-county region and then gathered e-mail addresses for principals of each school. Researchers sent an e-mail to each principal explaining the purpose of the research study and requesting their anonymous participation in the study. Demographic data including the school level (elementary, middle, high school, or combination) and school ethnic composition were collected.

Research Instrument

The research instrument utilized for this study was the Green School Feature Checklist (Chan, 2013). We utilized Qualtrics (www.qualtrics.com) for the construction and administration of our survey. The survey included items soliciting demographic information for each participating school and thirty-four inventory items requiring a "yes" or "no" or "don't know" response. Items were organized into five sections representing student involvement, water conservation, energy conservation, green environment, and waste management (Appendix A).

The Green School Feature Checklist was developed by Chan (2013) as part of a study investigating green school practices in the Atlanta metropolitan area. Survey development involved an extensive literature analysis. Survey validity was established through a review of the instrument by school facility experts. Through the review, content validity and face validity were achieved. Advice of facility experts led to

Table 1. School demographics

School level	N	M
High school	3	11.5
Middle school	10	38.5
Elementary school	13	50.0

revisions of the survey leading to the format utilized in the Chan's (2013) study. Our study involved a further review of our survey by three public school administrators to ensure the content and face validity of the research instrument. Suggestions by the public school administrators led to edits related to the positioning and flow of items in Qualtrics. Our study utilized the Green School Feature Checklist developed by Chan (2013).

Data Collection and Analysis

Quantitative data were collected through the survey instrument, the Green School Feature Checklist. Survey invitations were sent via e-mail to seventy-seven public school administrators in the study region representing all seventy-seven public elementary, middle, and high schools in the study area.

Follow-up survey invitations were sent to the administrators again two weeks and three weeks after the delivery of the original survey invitation. The survey link was active for a total of three weeks. At the end of the survey period, twenty-six surveys were completed with enough detail to be included in the analysis of the study data. The survey response rate was 33.7%.

Descriptive statistics were generated. Data analysis included demographic percentages including school level and ethnic composition of school student bodies. Percentages of responses were also generated for each of the thirty-four inventory items. Additionally, a Pearson correlation coefficient was computed to assess the linear relationship between the percentage of African American students and the presence of green school practices in schools.

RESULTS

Demographic data collected through our study included school level and student body racial/ethnic data. The largest percentage of schools represented in our study were elementary schools ($M=50.0$) followed by middle schools ($M=38.5$) and high schools ($M=11.5$).

Of these schools, twenty-one ($M=78\%$) were classified as Title I schools. The title I fund is provided to school districts for use in high-poverty schools with poor educational performance. See **Table 1** for descriptive statistics.

Racial/ethnic data were also collected for the participating schools. Data representing percentages of various racial/ethnic categories for individual schools were combined. Student bodies for participating schools are diverse with the majority being African American.

See **Table 2** for combined racial/ethnic demographic data for the participating schools. A Pearson correlation coefficient was computed to assess the linear relationship between the percentage of African American students and the presence of

Table 2. Racial/ethnic composition

Demographic	Percentage (%)
Caucasian	23.4
Hispanic	5.3
African American	64.6
Asian American	2.0
Native American	0.3
Mixed or Other	4.4

green school practices in schools. There was no correlation between the two variables, $r(24)=-.10$, $p=.102$.

The presence or absence of green school practices in the participating schools was examined by analyzing data representing the five subsections of The Green School Feature Checklist. The sections first developed by Chan (2013) and utilized in our descriptive survey were student involvement, water conservation, energy conservation, green environment, and waste management. These indicators align well with the three pillars of evaluation by both ED-GRS and AL-GRS and include

“reducing the environmental impact and costs of their facilities, improving the health and wellness of their schools, students, and staff, and providing effective environmental and sustainability education” (U.S. Department of Education, 2022).

Student Involvement

From early in elementary school, students can experience essential green school practices. Hands-on, real-world involvement in school and community greening practices provide relevance as students naturally learn to contribute and engage in making responsible and informed decisions about what is appropriate in situations involving science and technology (Alabama Department of Education, 2015). Five items in our survey focused on the issue of student involvement. These items focused on the teaching of environmental education, environmental education projects in the school, student involvement in recycling, the presence of an outdoor garden for student activities, and energy conservation efforts.

In this survey section, students were most likely to be involved in energy conservation in some way ($M=65.4$), and least likely to be involved in environmental education projects at school ($M=11.5$). Almost half of the participating schools have an outdoor garden available for the classrooms to utilize ($M=46.2$). Few schools specifically teach environmental education or involve their students in recycling activities. See **Table 3** for descriptive statistics related to student involvement.

Table 3. Student involvement

Question	Yes		No		Don't know	
	N	M	N	M	N	M
1. Teach EE	9	34.6	17	65.4	0	0.0
2. Recycling	9	34.6	16	61.5	1	3.8
3. Projects assigned	3	11.5	19	73.1	3	11.5
4. Outdoor garden	12	46.2	13	50.0	1	3.8
5. Energy conservation	17	65.4	9	34.6	0	0.0

Table 4. Water conversation

Question	Yes		No		Don't know	
	N	M	N	M	N	M
6. Timed Irrigation	2	7.7	24	92.3	0	0.0
7. Automatic Faucets	9	34.6	17	65.4	0	0.0
8. Automatic Flushing Toilets	1	3.8	25	96.2	0	0.0
9. Repairs to water leaks	19	73.1	6	23.1	1	3.8
10. Protect pipes from freezing	8	30.8	7	26.9	11	42.3

Table 5. Energy conversation

Question	Yes		No		Don't know	
	N	M	N	M	N	M
11. Solar panels	0	0.0	25	96.2	1	3.8
12. Natural lighting	12	46.0	13	50.0	1	3.8
13. Clean light fixtures	7	26.9	15	57.7	4	15.4
14. Conservation audit	11	42.3	11	42.3	4	15.4
15. Energy saving equipment	12	46.2	9	34.6	5	19.2
16. HVAC energy management	9	34.6	8	30.8	9	34.6

Water Conservation

Water conservation is an important aspect of a green school. To what extent does the facility efficiently utilize water and attempt to minimize the amount of wasted water? Participating schools indicate that water leaks are quickly repaired (M=73.1). However, other items related to water conservation were less likely to be part of the schools' operation including a lack of automatic flushing toilets (M=3.8) and timed irritation (M=7.7). See **Table 4** for descriptive statistics related to water conservation.

Energy Conservation

Energy conservation is another important green school initiative to be utilized and taught in schools. Reduced energy consumption in schools provides a number of benefits, both direct and indirect. The impact for an individual school is sometimes not measurable, but state-wide or nationally, the impact can be substantial (Kats, 2006). In this section, no survey items were present in the majority of our participating schools. Energy saving equipment (M=46.2) and natural lighting (M=46.0) were the most frequently seen green school features, and regular light cleaning (M=26.9) and solar panels (M=0.0) were the least likely green school features in our participating schools. See **Table 5** for descriptive statistics related to energy conservation.

Green Environment

The green environment survey section was related to the overall environmental quality of the environment at the school. These survey items related to the air quality and pest control at the schools. Extensive research indicates that students, as well as adult school faculty and staff, are affected by indoor air-quality. The research suggests that indoor environments influence the health, well-being, and productivity of those in the school (Eitland et al., 2017).

Air quality testing (M=7.7), radon testing (M=3.8), and lead testing (M=7.7) were conducted at few of the participating schools. Most schools did indicate that regular pest control occurs (M=65.4), air ventilation is adequate (M=69.2), and

Table 6. Green environment

Question	Yes		No		Don't know	
	N	M	N	M	N	M
17. Smoking prohibited	17	65.4	9	34.6	0	0.0
18. Air quality testing	2	7.7	9	34.6	15	57.7
19. Water quality testing	3	11.4	9	34.6	14	53.8
20. Radon testing	1	3.8	9	34.6	16	61.5
21. Lead in soil testing	2	7.7	7	25.9	17	65.4
22. Mold problems	7	26.9	18	69.2	1	3.8
23. School asbestos free	16	61.5	10	38.5	0	0.0
24. Adequate air ventilation	18	69.2	6	23.1	2	7.7
25. Regular pest control	17	65.4	5	19.2	4	15.4

Table 7. Waste management

Question	Yes		No		Don't know	
	N	M	N	M	N	M
26. Recycled cutlery	3	11.5	19	73.1	4	15.4
27. Recycled paper	7	26.9	14	53.8	5	19.2
28. Paperless practices	14	53.8	10	38.5	2	7.7
29. Recycling bins	5	19.2	20	76.9	1	3.8
30. Grease tank cleaning	9	34.6	4	15.4	13	50.0
31. Regular dumpster service	24	92.3	1	3.8	1	3.8
32. Hand dryers	4	15.4	22	84.6	0	0.0
33. Recycle computers, etc.	13	50.0	6	23.1	7	26.9
34. Litter abatement	2	7.7	17	65.4	7	26.9

smoking is prohibited at the school (M=65.4), see **Table 6** for descriptive statistics related to green environment.

Waste Management

The procedures in place to manage waste at an educational facility are also critical to lowering the environmental impact of that facility. A final section of the Green School Feature Checklist examined the presence of waste mitigation procedures at our participating schools. Over half of the schools indicated that their facilities have regular dumpster servicing (M=92.3) and have procedures in place to reduce the amount of paper required for operation (M=53.8).

Most schools indicated that they have not adopted litter abatement processes (M=7.7), don't have hand dryers in restrooms (M=15.4), recycle paper (M=26.9) or recycle cutlery in the cafeteria (M=11.5), or even have recycling bins available to categorize and recycle waste (M=19.2). See **Table 7** for descriptive statistics related to waste management.

DISCUSSION

The findings of this study have been informative and therefore merit further discussion around four focus areas: policy development, building practices, operational practices, and education planning.

Policy Development

As with Chan's (2013) study, our survey data indicate inconsistency and lack of focus across the board with regard to green school practices. In many areas, school leadership appears unclear and/or unaware of school participation. It is possible that teachers, staff, and students are involved on a higher level than indicated due to lack of a "big picture"

understanding on the part of school leaders. Ideally, green practices should be integrated into all areas of the school activity rather than items to be considered in isolation. Quality professional development and collaborative strategic planning for green school practices could increase awareness and provide accountability for all stakeholders.

Building Design

School building design is typically influenced by budget constraints. Leaders may opt for conventional designs to save initial costs. Unfortunately, these designs do not often provide for the comfort, productivity, and healthy work environment of students and adults.

School features related to water conservation, energy conservation, green environment (air, soil, pests, etc.), and waste management are all areas of green school design that must be addressed. The data show significant participation in practices proven effective over time, especially in the area of energy conservation. Some other areas still show room for improvement. As noted in Chan's (2013) study,

“green school designs with minimal additional costs can be approved easily particularly items that have proved to work in other school districts. Most school facility planners are operating under a limited budget and are unwilling to invest huge amounts of money to innovative green designs that may prove to be inefficient” (p. 25).

Perhaps these practices will improve as research in this area is increased.

Operational Practices

Many green practices are directly connected to the day-to-day operations of a school. Chan (2013) noted that schools can work toward meeting green school goals as they implement regular testing for environmental hazards, implement school recycling programs, ensure the overall cleanliness of the building, and put systems in place which regularly regulate the temperature of the school building (Chan, 2013). These operational practices can be organized and led by faculty/staff, students, parents, or community organizations. Rather than requiring additional funding, these practices simply require school leadership and direction to make these practices come to fruition. Many of these were areas for improvement among the schools surveyed. Hopefully, this study will provide a springboard for interest and implementation of these practices.

Education Planning

According to the Alabama Course of Study: Science (Alabama Department of Education, 2015),

“students should be able to contribute and engage in society as educated, literate science citizens who make responsible and informed decisions about what is appropriate in situations involving science and technology” (p. 9).

What better way to accomplish this goal than to involve them in lessons, projects, and daily activities that are relevant to their school and community?

It is concerning that according to survey data gathered most schools involved in our study show little participation in the areas of Student Involvement. Clearly, research suggests that being involved in green practices supports an effective learning environment. As educators, we are inclined to wonder if students are truly not involved in these areas or if there is a lack of awareness and communication among teachers, school administrators and system leaders. Schools may have great things happening with regard to green school practices but no systematic way of documenting and/or reporting their efforts. In either case, it is imperative (and required by state standards) that emphasis be placed on hands-on, student involvement, decision-making, and problem-solving around green practices.

As discussed in the Chan's (2013) study,

“environmental projects such as planting trees, starting a vegetable garden, raising a small animal farm or constructing a nature trail are meaningful activities to get them started” (p. 26).

By involving students in meaningful and engaging projects connected to the real world at an early age, teachers and other educators can help children understand that green school practices are a necessary part of the future of our planet.

CONCLUSION

Alabama provides many opportunities and resources to support schools and/or school systems in greening efforts. The most comprehensive of which is AL-GRS. In 2021, Tuscaloosa City Schools became the most recent recipient of AL-GRS recognition. Through their extensive efforts and many partnerships with state and local entities, the system has embedded green school practices with great success. Perhaps more Alabama schools should be encouraged to take advantage of this platform and these available resources to create awareness and implement student involvement in green practices.

Our study revealed many areas that provide opportunities for improvement and areas that suggest sources for future research. The results of this survey reveal to what extent green school practices are being implemented in public schools in a three-county region of central Alabama. This glimpse into the participating schools can be enlarged as other areas of the state are further surveyed. This view can be enlarged even further as schools across the Southeast and the United States are surveyed.

As more information is gathered, a more complete picture of the presence and/or awareness of green school practices in place in various schools can be seen, and comparisons and conclusions can be drawn. Are there areas where green school practices in schools are more likely to be seen? If so, what are the conditions in those areas that lead to green school practices being more likely?

More detailed information can be gathered regarding the factors that influence the presence of green school practices in schools. Case studies including qualitative data would also add to the state of the research literature in this area. With more information, initiatives can be targeted to meet the needs of those empowered to improve schools by including more green school practices and providing support to school faculties, principals, school boards, and others as they justify expenditures and efforts to increase green school practices in their schools.

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REFERENCES

- Alabama Department of Education. (2015). *Alabama Course of Study: Science*. <https://www.alex.state.al.us/browseSC.php>
- Archie, M. (2003). *Advancing education through environmental literacy*. Association for Supervision and Curriculum Development.
- Barr, S. K., Cross, J. E., & Dunbar, B. H. (2014). The whole-school sustainability framework: Guiding principles for integrating sustainability into all aspects of school organization. *The Center for Green Schools*. http://www.centerforgreenschools.org/sites/default/files/resource-files/Whole-School_Sustainability_Framework.pdf
- Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment*, 89, 118-133. <https://doi.org/10.1016/j.buildenv.2015.02.013>
- Berger, R. (2017). School district sustainability: Saving 'green' by going green. *Forbes*. <https://www.forbes.com/sites/rodberger/2017/05/15/school-district-sustainability-saving-green-by-going-green/?sh=6ec76675371e>
- Berto, R. (2014). The role of nature in coping with psychophysiological stress: A literature review on restorativeness. *Behavioral Sciences*, 4(4), 394-409. <https://doi.org/10.3390/bs4040394>
- Center for Green Schools. (n. d.). *Advancing green schools*. <https://www.centerforgreenschools.org/green-schools>
- Chan, T. C. (2013). An examination of green school practices in Atlanta schools. *Department of Educational Leadership, Kennesaw State University*. <https://www.thefreelibrary.com/An+Examination+of+Green+School+Practices+in+Atlanta+Schools.-a0341839957>
- Coyle, K. J. (2020). Green schools in the United States. In A. Gough, J. C. Lee, & E. P. Tsang (Eds.), *Green schools globally: Stories of impact on education for sustainable development* (pp. 370-385). SERIES: International Explorations in Outdoor and Environmental Education. <https://doi.org/10.1007/978-3-030-46820-0>
- Dillman, D. A., Smyth, J. D., & Christian L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. Wiley.
- Dyment, J. E. (2005). Gaining ground: The power and potential of school ground greening in the Toronto district school board. *Evergreen Learning Grounds*. <https://www.evergreen.ca/downloads/pdfs/Gaining-Ground-Summary.pdf>
- Dyment, J. E., & Bell, A. C. (2008). Grounds for movement: Green school grounds as sites for promoting physical activity. *Health Education Research*, 23(6), 952-962. <https://doi.org/10.1093/her/cym059>
- Eitland, E., Klingensmith, L., MacNaughton, P., Laurent, J.C., Spengler, J., Bernstein, A., & Allen, J. G. (2017). Schools for health: Foundations for student success. *Harvard T.H. Chan School for Public Health*. https://forhealth.org/Harvard.Schools_For_Health.Foundations_for_Student_Success.pdf
- Ghent, A., Trauth-Nare, A., Dell, K., & Haines, S. (2014). The influence of a statewide green school initiative on student achievement in K-12 classrooms. *Applied Environmental Education & Communication*, 13(4), 250-260. <https://doi.org/10.1080/1533015X.2014.983658>
- Gordon, D. E. (2010). Green schools as high performance learning facilities. *National Clearinghouse for Educational Facilities*. <https://files.eric.ed.gov/fulltext/ED512700.pdf>
- Kats, G. (2006). Greening America's schools: Costs and financial benefits. *The Massachusetts Technology Collaborative*. <http://www.usgbc.org>
- Kerlin, S., Santos, R., & Bennett, W. (2015). Green schools as learning laboratories? Teachers' perceptions of their first year in a new green middle school. *Journal of Sustainability Education*, 8. <https://doi.org/10.1088/1742-6596/1572/1/012042>
- National Environmental Education Foundation. (2022, February). Benefits of environmental education. *National Environmental Education Foundation*. <https://www.neefusa.org/education/benefits>
- National Research Council. (2006). Committee to review and assess the health and productivity benefits of green schools. Green schools: Attributes for health and learning. *National Academies Press*. <http://www.nap.edu/catalog/11756.html>
- National Research Council. (2012). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. *The National Academies Press*.
- U.S. Department of Education. (2021, January). Green ribbon schools: Highlights from the 2021 honorees. *U.S. Department of Education*. <https://www2.ed.gov/programs/green-ribbon-schools/performance.html>

- U.S. Department of Education. (2022, February). U.S. department of education green ribbon schools. *U.S. Department of Education*. <https://www2.ed.gov/programs/green-ribbon-schools/index.html>
- United States Environmental Protection Agency. (2010, November). *Indoor air quality tools for schools*. <https://www.epa.gov/indoor-air-quality-iaq>
- Yang, B. Y., Zeng, Z. W., Markevych, I., Bloom, M. S., Heinrich, J., Knibbs, L. D., Dharmage, S. C., Lin, S., Jalava, P., Guo, Y., Jalaludin, B., Morawska, L., Zhou, Y., Hu, L. W., & Yu, H. Y. (2019). Association between greenness surrounding schools and kindergartens and attention-deficit/hyperactivity disorder in children in China. *JAMA Network Open*, 2(12). <https://doi.org/10.1001/jamanetworkopen.2019.17862>

APPENDIX A

Green School Feature Checklist (Chan, 2013)

This Green School Feature Checklist is designed to inventory some of the basic practices schools are pursuing to achieve energy conservation and environmental protection. Your assistance in reporting the current school status is appreciated.

Please answer the following questions by checking either “Yes”, “No”, or “Don’t Know”.

Student involvement in green school

Yes	No	Don't know	
___	___	_____	1. Does your school teach environmental education?
___	___	_____	2. Does your school ask students to participate in recycling activities?
___	___	_____	3. Are green school projects assigned to students in class?
___	___	_____	4. Does your school have an outdoor garden or a designated green area for instructional use?
___	___	_____	5. Do your students practice energy conservation in school?

Water conservation

Yes	No	Don't know	
___	___	_____	6. Does your school have programmed timed irrigation for the lawn?
___	___	_____	7. Has your school installed automatic water faucets?
___	___	_____	8. Are your school toilets and urinals installed with automatic flushing?
___	___	_____	9. Are timely repairs made to water leaks in your school?
___	___	_____	10. Have the school water pipes been protected from bursting in freezes?

Energy conservation

Yes	No	Don't know	
___	___	_____	11. Have solar panels been installed in your school?
___	___	_____	12. Do your classrooms have natural lighting?
___	___	_____	13. Does your school schedule regular light fixture cleaning?
___	___	_____	14. Does your school have an energy conservation audit?
___	___	_____	15. Does your school use energy saving equipment?
___	___	_____	16. Does your school use an energy management system for its HVAC?

Green environment

Yes	No	Don't know	
___	___	_____	17. Is smoking prohibited throughout the school building?
___	___	_____	18. Does your school have annual air quality testing?
___	___	_____	19. Does your school have annual water quality testing?
___	___	_____	20. Does your school have annual radon testing?
___	___	_____	21. Has the soil around your school been tested for lead?
___	___	_____	22. Is mold a problem in your school?
___	___	_____	23. Is your school asbestos free?
___	___	_____	24. Does your school have adequate air ventilation?
___	___	_____	25. Does your school implement a regular pest control program?

Waste management

Yes	No	Don't know	
___	___	_____	26. Is recycled lunch cutlery used in your school?
___	___	_____	27. Is recycled paper used in your school?
___	___	_____	28. Has your school adopted electronic paperless practices?
___	___	_____	29. Does your school have recycling bins to categorize wastes?
___	___	_____	30. Is there a regular schedule for grease tank cleaning at school?
___	___	_____	31. Is there a regular schedule for dumpster service at school?
___	___	_____	32. Does your school use hand dryers instead of paper towels?
___	___	_____	33. Are old computers, printers, cartridges recycled?
___	___	_____	34. Does your school have a litter abatement program?