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NOT JUST SPACE: SCHOOL FACILITIES AS A REFLECTION OF INEQUALITY AND ITS  
IMPLICATIONS FOR EDUCATIONAL POLICY AND REFORM

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A Master's Paper in  
Education, Culture, & Society

Presented to the Faculty of the Education, Culture and Society Program of the University of  
Pennsylvania's Graduate School of Education in Partial Fulfillment of the Requirements for the  
Master of Science Degree in Education

May 2019

**ABSTRACT**

Poor educational facilities disproportionately affect low-SES and minority students. Not only do inadequate facilities undermine teaching and learning, but children maintain an awareness of the neglected physical environment of their school and, through its internalization and recognition of their status as second-class citizens, become disengaged. This paper seeks to offer a more comprehensive analysis of the ways in which school facilities are entwined with (1) student learning and cognitive processes, (2) student identity, and (3) school climate. As a result of this complex entanglement, inadequate facilities can be understood not only as a reflection of vast educational inequality, but also as a contributing factor to the further exacerbation of said inequality. The concrete nature of facilities makes it a visible, sustainable, impactful point of intervention that would enhance and support the effectiveness of other complex pedagogical and social reforms. For this reason, school facilities deserve greater acknowledgment and funding support from federal and state policy.

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## INTRODUCTION

Educational reform of late has focused on pedagogical change and accountability, dictating practice and enacting quantitative measurements to determine its effectiveness. However, these changes occur within spaces that differ widely between sites. Failure to acknowledge the role of space in undermining or supporting other forms of educational change can lead to a range of consequences. Foremost, it is economically disadvantageous – investments in reform are less impactful when facilities undermine their ability to be effective. The failure to invest in updating and maintaining school facilities may lead to unforeseen costs in student outcomes (C. Uline & Tschannen-Moran, 2008). Secondly, neglected facilities undermine the pursuit of equity in education since schools in communities with low-socioeconomic status (low-SES) are more likely to suffer from inadequate facilities. While 10% of public schools report unsatisfactory conditions, 27% of low-SES public schools report unsatisfactory conditions (Maxwell, 2016).

The disparate nature of school facilities and their quality emerges from a long history of segregation and localized control (B. D. Baker, 2018; Darling-Hammond, 2010; Kozol, 1991). This history culminated in an impactful report released in 1996 by the General Accounting Office (GAO). The following year, in his 1997 State of the Union Address, President Clinton declared, “we cannot expect our children to raise themselves up in schools that are literally falling down” and pledged to help communities finance school construction over the next four years (“President Clinton’s Message to Congress on the State of the Union,” 1997). School infrastructure finally had the spotlight; however, the investment that followed failed to rectify the shortcomings documented. This paper will begin by reviewing the findings of the GAO report and tracing the trends of school funding since its release in order to contextualize the current state of school facilities.

Overall, when (if) schools think about the role of the physical space, they tend to view it as a mere backdrop to learning, rather than as an active contributor. However, this fails to capture the scale of the impact. School facilities are often evaluated from an “engineering standpoint” that fails to consider the purpose of a space (Roberts, 2009), meaning, facilities are measured only in regards to structural performance; aesthetics and other markers of inadequacy that might be perceived but not measured are not considered, though they may carry a significant psychological influence on students and faculty. This paper seeks to offer a more comprehensive analysis of the ways in which school facilities are entwined with (1) student learning and cognitive processes, (2) student identity, and (3) school climate. As a result of this complex entanglement, inadequate facilities can be understood not only as a reflection of vast educational inequality, but also as a contributing factor to the further exacerbation of said inequality.

This paper argues that the role of the physical environment is extended and complicated by taking into account other aspects of space. The expanding levels of cognition, student identity, and school climate can be analyzed through three theories building upon one another. The first, (1) cognitive load theory, can be used to understand the direct effect of physical space on cognitive processes that impact a student’s ability to learn. The second, (2) place-identity theory, frames the interaction between a school building and the individuals within it. The third, (3) sociospatial relations, addresses school space on a macroscale; meaning, because schools exist in relation to one another, the perception of a school in contrast to others can influence behavior, patterns, and policy that also have repercussions for student learning. It is through the compounding effects of all three levels that the critical role of physical space in education is revealed. Finally, I conclude by considering the implications these interactions have for school

reform and argue that school space and infrastructure investment should be granted greater consideration in educational policy.

### **A HISTORY OF UNEVEN INVESTMENT**

Since its inception, the funding and financing of schools has been a local affair. This remains true for physical infrastructure more so than any other component. As a result, schools have often been a reflection of the wealth and affluence (or lack thereof) of the communities they serve (B. D. Baker, 2018; Darling-Hammond, 2010; Kozol, 1991).

In 1995, the U.S. Government Accountability Office released a report announcing that an estimated \$112 billion would be necessary in order to repair or upgrade the nation's schools to "good overall condition." Though about two-thirds of schools were deemed adequate or good, the remaining third served 14 million students. Meaning, about 14 million students attended 25,000 schools in need of extensive repair or replacement. For most districts, a lack of funds forced vital repairs and maintenance to be deferred year after year. However, such deference actually amplifies cost by speeding deterioration; "for every \$1 not invested, the system falls another \$620 behind" (U.S. General Accounting Office, 1995, p. 16). A follow up report in 1996 asserted that low-income and minority students were more likely to attend a school in disrepair (U.S. General Accounting Office, 1996).

Following this report, there was an influx of spending for school facility construction nationwide, spending \$504 billion in capital expenditures between 1995 and 2006. However, these expenditures were not equally distributed, with higher investments made in affluent districts and lower investments made in low-income districts. Further, the types of repairs and enhancements funded differed between districts. Low-income schools already in disrepair were

more likely to use funds for basic repairs like asbestos removal and roof replacements; affluent districts, with already adequate or good facilities, could use these funds on enhancements, such as science labs or performing arts centers. The conclusion is grim. In 2006, the disparity documented in 1996 remained. Schools serving low-income and/or minority students were the most likely to be in the worst physical condition (Filardo & Vincent, 2011; Filardo, Vincent, Sung, & Stein, 2006).

This disparity is largely a result of the funding structure for facilities and capital construction. Since a majority of funding comes from local sources, school districts' abilities to fund construction and investment in their schools is dependent on the wealth of the community. Between 1994 and 2013, about \$1.26 trillion was invested in K-12 capital outlays. However, only about 0.2% of this sum was funded by federal revenue; 19% came from states and 81% came from local sources (Filardo, 2016). Furthermore, capital construction is generally paid for through the use of loans, which carry additional burdens for low-wealth districts. First, carrying large debts causes funds to be continually diverted into interest payments. Second, low-wealth districts have a diminished capacity to borrow, compared to high-wealth districts that are capable of borrowing at high levels. At the end of 2013, districts reported \$407 billion in long-term debt, a majority of which resulted from capital spending on facilities. These districts spent approximately \$17 billion in interest on their long term debt (Filardo, 2016); that \$17 billion could have undoubtedly found better use elsewhere.

Thus, because capital construction funds are so heavily tied to local wealth (more so than operating budgets which receive 10% of their funding from federal sources), underinvestment in the maintenance and construction of school facilities continues to disproportionately impact children of low-income families, even when spending is substantially increased (Cohen, 2019;

Filardo, 2016). Mary Filardo, the executive director the 21<sup>st</sup> Century School Fund which analyses school facility issues in D.C. and other urban communities, observed,

From 1995 to 2004, there was tremendous growth in the U.S. economy, and I wondered whether because of this, low-wealth zip codes would get plenty of school construction money. What we found is that there was no trickle down—the poor districts were starved compared to the wealthiest districts, except where there had been court cases, and even then it still didn't compensate for the differences in where they started out (Filardo quoted in Cohen, 2019).

In order to understand why this disparity matters for students, one must understand the complex and subtle ways in which space permeates identity and society. More than a mere backdrop, the physical environment interacts with individuals and society in a variety of ways which will be explored through cognitive load theory, place-identity theory, and sociospatial relations.

### **THEORIES OF SPACE AND PLACE**

The inadequacy of school facilities and its disproportionate association with low-income and minority communities has wide implications for student learning that can only be fully understood using multiple frameworks. Three theoretical frameworks will be used to analyze the different levels of interaction between space and student learning. Starting small, the first is cognitive load theory (CLT) which considers cognition and learning at its most basic—the neurological. Cognitive load theory can be used to understand some very impactful, though limited, ways in which physical space can support or impair student learning. Place-identity theory expands this scope by considering the student's position within and attachment to a particular space that is embedded with implicit meaning. Place-identity can be used to understand the ways individuals read and internalize messages signaled by their environment which further impacts the learning and developmental process of the student. Expanding our



scope once again, sociospatial relations offers a theoretical framework for understanding a school in relation to other schools and the community. Sociospatial relations reveals the ways in which a school's facilities may influence the flow of individuals in and out of that space.

Meaning, the state of a school's facilities impacts the retention of both students and faculty in a manner that can have consequences for student learning. Sociospatial relations may also impact funding and community perception, often in a manner that exacerbates the already present inequality.

### **Cognitive Load Theory, Expanded**

One way to understand the impact of space most directly is through a reconceptualization of cognitive load theory (CLT). In its original formulation, CLT is a framework based upon the cognitive architecture of long-term memory (LTM) and working memory (WM), the latter of which is extremely limited in capacity. CLT asserts that it is the presence of familiar information and schemas in the LTM that permits complex cognitive tasks in the WM. Therefore, using knowledge of the task and prior knowledge and capacities, CLT can be used to predict learning performance (Sweller, Van Merriënboer, & Paas, 1998). However, this formulation lacks a consideration of the impact of the physical environment on WM. Cognitive effects emerge primarily in the form of auditory or visual noise. Irrelevant environmental stimuli deplete WM resources. Furthermore, automatic target-context binding encodes environmental stimuli into the cognitive scheme. Meaning, knowledge is linked to the context in which it is learned. Matching learning and testing environments increases performance (Choi, van Merriënboer, & Paas, 2014).

This theory could be used to understand why noise is detrimental to student learning (Hygge, 2003). However, this biological framework alone is insufficient for understanding the

impact that the physical environment has on learning. It is important to acknowledge the social ways in which space shapes learning and development. Theories of place-identity and sociospatial relations illuminate the more complex ways in which space can shape student learning.

### **Place-Identity Theory**

Philosophers from Heidegger (1962) to Lefebvre (1991) have consistently asserted the centrality of space for personhood and identity, the latter asserting, “space is never empty: it always embodies a meaning” (p.154). This sentiment is echoed in the conceptualization of “place-identity” by Proshansky, Fabian, & Kaminoff (1983) which argues that the places and spaces a child inhabits contribute significantly toward the development of that child’s self-identity; this influence is salient for three reasons. First, children spend a majority of their time immersed in the home, neighborhood, and school from infancy to adolescence with unyielding continuity. Second, the impact is significant not only because of the consistency of exposure, but because it is within these environments that the child learns their most significant social roles. And finally, children must learn to directly engage with and respond to the demands of their physical world. As a result, an individual “learns through his interactions with his environment the rules of life that are inherent to those places...and eventually ends up identifying himself to those places” (Marcouyeux & Fleury-Bahi, 2011, p. 345).

Proshansky et al. (1983) also notes that, although children often consciously participate in some of their learning and socialization processes, the impact of the physical environment is “indirect, that is, without the child consciously participating in it or being aware of the process” (p. 63). When considering this unconscious impact of the physical environment, the school space

can come to be thought of as “the third teacher” (Nicholson, 2012) complimentary to the actual teacher and curriculum shaping the student’s learning. Nicholson (2012) notes that, in addition to the educational objective, a school “building can also communicate to children a great many subtle messages about what is important and what is deserving of respect” (p. 45). Thus, we can understand schools as a social context that has been permeated with meaning emergent from the interactions between individuals with one another and their environment. It is through these embedded meanings and interactions that a place comes to influence one’s place identity (Marcouyeux & Fleury-Bahi, 2011).

Place-identity can be broken down into three components: (1) place attachment, (2) place dependence, and (3) group identity (Marcouyeux & Fleury-Bahi, 2011). Though place attachment is a subcomponent of place-identity, the two are often conflated in the literature (Altman & Low, 1992). However, place attachment can be understood as a link between an individual and a place; place-identity builds upon this attachment. The greater the attachment and the will to maintain said attachment, the greater the sense of place-identity. Place dependence suggests an association between the quality of the physical and social resources of a place as compared to other places; within the context of the school, place dependence might be expressed as a belief that one’s school holds advantages over others. Group identity can be expressed in a school space as acknowledgement of the space’s role in one’s self-image. (Marcouyeux & Fleury-Bahi, 2011).

Because physical space is a central component of a student’s interactions with their peers, teachers, and education, it can communicate expectations, or lack thereof, that are further reinforced by the policies shaping those spaces (Tanner, 2000). In considering the various ways in which space impacts student learning, place-identity is central to understanding the impact of

school facilities on student identity and school climate, the latter in the form of behavioral problems and absenteeism. Place-identity as a construct is constrained mostly to the site itself—in this case, the school. However, using the additional concept of sociospatial relations, one can examine the ways in which school facilities relate to one another and impact student learning.

### **Sociospatial Relations**

Setha Low continues this discussion by acknowledging the role of spaces and places in exerting and maintaining inequalities and structures of dominance (2011, 2017). Proshansky et al. (1983) also recognized the social location of place for children by acknowledging that place-identity is not simply a product of the child's experience of the physical environment, but also a function of what others say and think about said space. Thus, as Lefebvre theorized, space is not simply the material and physical, it is the space of social relations (1991). In expanding this concept beyond the student, we can begin to see the way in which a school's identity (that which is read by its students) is the product of its sociospatial location; "the unequal and contrasting sociospatial relations that exist today among urban schools and between urban and suburban districts are a consequence of these larger developments" (M. Baker & Foote, 2006). The larger developments to which Baker and Foote refer are the shifting sociospatial relations produced by the social and economic transitions within American history that have led to the emergence of sustained segregation and suburbanization and its impact on the development of public schools.

Within the context of school facilities, sociospatial relations contextualizes schools based upon their relationship to others within a framework of hierarchy, power, and access. First, as shown in the historical outline of school funding, facility quality is related to, and in many ways a product of, the social circumstance and wealth of the surrounding community. Thus, the

conditions of a school are a reflection of already prominent social stratification. However, the schools are not only a product of this stratification and inequality, but also a producer of it. When the conditions are seen and interpreted by individuals within the space, they may inform decisions that impact student learning. An impactful way that space and sociospatial relations play out is through teacher retention and turnover, impacting the quality of instruction and continuity available to students within the space. Space also impacts parent choice and community perception in ways that are beyond the scope of this paper, but nevertheless may have ramifications for student learning. The former will be addressed more extensively and the latter only briefly.

### **THE IMPACT OF PHYSICAL SPACE ON EDUCATION**

These frameworks will be used to analyze a range of studies that consider the role of space in education. Most studies seek to isolate a cause or impact; therefore, these studies have been organized based upon their methodology and the level of impact they attempt to measure. Beginning again at the level of cognition, the first grouping consists of studies that look solely at learning in its most simplistic sense—academic achievement and testing scores. The next grouping of studies examines physical space and student identity. The final grouping considers physical space and school climate. Within these studies, school climate acts as a mediating factor that further impacts student identity and achievement (C. Uline & Tschannen-Moran, 2008). School climate “is based on patterns of people’s experiences of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures” (Thapa, Cohen, Guffey, & Higgins-D’Alessandro, 2013, p. 358). Within school climate, I have sorted studies based on their impact on four categories: student behavior and

aggression, absenteeism, teacher retention and quality, and outside engagement and perception (i.e. community and parents). Each of these categories fall within the realm of school climate and have a substantial impact on student learning and identity. Each set of studies reveals implications for the role of physical space, but it is through their compounding that spaces exerts a powerful influence on student learning and inequality.

### **Space and Learning**

Choi, van Merriënboer, & Paas (2014) expanded the concept of Cognitive Load Theory to understand the impact of space on student learning and performance. This framework shows the rudimentary ways in which learning is impacted by the physical environment. This direct impact might originate from lighting, temperature, population density, noise, color, and a number of other features (Cash, 1993; Earthman, 2004; Hines, 1996; Mark Schneider, 2002). Thermal comfort and air quality have physiological effects that deplete working memory resources and have been shown to be directly linked to student performance (Earthman, 2004), thereby emphasizing the importance of well-functioning heating and ventilation in schools. Earthman rated thermal comfort and indoor air quality as the top two most impactful environmental conditions for student performance; this is followed by lighting and acoustical control.

Noise has also been shown to be detrimental to learning (Heschong & Oaks, 2003; Hygge, 2003). In a study of 1,358 children between 12 and 14 years old, Hygge (2003) performed ten different noise experiments in classrooms and later tested for recall and recognition. The data revealed that recall is vulnerable to noise effects, particularly aircraft and road traffic noise. Unfortunately, poor ventilation, low air quality, thermal comfort, and acoustic conditions seem hopelessly entwined. When a teacher seeks to rectify one, they may exacerbate

another; opening a window to ventilate a hot room may introduce polluted urban air and traffic noise (Heschong & Oaks, 2003), offering students little respite from the environmental stimuli that deter their learning.

The relationship between the physical environment and learning in this sense has most frequently been measured by student performance on standardized tests. Though contested and problematic, this measure of achievement and learning is one that is greatly valued in the contemporary school system, especially when determining funding. A straightforward quantitative study of Washington DC Public Schools compared the Facility Condition Index (FCI) with student performance on the Stanford 9 achievement test in 2005. After stratifying the schools by socioeconomic status (based on Title 1 eligibility), disparities in achievement persisted in both categories, with students in “acceptable” schools performing at a higher level in both reading and math (Taylor, 2009). Another study in Florida sought to study the impact of facilities using a causal-comparative approach. Lumpkin (2013) measured the passing rate of fourth, eighth, ninth, and tenth grade students on the Florida Comprehensive Assessment Test (FCAT) before and after their transition into a new facility. Lumpkin (2013) found that students moving from an old school building into a newer facility improved their mean scores on both mathematics and reading; this suggests a direct relationship between student academic achievement and their school environment.

Studies of school facilities and their impact on student learning are not always so consistent. Picus, Marion, Calvo and Glenn (2005) asserted that there is “essentially no relationship” (p. 88) between higher quality buildings and student performance in Wyoming. However, this study is not likely to be representative of the high-need, low-income urban districts discussed in this paper. Many of these districts have a high percentage of schools

deemed inadequate and in need of immediate repairs. However, only 7.1 percent of schools studied by Picus et al. (2005) were considered in need of immediate attention or repairs. Thus, this article does not necessarily undermine the need for clean, safe, adequate facilities that are conducive to learning because it is representative of a limited sample that does not represent the full scope of disrepair experienced by urban, low-income districts.

Lewis (2001) examined 139 K-12 Milwaukee public schools in order to determine the impact of facility conditions on test scores, compared to other factors such as socioeconomic status, family background, and race/ethnicity. Using student performance on the Wisconsin Student Assessment System Mathematics, Science, Language, and Social Studies tests of fourth, eighth, and tenth graders in 1996, 1997, and 1998, Lewis (2001) found facility condition to be the strongest predictor of performance; facility quality accounted for about 10-15% of variance in performance across schools when all other variables were statistically controlled. After acknowledging the prominence of family background and school attachment (as reflected in attendance and other forms) in the history of educational research, Lewis (2001) concludes, “it is somewhat surprising, therefore, that...measures of school facilities explained as much of the differences in test performance across schools as indicators of family backgrounds and school attachment” (p. 10).

However, these studies have taken a very limited, approach to student learning and the attempt by Lewis (2001) to disentangle family background and school attachment from facility quality is somewhat misguided. Quantitative studies comparing facility measures with test scores may capture an aspect of their interaction through cognitive load theory, but it misses the complex role of place-identity theory and sociospatial relations. Echoing Dewey, Taylor (2009) stated, “If it is accepted that self-worth and educational worth are knowledge, it can be proposed



that a student is gaining information about these concepts daily through the quality of his or her educational environment” (p. 22). This learning of self-worth and educational worth cannot be explained by cognitive load theory. In order to understand this next level of education, we shift to place-identity theory.

### **Space and Identity**

Place-identity theory asserts that the settings of home, school, and neighborhood dominate the physical world of a child and are therefore impactful on their development of self-identity, particularly one’s understanding of social roles (Proshansky et al., 1983). The building as “third teacher” expands upon this concept and brings attention to the ways in which students are aware of and internalize the symbolic messages of their built environment. Aligning the building with the roles of teachers and curriculum suggests that education is most successful when these three components align and enforce one another; school design and maintenance reflect the priorities and values of a school and community from which meaning will be read by its users (Nicholson, 2012).

The concept of place-identity can be used to understand the way in which perceptions about self, community, and the quality of education can be made from the condition of the school building. A poorly maintained school is mirrored in student perceptions that their school is unable to provide the resources necessary to achieve academic success. Thus, students perceive a link between building quality and one’s own potential to achieve, expectations of behavioral conduct, and self-worth (Marcouyeux & Fleury-Bahi, 2011; Maxwell & Schechtman, 2012).

One study collected data from 89 students throughout six non-selective secondary schools in London, focusing on students considered at risk of “social exclusion” or dropping out

from school. In this study, children made strong connections between poor physical environments and problematic behaviors of others, displaying the ways in which poor physical conditions become intimately bound with poor social conditions, crime, and feelings of unease in children. Children's awareness of the neglected physical environment of their schools inculcated self-conceptualizations of worthlessness, damaged learner identities, and inferior education opportunities (Hollingworth & Archer, 2010).

Poor and working-class youth of color are reading these conditions of their schools as evidence of their social disposability and evidence of public betrayal. These young women and men critically analyze social arrangements of class and race stratification and come to understand (but not accept) their "place" in the social hierarchy. Like children who learn to love in homes scarred by violence, these young women and men are being asked to learn in contexts of humiliation, betrayal and disrespect (Fine, Burns, Payne, & Torre, 2004, p. 2194).

However, one school in Hollingworth and Archer's (2010) study was distinctly different from the others. Hillside Park had substantial investments in the school's physical environment and thus garnered the reputation of a "good school" despite slightly lower test scores than a neighboring school. This superior physical state was reflected in both the students' and community's perspective on the school and education. Students at the well-maintained Hillside Park held more positive attitudes about their school, teachers, and their ability to learn (Hollingworth & Archer, 2010).

The decline in self-efficacy as an internalization of one's physical environment is salient when progressing between school stages. Elementary students are often blissfully unaware of superior conditions elsewhere. As they age, awareness of inferior spaces is coupled with a hopefulness that conditions would improve if only someone "knew." Come high school, students have "a deep, well-articulated, painfully sophisticated analysis suggesting that 'no one' cares" (Fine et al., 2004).

This sentiment is echoed in a qualitative study<sup>1</sup> that surveyed, interviewed, and observed fourteen middle-school and twenty-five high school students enrolled in the Ohio public school district's Summer School session. Analysis of the data revealed that the students in the study perceived a connection between the condition of their school and their personal levels of achievement, motivation, and conduct. Furthermore, within this study, 53% of the respondents agreed that, "the condition of their educational facility was directly connected to the value the school district placed upon their education and safety" (Edwards, 2006, p. 139). A high-schooler interviewed in this study acknowledged,

When you look at your school, you see how it represents you and your classmates. You know, you're going to want to do the same exact job that the school is doing. You're going to look at the school and be like, 'Well look what they're giving us. What do we want to give back to them?' We're not going to want to give them 100% (quoted in Edwards, 2006, p. 112).

Thus, as articulated by Fine (2004), students are well-aware of and able to articulate the ways in which the neglected space of their school seems to reflect the neglect of their well-being and education within society and policy.

### **Space and School Climate**

The impact of school design and facility quality on student learning and achievement is difficult to measure and often obscured through the mediating effect of other components that can most readily be grouped into school climate. Student behavior, absenteeism, teacher attitude and retention, and community and parent engagement have all been shown to correlate with school

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<sup>1</sup> It is worth noting that very few of the existing studies regarding physical environment and student learning are qualitative in nature. A shortcoming in the research that I will further discuss later.

design and facility quality (Branham, 2004; Durán-Narucki, 2008; Fram & Dickmann, 2012; Horng, 2009; Kumar, O'Malley, & Johnston, 2008; Roberts, Edgerton, & Peter, 2008; M. Schneider, 2003).

*School Facilities and Student Behavioral Problems.*

Cognitive load theory as discussed earlier points to the impact of external noise on learning capacity. However, this stress of environmental stimuli is not limited to merely working memory. Drawing on a plethora of literature connecting crowding, temperature, and noise to heightened aggression, Kuo and Sullivan (2001) consider this phenomena as a product of mental fatigue and its draining influence on cognitive processing. Prior to Kuo and Sullivan's paper, Dodge and Crick (1990) proposed a series of steps in information and cognitive processing as the basis for a child's behavioral response to external social stimuli. Each of these steps can be either reflexive and effortful or reactive and effortless, the latter being more likely to exacerbate already problematic social situations by generating "conflict-escalating behavior" (p. 546).

Combining Dodge and Crick's observations of behavioral response processing in children and the impact of mental fatigue on cognitive processing suggests three ways in which school settings can contribute to aggressive behavior. First, "deficits in effortful processing are likely to manifest in inattentiveness" (p. 546) and hyperactivity which have been linked to aggression in young children and adolescents (Kuo & Sullivan, 2001). Second, mental fatigue causes heightened irritability which has a well-established connection to aggression; though it may seem common sense, Kuo and Sullivan (2001) cite over eight studies regarding this phenomenon. And, finally, mental fatigue decreases control over impulses which also has a well-established connection with increased aggression and violent behavior. Thus, because "impairments in

effortful cognitive processing, irritability, and impulsively” have all been implicated in aggression, Kuo and Sullivan conclude, “to the extent that mental fatigue combines these three factors, mental fatigue seems likely to contribute substantially to aggression” (2001, p. 547)

Studies seem to support these processes in schools. A Canadian study surveyed principals at 1,100 schools across the country about both facility conditions and 24 different indicators of school climate and the learning environment. The evidence showed substantial differences in all factors between schools with top-ranked and bottom-ranked facilities. Principals at bottom-ranked facilities reported higher rates of disruption by students; 35% of principals at bottom-ranked facilities claimed “a lot” versus 23.3% from top-ranked, similarly, no principals at bottom-ranked facilities selected “not at all” compared to 19.7% at top-ranked (Roberts et al., 2008). Other studies have uncovered associations between negative physical environments and problem behaviors including increased substance abuse (Kumar et al., 2008) and bullying (Fram & Dickmann, 2012).

Lacking understanding of the complexity of the relationship between physical space and its occupants, many districts and policy makers have sought to curb behavioral problems and violence through the installation of various physical monitorial controls, namely cameras, metal-detectors, and security guards. In 2006, approximately 10% of middle and senior high schools used metal detectors including the Cleveland public school district that spent an estimated \$3.7 million to install metal detectors, X-ray scanners, and security guards at their 111 public schools (Hankin, Hertz, & Simon, 2011). These implementations often came at a great expense in the same urban, low-income, predominantly minority districts already afflicted by maintenance backlog and inadequate facilities. Instead of promoting security and positive behavior, the presence of these metal detectors was associated with lower student perception of safety that

could lead to “heightened feelings of vulnerability and aggression” (Hankin et al., 2011, p. 104) and “higher levels of school disorder” (Hankin et al., 2011, p. 105). Another study using statistical and survey data from nationally representative sources concluded that there was no evidence of any beneficial impact on academic outcomes. Instead, the system intending to decrease problematic behavior in order promote academic success had the opposite effect; visible security measures adversely impacted students’ academic performance, attendance, and postsecondary aspirations (Tanner-Smith & Fisher, 2016). It appears that visible security measures undermine education by promoting a culture of fear and criminalization (Mayer & Leone, 1999) that “may elicit negative expectancy or self-fulfilling prophecy effects among students, such that students labeled as criminal or suspect adjust their behaviors to align with those labels attributed to them” (Tanner-Smith & Fisher, 2016, p. 196). An understanding of place-identity theory quickly reveals why; the physical presence of security measures signal expectations of misbehavior which may become internalized into the identity of students which then act based upon perceived expectation.

This criminalization of students inherent in the presence of metal detectors does not go unnoticed by students and faculty. In April of 2019, protesters shut down a Philadelphia School District board meeting after they voted 7-2 in favor of requiring metal detectors and X-ray machines in every district high school (Murphy & Wolfman-Arent, 2019). Philadelphia currently holds large budget deficits, including \$5 billion in backlogged repair costs as of 2017 (Graham, 2017). Based upon the evidence presented here, it is unlikely that the installation of metal detectors and other security measures would be an efficient use of funds.

*School Facilities and Absenteeism.*

In varying studies, absenteeism has been found to correlate with school facility quality. Students that are chronically absent from class receive less academic instruction than their peers, placing them at a disadvantage. A study of New York City public schools found school facility condition to be a predictor of attendance which acted as a mediating variable on English Language and Math scores (Durán-Narucki, 2008). Additional studies found associations between school facility conditions and student absenteeism in Upstate New York (Simons, Hwang, Fitzgerald, Kielb, & Lin, 2010), Baltimore (Berman et al., 2018), Houston (Branham, 2004), Washington DC (Taylor, 2009) and elsewhere (Kumar et al., 2008; Maxwell & Schechtman, 2012). In Braham's study, an additional correlation was found between the need for structural repairs and dropout rates, suggesting that such schools would experience an annual increase of 10-13 dropouts per 1,000 students (Branham, 2004).

Duran-Narucki articulated three levels on which this interaction occurs: (1) direct impediment, (2) social interaction, and (3) prescribed meaning (2008). Direct impediment refers to the way in which poor physical conditions disrupt learning. This could occur through the experience of discomfort; for example, poor bathroom facilities may deter students from using them, causing them to instead endure discomfort that distracts them from learning (by draining cognitive resources). Students may be discouraged to attend a school in which such repeated discomforts must be endured. Additionally, poor facilities may cause poor air quality that

impacts student health. This can lead to increased absenteeism for students with untreated asthma or other medical conditions (L. Lewis et al., 2000; Mark Schneider, 2002).<sup>2</sup>

The second level on which the school facilities interact with absenteeism is social interaction. Poorer facilities may lead to frustrated teachers, administration, and fellow students creating a hostile and unwelcoming environment that deters a student from attending (C. L. Uline, Wolsey, Tschannen-Moran, & Lin, 2010). Other ways in which building facilities interact with teacher attitude will be further addressed later.

Finally, the third level on which school facilities interact with absenteeism is through prescribed meaning or “environmental meaning.” Duran-Narucki notes that school facilities are “conditions created in social and cultural contexts that produce collective and individual meaning” (2008, p. 284). Therefore, the state of school facilities convey meaning to its users regarding the value of their well-being and education in a larger social framework. Thus, place-identity provides an explanation for the association between absenteeism and inadequate school facilities; schools in a state of disrepair convey a sense of unworthiness or abandonment which may be normalized and internalized by students. The perception displayed by poor facilities devalues education causing students to feel helpless and discouraged to attend (Branham, 2004). Echoing this sentiment, an investigation of school attendance and influencing factors in five Maryland counties found that, regardless of individual, family, and community factors, “most children will attend school if it is a safe place that welcomes them rather than a place where a

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<sup>2</sup> Inadequate school facilities, such as poorly maintained or missing recreational spaces, have also been found to be associated with increased sedentary behavior among students of all ages (Crosatti et al., 2016; Morton, Atkin, Corder, Suhrcke, & Sluijs, 2016; Peden, Jones, Costa, Ellis, & Okely, 2017). Furthermore, the design and maintenance of facilities, including but not limited to dining spaces, can influence dietary choices (Frerichs et al., 2015). Thus school design can have a role to play in fighting childhood obesity (Gorman et al., 2007) and other health concerns that disproportionately impact low-income, urban communities (N. R. Smith et al., 2015).



child's sense of rejection, low self-esteem, or problems from poverty, exclusion, and despair are reinforced” (Bryant, Shdaimah, Sander, & Cornelius, 2013, p. 850).

### *School Facilities and Teacher Attitude and Retention*

Multiple studies have found connections between the quality of school facilities and teacher quality, which thereby impacts school climate and student learning. This occurs on two levels. The first is the teacher’s ability to practice effectively. The second is teacher retention; teachers are less likely to remain at a school or even within the teaching profession if they teach at a facility they perceive as poor or inadequate.

The quality of teaching declines for teachers forced to adapt to inadequate facilities. In a study of teachers’ perceptions of their classroom and school facilities in comparison to their experience of satisfaction and success, 43.8% of teachers in unsatisfactory buildings believed their classroom was a hinderance to their ability to teach effectively. Furthermore, over one third of respondents in unsatisfactory facilities believed their school negatively impacted the health of themselves and their students (Earthman & Lemasters, 2009).

Furthermore, Canadian study of 1,100 schools found that lower ranked facilities correlated with decreased teacher moral and lowered expectations for students (Roberts et al., 2008). In a study of 1,134 teachers throughout 80 schools in Virginia, a similar correlation between poor facilities and decreased teacher enthusiasm for their jobs was evident (C. Uline & Tschannen-Moran, 2008). The need to endure and compensate for poor facilities causes frustration among teachers which negatively impacts both collective efficacy and student outcomes (Plank, Bradshaw, & Young, 2009; C. L. Uline et al., 2010).

Cognitive load theory and place-identity theory illuminate the reason for these pedagogical difficulties in schools. Teachers attempting to mitigate the cognitive effects of one physical factor may exacerbate another; opening a window to cool a room may introduce harmful levels of noise and pollution (Heschong & Oaks, 2003). Furthermore, place-identity seems to underline the role of space in shaping the expectations that teachers hold of their students, as well as their own capability to perform.

Unlike students, teachers have the ability enter, leave, and move between schools. This places them within a wider context that can best be considered using sociospatial relations. The physical condition of one school does not exist in isolation from others. Schools exist in hierarchical relationships of power and access (M. Baker & Foote, 2006). This hierarchy influences the decisions of teachers to stay or leave not only their school, but their profession (Buckley, Schneider, & Shang, 2004; Horng, 2009; M. Schneider, 2003). Thus, as teachers seek opportunities with more supportive environments, teacher quality can become consolidated within schools boasting well-maintained modern facilities.

Eileen Horng conducted a study of 531 full-time classroom teachers in a Southern California school district (2009). In her study, she asked teachers to rate and trade-off various workplace characteristics including student demographics, class size, administrative support, and school facilities. Previous studies had suggested that teachers avoid schools with large populations of minority, low-income, and low-performing students. As a variety of studies cited within this paper have continually demonstrated, poor school facilities impact student performance and disproportionately affect urban, low-SES communities. Horng sought to disentangle these components. The results suggested that the quality of facilities is the strongest influencer on a teacher's decision about where to teach. In fact, school facilities proved more

important than salary and more than twice as important as the student demographic variables of socioeconomic status, performance, and ethnicity (Horng, 2009). It was not the students deterring teachers from working in hard-to-staff schools, but rather the facility conditions.

An earlier study by Mark Schneider analyzed the connection between facility conditions and teacher satisfaction in Washington D.C. and Chicago (2003). Nearly 60% of teachers in DC and over 30% in Chicago reported dissatisfaction with facilities. Further, over 40% of DC teachers and over 20% of Chicago teachers reported that facilities were inadequate for effective teaching and learning. Among the most salient problems were school and classroom size, inadequacy of specialty classrooms like science labs and art rooms, poor air quality, and high noise levels, all of which have been demonstrated to substantially impact student performance in other studies. Among those to rank the facility quality at a “C” or lower, between 45-50% expressed a plan to change schools while nearly 30% expressed a plan to leave teaching altogether. These numbers continue to escalate among teachers who experienced adverse health effects (M. Schneider, 2003). Another report concluded that the benefits of facility improvement for teacher retention “can be equal to or even greater than those from pay increases. Furthermore, a major facilities improvement is likely to be a one-time expense, last for many years, and have supplemental sources of state or federal funding available” (Buckley et al., 2004).

Another study of 63,772 teachers across North Carolina found that 19% of respondents ranked “Facilities and Resources” as the domain that most impacted their willingness or unwillingness to remain at their current school (ranking third behind leadership and empowerment). However, in considering the connection between facilities and retention more closely, of the respondents that selected “Facilities and Resources” as the top domain impacting their decision, 35% planned to leave their school, district, or the profession altogether; when

looking only at low-wealth districts, this percentage increased to 38% (Stallings, 2008).

However, teachers are not the only individuals with ability move between schools; (some) parents also have this power.

### *School Facilities and Outsider Perception*

As noted by Baker and Foote, “the American urban school in many ways embodies the special and economic transitions from an industrial city and welfare state in the 1970s, to an informational city and competitive state in the 1980s and 1990s” (2006). In this later era of competition to which the marketplace and school choice have become central components, the perception of a school has become critical to its survival. And, regardless of other performative measurements, inadequate and facilities will negatively impact parents and families “shopping” for schools. In Philadelphia, the “shabbiness” of public schools caused parents to say, “I don’t know what’s going on there. I don’t care what’s going on there. I can’t get past what it looks like” (Cucchiara, 2013, p. 57). Such negative perceptions (among not only the middle- and upper-classes, but the lower-classes as well) led parents to seek out alternatives, sending their children to private, independent institutions or charter schools leading to further stratification.

### **SCHOOL FACILITIES AND THE EXACERBATION OF INEQUALITY**

Unequal investment in education is often justified through claims of community deficiency or a “poverty of aspiration.” However, such deficit ideologies are flawed and lack an understanding of the nuanced impact that environment has on individuals (Fox, 2016; Jimenez-Castellanos, 2012; Rodriguez, 2007). Children maintain an awareness of the neglected physical environment of their school and, through its internalization and recognition of their status as second-class

citizens, become disengaged. The perception of one's ability to achieve is not the only thing impacted. Built environmental factors impact student learning progress by 25%. "Comparing the "worst" and "best" classrooms...[environmental] factors alone were found to have an impact that equates to the typical progress of a pupil over one year" (Barrett, Davies, Zhang, & Barrett, 2015).

The underinvestment in and shortcomings of facilities impact the lives of students and teachers daily. Though student learning and identity is abstract, headlines in the media point to the urgency of improving school facilities. In 2005, a Philadelphia elementary school had to delay opening for the school year when it was discovered to be structurally unsound. The emergency repairs needed were simply "part of an ongoing problem in the city school system, where many of the 200-plus buildings are old and in poor condition" (Graham, 2015). In 2016, Detroit teachers protested the school system's dilapidated facilities by staging a "sickout," forcing 85 of approximately 100 public schools to close. An article covering the incident was titled "Rats, roaches, mold," highlighting just some of the conditions teachers and students were forced to endure (Brown, 2016). Beyond the complex argument presented above, here a simpler one can be made to underscore the dire need for investing in school facilities. When schools are structurally unsound, the health and safety of everyone inside is at risk. When schools are closed, students aren't learning.

As of 2018, Baltimore public schools faced a \$3 billion maintenance backlog, more than double their annual operating budget (Richman, 2018). In 2017, the Philadelphia School District reported nearly \$5 billion in backlogged repair costs (Graham, 2017) and Rhode Island reported \$2.2 billion (McGowan, 2017). These estimates typically represent only the essentials, functional in nature: heating, plumbing, aging roofs, and broken elevators.

Poor educational facilities disproportionately affect low-SES and minority students. While 10% of public schools report unsatisfactory conditions; 27% of low-SES public schools report unsatisfactory conditions (Maxwell, 2016). In the age of accountability, the failure to perform on tests means valuable resources are withheld from schools suffering from deteriorating infrastructure, which further impedes their ability to perform in the future. Hollingworth & Archer (2010) consider this phenomena in terms of symbolic capital in which poor physical space is marked by a perceived 'lack of pride' which is further pathologized into moral bankruptcy. Within this framework, underperforming and failing schools are deemed unworthy of the very resources necessary to uplift them.

### **CONCLUSIONS & LIMITATIONS**

The maintenance backlog of urban, low-income public schools is a signal of a lack of priority in budgeting and school reform. At its most innocent, this reveals a lack of the understanding about the importance of space. At its most malicious, deteriorating facilities can be read as a reflection of society's lack of policy and priority for the education and well-being of poor, urban students (Carnegie Foundation for the Advancement of Teaching, 1988).

It is not the purpose of this paper to argue that school facilities are the only component deserving of investment; rather, it is to highlight that space should not be ignored. Too often facilities are a mere backdrop to reform, its influence rendered invisible. However, as demonstrated, school building quality has a substantial impact on student performance, self-identity, and school climate. Therefore, it should be considered an important component of school reform.

The concrete nature of facilities makes it a visible, sustainable, impactful point of intervention that would enhance and support the effectiveness of other complex pedagogical and social reforms. However, a shortcoming of much of this research is its quantitative nature, which fails to capture to full scale of impact and influence that space has on student development and identity. More qualitative studies could bolster the argument for space by providing data that is inaccessible quantitatively, or by providing useful contextualization for deciphering influences and impacts that appear tightly wound together.

### **RECOMMENDATIONS**

The disparity documented in school facility conditions and its impact on educational inequality support two primary policies recommendations: (1) acknowledgement of and support for schools suffering from disrepair in federal and state policy and (2) greater federal support for school construction funding.

When No Child Left Behind was enacted, it sought to boost academic performance and close the achievement gap. However, despite increasing expectations, no relief was provided for districts suffering from crumbling infrastructure. Filardo laments, “while the law acknowledges the importance of teachers, governance, curriculum and standards, it is stunningly silent on educational facilities” (2006, p. 30). Instead, any policy that seeks to close the achievement gap must also seek to close the school facility gap.

While state sources vary (with some offering no funding), less than 0.2% of funding for school construction and maintenance comes from federal sources (Filardo, 2016). Therefore, the ability to finance facility improvement is heavily tied to local resources, advantaging those with greater community wealth. Furthermore, some states offer funding for new construction and

capital projects through reimbursements; meaning, districts must possess funds upfront, again advantaging more affluent districts. Instead, federal and state governments should fund capital projects and construction similar to operating budgets—at a higher rate and with consideration for the level of need.

I initially began this paper as an effort to uncover the ways in which good school design could enhance development and learning. However, I was confronted instead with the seemingly insurmountable disrepair facing low-income, urban schools. What does good school design matter if the basics aren't met? Thus, attaining adequacy in school facilities is a priority. But space can offer so much more. Beyond adequacy school space should aspire to three ascending goals: (1) functionality and pedagogical alignment, (2) appropriate aesthetics, and (3) authorship. Each of these aspirations holds its own significance for education.

Functionality and pedagogical alignment are essential for effective teaching and delivery of the curriculum. It should also minimize physical stimuli like noise in order to support student cognition. When we move beyond adequacy, studies emphasize the importance of pedagogical alignment between space and curriculum (Imms & Byers, 2017; Sigurðardóttir & Hjartarson, 2015; van Merriënboer, McKenney, Cullinan, & Heuer, 2017). However, these studies are still narrowly focused on the instruction and reception of academic subjects like language and mathematics. Beyond this alignment is another of greater importance—an alignment of the quality of space with the value of education and the students housed within it. We must ask ourselves, do the school environments we build reflect neglect or care? (Uhrmacher, 2004)

Here lie goals two and three: aesthetics and authorship. Schools should provide an aesthetic that signals the value and dignity of education. But we shouldn't stop here. As outlined previously, existing within a poorly maintained physical space can have a detrimental impact on



one's sense of self-worth and efficacy. However, studies show that even modest levels of personalization in a space can increase children's self-esteem (Maxwell & Chmielewski, 2008). Built learning environments should invite authorship and participation from their users. A variety of studies have analyzed the ways in which participatory design has enhanced educational spaces and student learning (Könings, Bovill, & Woolner, 2017; Könings & McKenney, 2017; Nair, 2014; Newman & Thomas, 2008; R. C. Smith & Iversen, 2018; van Merriënboer et al., 2017; Pam Woolner, Hall, Wall, & Dennison, 2007; Pamela Woolner, McCarter, Wall, & Higgins, 2012) by inviting authorship from its users—students, teachers, and the community. However, these studies exist predominantly in communities of affluence, with one exception (Stovall, 2007). Space can be a powerful tool for transformation; therefore, the conversation about space shouldn't stop at adequacy. Innovative approaches like participatory design should be studied and considered for the role they could play in the pursuit of educational equality.

The physical environment is not a static backdrop to learning. It sends children messages. It sends them messages about not only the value and importance of education, but messages about the way they are valued by society. In considering the way we invest in and maintain the space of our schools, particularly within the poorest and most vulnerable communities, we must also consider what messages we want to send.

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