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Designing Classrooms to Maximize Student Achievement

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Abstract

Improving student achievement is vital for our nation's competitiveness. Scientific research shows how the physical classroom environment influences student achievement. Two findings are key: First, the building's structural facilities profoundly influence learning. Inadequate lighting, noise, low air quality, and deficient heating in the classroom are significantly related to worse student achievement. Over half of U.S. schools have inadequate structural facilities, and students of color and lower income students are more likely to attend schools with inadequate structural facilities. Second, scientific studies reveal the unexpected importance of a classroom's symbolic features, such as objects and wall décor, in influencing student learning and achievement in that environment. Symbols inform students whether they are valued learners and belong within the classroom, with far-reaching consequences for students' educational choices and achievement. We outline policy implications of the scientific findings—noting relevant policy audiences—and specify critical features of classroom design that can improve student achievement, especially for the most vulnerable students.

Keywords

classrooms, schools, physical environments, objects, stereotypes, learning

Tweet

Classroom physical environments—both facilities (noise, lighting) and symbolic (everyday objects)—affect student achievement.

Key Points

- Classroom physical environments affect student achievement.
- The facility's structural features—inadequate lighting, noise, poor air quality, and deficient heating—can undermine learning.
- The classroom's symbols, such as objects and décor, also influence student achievement.
- Evidence-based classroom design can maximize education outcomes for all students.

Introduction

American students average 11,700 hours of their lives in a school building from kindergarten to 12th grade (Hull & Newport, 2011), and college students typically spend at least another 400 classroom hours in post-secondary education buildings (Wellman & Ehrlich, 2003). A growing body of scientific work has revealed the physical classroom environment's important—and sometimes surprising—effects on students' academic performance. Evidence demonstrates that classrooms' structural features (e.g., noise, lighting) and symbolic features (e.g., everyday objects that signal who belongs in the classroom) can facilitate or hinder student learning and achievement. In considering changes to classroom environments, policymakers may want to consider both the inadequate facilities of many U.S. schools, as well as the symbolic aspects that may prevent students from achieving their full potential.

The Classroom's Structural Environment

According to the National Center for Education Statistics (Alexander & Lewis, 2014), more than half of U.S. public schools in 2012-2013 reported needing to spend money on their school buildings to bring them up to good condition. The most commonly reported structural inadequacies included windows, plumbing, and temperature regulation/ventilation. Schools that serve a higher concentration of children on free or reduced lunch were more likely to report

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structural inadequacies. Inadequate school facilities are related to worse test scores, even when taking into account (by statistically controlling for) the socioeconomic status and racial makeup of students (Crampton, 2009; Durán-Narucki, 2008; Lewis, 2001; Tanner, 2008). One study did not find this relationship between structural condition and student performance in Wyoming (Picus, Marion, Calvo, & Glenn, 2005); however, a reason could be the way that structural conditions were assessed. It has been suggested that assessing the structural conditions with the educational purpose in mind is a better predictor of student performance than engineering assessments of structural quality (Roberts, 2009).

The next sections review more detailed evidence showing that structural aspects of classrooms, such as lighting and acoustics, influence students' ability to learn effectively. Furthermore, a substantial proportion of U.S. classrooms currently do not meet minimum standards of structural quality. For each structural aspect, we critically examine the evidence and note exceptions or contingencies where relevant. All studies were conducted in the United States, unless noted otherwise.

Lighting

Students exposed to more natural light (i.e., daylight) in their classrooms perform better than students exposed to less natural light (Edwards & Torcelli, 2002; Tanner, 2008). In a study with more than 2,000 classrooms in California, Washington, and Colorado, students who were exposed to a larger amount of daylight in their classroom had higher math and reading test scores than students who were exposed to less daylight in their classroom (2%-26% higher, depending on school district), even after statistically controlling for student population characteristics such as socioeconomic status and race (Heschong Mahone Group, 1999). According to the National Center for Education Statistics (Alexander & Lewis, 2014), 16% of schools with permanent buildings and 28% of schools with temporary (i.e., portable) buildings have natural lighting that is unsatisfactory or very unsatisfactory. Although incorporating more daylight into classrooms may be beneficial, it should be done carefully, to avoid visual discomfort and temperature increases (Benya, 2001).

Acoustics

Excessive external noise hinders learning (Klatte, Bergstroem, & Lachmann, 2013). The source of classroom noise can vary, but commonly includes heating and ventilation units (U.S. Architectural Transportation Barriers Compliance Board, 2002), airplane flight paths (Evans & Maxwell, 1997), and road traffic (Woolner, Hall, Higgins, McCaughey, & Wall, 2007).

Classrooms with greater external noise are more likely to have lower student achievement. For instance, one study compared reading test scores of students in two schools with matched demographic factors (e.g., household income). One school was in the flight path of a major airport, whereas the other was in a quiet neighborhood. Students from the school in the flight path performed significantly worse than those from the quieter school (Evans & Maxwell, 1997). In an experimental demonstration, 12- to 14-year-old students in Sweden were randomly assigned to read about world cultures in the presence of one of four prerecorded noises (aircraft, road traffic, train, or verbal) or in quiet conditions. Students performed significantly worse on a subsequent test of reading comprehension when exposed to aircraft or road traffic noise than without noise. Train noise and verbal noise did not interfere with reading comprehension in this study (Hygge, 2003; see also Dockrell & Shield, 2006). Unsatisfactory or very unsatisfactory acoustics were reported for 14% of U.S. public schools with permanent buildings and 21% of U.S. public schools with temporary buildings (Alexander & Lewis, 2014). Classroom noise is an even more serious concern for students with hearing loss or attention deficits (U.S. Architectural Transportation Barriers Compliance Board, 2002).

Temperature

The optimal temperature range for learning appears to be between 68° and 74° (Earthman, 2004; see also Huffman et al., 2003; McGuffey, 1982). In an experiment on effects of temperature on learning, male undergraduates performed best on a test of word associations when they had learned those associations in a 72° room, and performed significantly worse as temperatures became more extreme in either direction (Allen & Fischer, 1978). Heating is reported as unsatisfactory or very unsatisfactory for 14% of U.S. public schools with permanent buildings and 12% of U.S. public schools with temporary buildings (Alexander & Lewis, 2014).

Air Quality

Exposure to low-quality air is related to decreased student attendance and affects teachers' abilities to teach well (Schneider, 2002). Schools serving students of color and low income students are disproportionately likely to have low air quality (General Accounting Office, 1996). Unsatisfactory or very unsatisfactory air quality is reported for 9% of U.S. public schools with permanent buildings and 16% of U.S. public schools with temporary buildings (Alexander & Lewis, 2014).

Accessibility

Ensuring adequate structural quality is important for all students and is particularly so for students with disabilities. For example, students with hearing loss may find it particularly difficult to discriminate the teacher's words from competing

background noise. One study that modified the classroom physical environment (e.g., acoustic quality, seating arrangements, visual stimulation, and classroom organization) improved academic engagement for deaf and hard-of-hearing students, although it could not isolate which factor(s) made the difference (Guardino & Antia, 2012).

In addition to these structural features, an absence of ramps, elevators, and automatic door openers, as well as desks, chairs, and other objects that are suitable for students with physical disabilities restricts their ability to participate in class activities (Hemmingson & Borell, 2002). Structural barriers and lack of assistive technologies impede accessibility and inclusion for students with physical disabilities in colleges and universities and in K-12 settings (Dudgeon, Massagli, & Ross, 1997; West et al., 1993). In a survey conducted in the United States and Canada, parents of primary and secondary school children with disabilities were more likely to report that features of the school's environment (including physical layout) were a barrier to their children's participation than the parents of children without disabilities (Coster et al., 2013).

Summary

Many studies have revealed a significant relationship between quality of physical infrastructure and student achievement. Note that most of the classroom studies used correlational methods, rather than randomly assigning students to structurally different schools or classrooms. Correlation is not causation. However, as noted, experimental studies performed in laboratories have similarly shown that subpar structural conditions (e.g., noise, heating) cause decrements in cognitive performance. Taken together, these results strongly suggest that building and classroom improvements to subpar facilities can increase student learning and achievement.

The majority of U.S. public schools have building-quality issues, with poor lighting, acoustics, temperature regulation, or air quality. This is particularly true for schools that serve students from lower income families and have a large population of students of color. These students may be bearing the brunt of inadequate infrastructure.

Granting that minimal levels of adequacy for heating, lighting, and acoustics matter for achievement, the following question arises: Can student achievement be further boosted by allocating more resources to state-of-the-art classrooms or the latest technology? Evidence suggests that this is not the case (Margolis, Estrella, Goode, Holme, & Nao, 2008; Woolner et al., 2007). For instance, providing schools with the latest technology may not benefit students if there are other barriers to achievement that diminish the uptake of these potential upgrades. These barriers can include an inadequate curriculum or assumptions about students' unwillingness to learn (Margolis et al., 2008). Evidence suggests that bringing the structural environment up to adequate levels is important to maximize learning, but excessive remodeling (e.g., taking a school environment "from the equivalent of a Ford to a Ferrari"; Stricherz, 2000, p. 30) may be ineffectual at raising achievement if other factors (e.g., good curriculum) are not in place.

The Classroom's Symbolic Environment

Once schools have achieved minimum structural conditions, do students have what they need to succeed? Work in psychology and education has demonstrated the importance of environmental features that we term the *symbolic classroom*. These symbols include wall décor and objects that are displayed in classrooms. Far from being trivial details, these features powerfully affect classroom culture. The objects present in a classroom influence performance and shape student aspirations (Fisher, Godwin, & Seltman, 2014), which is partly why teachers have displayed pictures of presidents, inventors, and thought leaders in classrooms for many years. Recent empirical work shows that such displays affect students from historically underrepresented populations in subtle and important ways (Rivlin & Weinstein, 1984; Weinstein & Woolfolk, 1981). Even brief and subtle messages that signal to students of color and female students that they may be evaluated based on their race or gender can raise fears of confirming negative stereotypes about their group's abilities, causing worse performance on tests (Steele, Spencer, & Aronson, 2002). Yet, teachers and staff can modify the symbolic classroom relatively easily. Small changes to the symbolic classroom can improve learning outcomes for all students and help reduce racial and gender achievement gaps. These "safe" classroom contexts can be created even with limited resources.

A fourth-grade classroom intervention reveals the importance of the symbolic classroom (Guardino & Fullerton, 2011). The authors rearranged desks to create distinct areas for individual and group work, added plants and inspirational posters, and reorganized materials to make them more easily accessible. Making these changes took only a few hours, but following this intervention, students showed sustained improvements in engagement and reduced disruptive behavior.

The next sections discuss specific symbolic aspects of classrooms, including classroom layout and décor, that influence students' ability to learn effectively. We examine why these aspects affect students, the degree to which they are relevant to students of all backgrounds, and how they may more specifically impede the success of historically underrepresented groups.

Classroom Layout

Furniture arrangement in the classroom influences how comfortable students feel and the amount of interaction with other students and with the teacher (Burgess & Kaya, 2007;

Martin, 2002). Different arrangements may achieve these goals for different people. For example, in a survey of more than 900 college students, women reported feeling more at ease in classrooms with desks arranged in clusters or in rows (Burgess & Kaya, 2007). However, clustered arrangements can also lead to more disruptive and off-task behavior (Hastings & Schwieso, 1995); thus, task demands and learning goals are relevant considerations in selecting optimum seating arrangements (Wannarka & Ruhl, 2008).

Objects and Décor

Everyday objects displayed in a school or classroom can be detrimental when they distract from learning. In one study, kindergartners were randomly assigned to learn introductory science lessons in a classroom that had many wall displays or no wall displays. Students in the classroom with wall displays were more distracted and performed worse on lesson worksheets than students in the bare classroom (Fisher et al., 2014). More research can help to understand optimal amounts of wall adornment and the degree to which these findings generalize to children of older ages.

Objects can also hinder (or improve) the achievement of students of color and females of all backgrounds when they allow for (or remove) uncertainty about whether one's social identity will be accepted. In one study, female undergraduates completed analogies after waiting in the office of a male graduate student who they thought would be evaluating them. When the office contained objects (e.g., a university banner) that did not signal anything positive about the occupant's attitudes toward women, women who had prior concerns about gender prejudice performed worse on the analogies task than women without such concerns. Removing uncertainty about whether women would be judged based on their gender by incorporating cues that clearly communicated the occupant's attitudes, such as an equality award, eliminated this performance gap (Mendoza-Denton, Shaw-Taylor, Chen, & Chang, 2009).

Adding symbolic objects to a classroom can positively affect student performance. In one study, male and female students were randomly assigned to give a persuasive speech in front of an audience in a virtual-reality classroom that had either a photograph of Bill Clinton, Hillary Clinton, German Chancellor Angela Merkel, or no photograph displayed on the back wall. When the room featured either a photograph of former President Clinton or no picture, men gave speeches that were significantly longer and rated as better than women's. When a photograph of either Hillary Clinton or Angela Merkel was displayed, however, the gender differences in speech length and quality were eliminated. The presence of female-leader photographs increased women's speaking time and performance, without any detriment to men's speaking time or performance (Latu, Mast, Lammers, & Bombari, 2013).

Objects in the environment can also influence students' educational interests and choices. Stereotypically masculine objects in the classroom undermine many female students' career aspirations (Cheryan, Plaut, Davies, & Steele, 2009). Undergraduate women who were randomly assigned to view a computer-science classroom with objects that were perceived by students as highly associated with computer-science environments (e.g., *Star Trek* and *Star Wars* items, video games) expressed less interest on average in pursuing computer science than women in a computer-science classroom with non-stereotypical objects (e.g., art and nature pictures, plants).

Why did stereotypical objects steer women away from computer science? Objects in the environment signaled who "belonged" in the space. A follow-up study revealed that the majority of women significantly preferred the non-stereotypical space to the stereotypical space, even when women were the only occupants of both spaces, suggesting that simply having an all-girls class or school does not guarantee that female students will feel belonging. To feel like they belong, students must also be able to relate to the other people who commonly seem to inhabit a space or pursue a type of career. Objects shape this sense of belonging.

Three other studies demonstrate how objects can influence students' academic outcomes. Ninth- and tenth-grade female students, who were randomly assigned to view chemistry textbook materials containing pictures of women scientists, showed better comprehension than students who viewed stereotypical pictures depicting only males (Good, Woodzicka, & Wingfield, 2010). In another study, American Indian high school students who were randomly assigned to see American Indian mascots (e.g., Chief Wahoo of the Cleveland Indians) were less likely to mention academic achievement when asked about where they imagined themselves in the future than American Indian students who saw either no image or a counter-stereotypical one (a poster of an American Indian woman in front of a microscope; Fryberg, Markus, Oyserman, & Stone, 2008). In another study, Buddhist, Sikh, and Christian students were randomly assigned to answer questions about how included they felt at their university while seated in either a cubicle with a small Christmas tree or a cubicle with no Christmas display (Schmitt, Davies, Hung, & Wright, 2010). The Christmas display made no difference for Christian students, but Buddhist and Sikh students who saw the display reported feeling less included at their university as a whole and expressed less self-assurance than did Buddhist and Sikh students in the cubicle with no display. When asked how they thought the presence of the Christmas display would affect them, both Christians and non-Christians predicted that the display would have *positive* effects on them, if any.

One caveat concerns how exactly to add objects that signal valuing students of color, female students, and students with disabilities. Inserting token symbols to represent a group will not be successful if done disrespectfully or stereotypically. For example, viewing images of Pocahontas or American Indian mascots such as the Chief Wahoo Cleveland

Indians logo caused American Indian high school students to express lower self-esteem and community worth (Fryberg et al., 2008). The sense of being reduced to a single symbol or stereotype—even a seemingly "positive" one, such as Asians being good at math—can be a negative experience for many people in that group (Siy & Cheryan, 2013).

A second caveat concerns how to create a welcoming classroom for historically underrepresented groups without alienating majority groups. When diversity is framed only in terms of one or a subset of minority groups, majority groups can feel excluded. However, when diversity initiatives are framed as all-inclusive (e.g., including both displays of majority and minority groups), they may diminish majority groups' feelings of exclusion and increase their engagement with these initiatives (Plaut, Garnett, Buffardi, & Sanchez-Burks, 2011).

Virtual Classrooms

As the popularity of online education continues to increase (Lederman, 2014), greater attention is being paid to the design of virtual learning environments. Although we have focused on the effects of objects that are physically present in a space, objects matter in virtual environments as well (Latu et al., 2013). Virtual computer-science classrooms with stereotypical computer-science objects reduced women's interest and sense of "belonging" in computer science, just as stereotypical objects in real classrooms do. Replacing stereotypical objects with non-stereotypical ones effectively increased interest and belonging among female students and boosted their interest and belonging to the level of their male peers (Cheryan, Meltzoff, & Kim, 2011). As the use of virtual classroom environments continues to grow, care should be taken in how these spaces are designed to create a virtual classroom culture that is welcoming to all students.

Summary

Although negative effects of inadequate structural features have been known for decades, recent research underscores the importance of symbolic features of classrooms in shaping student achievement. A growing body of scientific evidence indicates that students use objects to draw inferences about the classroom's culture. Weinstein and Woolfolk (1981) state that "the visual appearance of the classroom can be conceptualized as a nonverbal statement about the teacher who has structured this learning environment" (p. 384), and the research shows that students pick up on these cues. Symbolic features can signal to students whether they will be valued and encouraged within the classroom, with consequences for educational equity.

Although we have separated the structural and symbolic features of school physical environments, these features may intertwine. First, structural features can take on symbolic properties because they signal whether students and educators are valued (Durán-Narucki, 2008). Two studies suggest a possible relationship, although neither study is conclusive. In one Virginia middle-schools study, teachers' rating of the quality of school facilities predicted students' standardized tests scores, and this was driven in part by teachers' perceptions that the school climate was worse in schools with poor facilities (Uline, Tschannen-Moran, & Wolsey, 2009). In a New York City elementary-schools study, worse school-building conditions predicted lower academic achievement, and this was driven in part by lower student attendance (Durán-Narucki, 2008). Lower student attendance may have been due to students perceiving that they were not valued in schools with worse building conditions. All of the experimental research on symbolic features has been conducted within relatively well-resourced schools and universities. Additional studies need to be designed to identify how structural and symbolic features interact—for instance, whether symbolic features have different effects in schools with lower quality infrastructure.

For students with physical disabilities, the symbolic aspect of the structural classroom may be especially important. Structural barriers can restrict students with physical disabilities from participating in classroom activities (Hemmingson & Borell, 2002), and yet, being able to actively participate in classroom activities plays a key role in fostering feelings of belonging for students with disabilities (Williams & Downing, 1998). This latter finding was based on a small number of individual interviews and is not conclusive, but it suggests that environmental modifications enabling students with physical disabilities to participate with their classmates may also increase their feelings of inclusion and belonging in the classroom.

A Practical Example: University of Washington Computer Science and Engineering (UW CSE)

After learning about research on stereotypes, the UW CSE department redesigned their computer lab in 2010 to communicate a more welcoming environment to their students (see Figure 1). Changes such as repainting the walls and hanging nature posters were relatively inexpensive and took less than 2 weeks to implement. The goal of this remodel was to create a warm and appealing workspace, and to communicate that the department and the field are welcoming to all. Feedback from students and faculty indicated that these efforts were successful. Students preferred the new space and felt it better communicated the people-oriented nature of the department. For more information about this remodel and how to undertake similar renovations, see the National Center for Women in Information Technology's Promising Practices Sheet on physical space: http://www.ncwit.org/sites/default/files/resources/designphysicalspacebroadappeal_affectingwomensentrypersistencecomputingphysicalspace_web.pdf

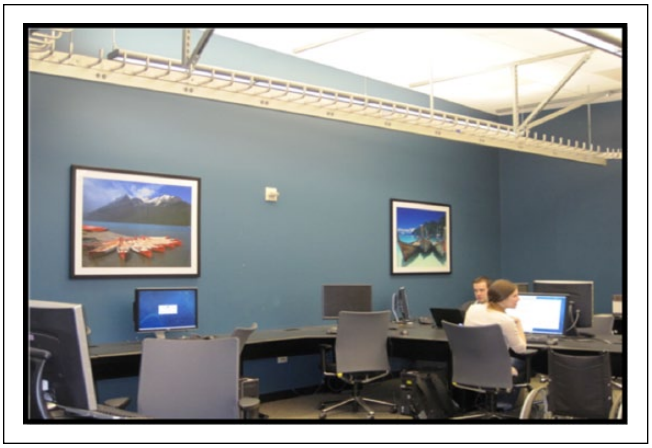

Figure 1. The University of Washington Computer Science and Engineering Department renovated their computer lab to take into account the scientific findings on stereotypes and belonging.

Policy Implications: Putting Research on Structural and Symbolic Classrooms Into Practice

The evidence presented here has direct policy implications. The work could be useful for developing and implementing education policy for state-level boards, local school boards, school and program administrators, and teachers. Organizations that promote standards for certification and accreditation might encourage training on classroom environments. Professional development programs might consider adopting research findings into their curricula. School administrators might provide venues for teachers to share information on school environments.

Structural Features: Lessons From Research Evidence

Many schools continue to describe aspects of their facilities as unsatisfactory (e.g., lighting, acoustics, air quality), and these structural inadequacies can hinder learning. Districts might avail themselves of research on structural inadequacies and their potential impact, and weigh these among other budgetary priorities. In addition, policymakers might incorporate scientific findings when updating building standards. Legal requirements do not always cover the spectrum of physical conditions that can facilitate achievement for all or certain groups (e.g., voluntary standards for acoustics that can help children with hearing impairment or attention deficit disorder; Sorkin, 2000).

When budget constraints pressure school infrastructure, resources might best be allocated toward bringing all schools up to par on structural conditions such as adequate lighting, air quality, and temperature regulation. Once these basics are in place, further high-end structural improvements in facilities do not necessarily improve student performance (Margolis et al., 2008; Woolner et al., 2007). Because schools with inadequate structural conditions are more likely to serve students of color and low-income students (General Accounting Office, 1996), making improvements to structural conditions may also help reduce achievement gaps.

Symbolic Features: Lessons From Research Evidence

Beyond the structural classroom, four aspects of the symbolic classroom are relevant to student achievement. First, when adding décor, teachers may want to keep in mind its potential to create visual distraction and interfere with learning. Second, care should be taken to ensure that classrooms do not feature objects that acknowledge only high-status groups or make students from historically underrepresented groups feel excluded. For instance, American history classrooms could display photographs of successful female leaders such as cabinet secretaries, along with portraits of past presidents (who to date are exclusively male). Third, adding objects can make underrepresented groups feel welcome in the classroom without having negative effects on the majority group. For example, non-stereotypical items such as art and nature posters in a computer-science classroom can make more women feel they belong in the field without dissuading men. Fourth, adding objects that celebrate minority groups or cultures should take care to not constrain these students to a limited set of roles. For instance, rather than displaying stereotypical images of American Indians as celebrated warriors, teachers could display images such as posters from the American Indian College Fund depicting American Indian scientists.

Metrics for success are crucial to evidence-based interventions. After implementing classroom changes, it is important to evaluate their impact. Students are not always willing or *able* to report verbally how they are affected by objects in their surrounding environment because the ambient environment may not rise to the level of explicit analysis and awareness (Schmitt et al., 2010). Consequently, these evaluations cannot rely entirely on directly asking students whether structural changes or objects in a classroom are harmful or helpful. Instead, more multi-method evaluations, including measures of implicit cognition, can add valuable information.

Further empirical research also can help guide teachers and administrators on how to implement changes in the symbolic classroom to have the most positive impact. For instance, displaying items from a wider variety of cultures can make students from minority groups feel that they "belong," but this strategy could backfire if students feel reduced or constrained to a stereotypic role. In addition, there may be interesting interactions between several of the ideas presented here. For instance, would décor that is inclusive but also high in visual distractibility improve performance or hinder it? Finally, most studies have focused on able-bodied students and not specifically investigated effects on students with disabilities.

Bringing the Structural and Symbolic Classrooms Together: Policy-Relevant Considerations

Several key differences between structural and symbolic features of the classroom are relevant for policy. First, structural and symbolic features typically have different budget implications, with structural features generally being more costly. This may affect policy choice, but choices about structural and symbolic features need not compete with each other.

Second, different decision makers may be involved in structural and symbolic features. Structural decisions typically reside more with school districts, whose decisions about buildings are bound by state statutes and regulations (as well as federal laws and regulations regarding accessibility). Symbolic decisions often reside with individual teachers, who might value access to information about such research in their training and professional development. Teacher training programs in schools of education could consider incorporating guidelines on symbolic aspects of the classroom, and school district officials and principals could consider the symbolic classroom in selecting professional development resources. All these decision makers are guided and constrained by state regulations (see the National Association of State Directors of Teacher Education and Certification), federal initiatives (e.g., through the U.S. Department of Education), and national organizations involved in certification (e.g., National Education Association, *National Board for Professional Teaching Standards*) and accreditation for teacher preparation (e.g., *Council for the Accreditation of Teacher Preparation*).

Third, increasing achievement for *all* students may require different environmental interventions than reducing achievement gaps *between* students. Because structural inadequacies of classrooms are often directly tied to school and district resources, they will often affect most or all students in a school, with a possible greater impact on students with disabilities. Symbolic features may similarly affect all students (e.g., when the symbols are distracting) or be more limited to certain groups within a school setting (e.g., girls in a science classroom).

Conclusion

For students to learn to their full potential, scientific evidence suggests that the classroom environment must be of minimum structural quality and contain cues signaling that all students are valued learners. Of course, the redesign of classrooms must be considered within the context of a set of larger factors that promote educational attainment, such as curriculum development and teacher training. Nonetheless, a plethora of scientific evidence suggests that student learning and achievement is deeply affected by the environment in which this learning occurs. Improving student learning, achievement, and motivation requires attending to both the structural and symbolic features in the classroom.

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