

# **More Than Me! Sustainable Schoolyard Design**

by

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## **Abstract**

This paper examines how schoolyard design in low resource communities can create a natural, restorative environment to not only foster learning, but also trauma recovery. Research has shown that nature can provide much needed cognitive restoration for children who have limited access to nature. However, there are no existing applications of sustainable schoolyard design in developing country contexts.

We provide a case study of our schoolyard redesign project with More Than Me Academy (MTM), a girl's school in Monrovia, Liberia. MTM aims "to make sure education and opportunity, not exploitation and poverty, define the lives of the most vulnerable girls from the West Point Slum of Liberia." We used human centered design methods to uncover the cognitive and curricular needs of the students, staff, and community. Through this process, we discovered that the school needed enhanced caretaking (including safety, hygiene, and responsibility), opportunities for play and expression, restoration, and community. While the project was interrupted by the 2014 Ebola outbreak in Liberia, we offer a guideline for how other multidisciplinary groups can approach redesigning a sustainable schoolyard to increase cognitive restoration in low resource contexts.

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## Introduction

Education – particularly girl’s education – has long been held as the cornerstone of poverty reduction and sustainability initiatives. In 2000, the United Nations Secretary-General launched the United Nations Girls Education Initiative in order to promote gender equality, and thereby alleviate poverty (United Nations, 2008). Girls’ education is a critical strategy for fighting poverty because educated women help foster economic growth and stability (Kristof, Nicholas; WuDunn, 2009). From a sustainability perspective, girls’ education reduces the population growth rate, also a critical strategy for reducing the human impact on the planet (United Nations Population Fund, 2012).

Strategies for increasing girls’ education are multitudinous and span diverse disciplines from economics to public health to public policy (Banerjee & Duflo, 2012; Karlan & Appel, 2012). However, in our literature review, we discovered that there is no documentation of the role of environmental psychology in poverty alleviation – particularly as it relates to girls’ education.

In this paper, we provide a case study on how environmental psychology and human centered design (HCD) methods can be used to improve the school environment, and thus, the learning capacity of girls in an underprivileged community. We worked with More Than Me More Than Me! Academy (MTM), a girls’ school in the heart of downtown Monrovia. MTM enrolls girls between the ages of 8-18 from West Point, a slum of approximately 70,000 individuals in Monrovia (IRIN, 2009). Founded by Katie Meyler, MTM aims “to make sure education and opportunity, not exploitation and poverty, define the lives of the most vulnerable girls from the West Point Slum of Liberia.” (More Than Me Academy, 2015).

When MTM kicked off its school year in September 2013, the school did not have sufficient time or funds to invest in the space around the school, and thus the administrators poured gravel on the schoolyard to cover the pre-existing trash and debris in the school lot. MTM reached out to the Sustainability Without Borders group at the University of Michigan School of Natural Resources and Environment to help redesign their schoolyard to support the school in its objectives to help the students overcome trauma, build resilience and determine their futures for themselves.

Children in poverty experience significant psychological stressors and challenges due to a lack of food, water, shelter, rest, safety, or security. In turn, humans can restore their cognitive functioning when they engage with nature (Berman, Jonides, & Kaplan, 2008a). Schools in high-income contexts have taken advantage of nature as a critical asset for improving the cognitive functioning of students (Danks, 2010). However, many schools in low-income contexts – particularly in developing countries – have not integrated nature into their school environment, despite the fact that children in these contexts could significantly benefit from nature’s restorative power.

In this case study, we demonstrate how designers can use HCD methods to understand the needs of a school community, as input for designing an engaging and restorative

natural schoolyard in a low-income context. HCD prioritizes empathy and understanding in developing design solutions (IDEO.org, n.d.). We spent a week at MTM collecting observations about the day-to-day behavior and activities of the MTM community.

We chose to use HCD methods because children often struggle to articulate their thoughts and needs – particularly when interacting with perceived authority figures (Baek & Lee, 2008). These challenges are particularly acute in Liberia, where students are not well prepared to articulate or communicate effectively because of the weak education system.

Though our project was interrupted by the 2014 Ebola crisis, we discovered that HCD was an effective process for observing the tacit needs of the MTM community. In particular, we performed four workshops with the students, each of which helped identify the needs, interests and priorities of the MTM students. Moreover, we found that restoration and interaction with nature was a consistent theme in these workshops.

In conclusion, we encourage other groups to use this case study as a starting point for similar design projects in low resource contexts. While this study is primarily qualitative in nature, we recommend that environmental psychology studies be replicated in developing countries to better understand the cognitive benefits nature might provide in these contexts.

## **Environmental Psychology and Preferred Environments**

Environmental psychology explores the dynamics between humans and their surrounding environments. Through this field, researchers have found that there are deep cognitive benefits gained from natural environments. In particular, nature can help humans restore their directed attention, which is the capacity to focus on a given mental activity (Berman, Jonides, & Kaplan, 2008b).

Students require sufficient directed attention in order to learn effectively. Students with low directed attention do not want to be in the presence of others nor help one another (S. Kaplan, 1995). Children raised in crowded residential areas exhibit greater problems with behavior, challenges in school and poor relationships with their parents. In particular, girls tend to feel helpless in response to the psychologically stressful, overcrowded environments. In these environments, girls have lower expectations for themselves and are more likely to feel defeated by failure (Evans, Lepore, Shejwal, & Palsane, 1998). Children in crowded residential areas are also exposed to psychosomatic illnesses (e.g., headaches, dizziness, shortness of breath), along with poor cognitive control and directed attention fatigue (Wells, 2000). To this end, students must have access to opportunities to restore their directed attention in order to stay cognitively alert.

Parks and wilderness areas are often idealized for their capacity to restore directed attention. Yet humans can also restore their directed attention in urban environments. Studies have shown that nature in urban environments can offer meaningful restoration. A study performed in the inner city of Chicago found that residents who lived in housing

close to nature (e.g., trees, grass) were likely to exhibit far less aggression and violence than those who did not have access to nature (Kuo & Sullivan, 2001). Another study performed in Chicago showed that cognitive functioning improved when seventeen children were moved from an environment with little access to nature to one with significant access to nature (Wells, 2000). In fact, studies have shown that individuals with a window view of nature have higher well-being than individuals without a view of nature (R. Kaplan, 2001). All of these studies demonstrate that the cognitive benefits of nature need not be extravagant transformations of space. That is, humans do not need direct access to a forest or other natural landscape to benefit from its restoration effects. These findings are important for schoolyard redesign projects – particularly in low resource contexts – because they demonstrate that thoughtful design solutions can yield meaningful cognitive benefits to children.

Integrating nature into schoolyard design is a well-established concept in developed countries where children have access to natural design features, such as school gardens, story circles, nature trails and playgrounds (Danks, 2010). Children in industrializing societies spend less time playing outside, thus schoolyards may be their only contact they have with nature (Newman & Dale, 2009).

Most research related to children and schoolyard design is centered in the United States, Finland and Australia. Andrea Faber Taylor, Frances Kuo, and William Sullivan have found that children with Attention Deficit Disorder experience fewer symptoms after activities in green settings (Faber Taylor, Kuo, & Sullivan, 2001). From this research, Faber Taylor, Kuo and Sullivan encourage incorporating vegetation into all places where children live, learn and play. Similarly, Kathleen Bagot, Felicity Catherine Louise Allen, and Samia Toukhsati studied the perceived restorativeness of a variety of playground characteristics, including nature, size, play areas, play equipment, and ratio of playground to total grounds. Across these variables, Bagot, Allen and Toukhsati found that vegetation volume was the only significant variable in increasing perceived restorativeness (Bagot, Catherine, Allen, & Toukhsati, 2015). In addition to academic research, *Asphalts to Ecosystems: Design Ideas for Schoolyard Transformations* has dozens of examples of sustainable schoolyards in the US, Europe and Japan (Danks, 2010).

Natural schoolyards can also benefit teachers. Gowri Betrabet Gulwadi analyzed how teachers in Chicago found opportunities to restore their directed attention. She discovered that teachers tend to seek out nature and proposes that more schools incorporate natural space where teachers can restore directed attention fatigue (Gulwadi, 2006).

Despite the thorough documentation of green schoolyards, there are no studies exploring how natural schoolyards can benefit the cognitive functioning of children in developing countries, where resources are even more limited. While environmental psychology theories are likely generalizable globally, sustainable development professionals would benefit from specific assessment of the cognitive benefits of natural schoolyards to children in developing countries. Natural design features often very affordable solutions for schools. If it were demonstrated that natural design features meaningfully increased

education outcomes in developing countries, sustainable development professionals would have an affordable solution to the current problem of underperforming schools. With this in mind, this paper offers the groundwork for this focus area.

## **Context in Liberia**

Liberia was subject to a devastating civil war for most of the 1990s, where most of the country's infrastructure, including roads, electricity generation, water access and telecommunications, were destroyed. Ten years later, only a small portion of population has access to electricity or clean water. Since 2005, when Liberia held its first post-war democratic elections, the country has been recovering, yet as of 2010, 64% of the country lives in poverty (Millennium Development Goals, 2010).

Liberia, as in many developing countries, has a youth bulge, where most of the population is under the age of 30. In 2005, forty percent of registered Liberian voters were between the ages of 18 and 28 (Polgreen, 2005). While birth rates have declined from 3.4% in 1984 to 2.1% in 2008, Liberia continues to have a significant portion of its population under the age of 30 (Johnson-Sirleaf, 2008). Children bear the brunt of the fractured country. Many children only have one parent, or none at all, or are taken care of by relatives (grandparents, aunts, siblings, etc.) Child prostitution is an ongoing issue in Liberia and is especially prevalent in West Point (Kerppola & Johnson, 2014). MTM's mission to get girls off the street and give them access to an education directly touches on this issue. By giving these victims an opportunity for an education, the children may be able to escape prostitution and create better lives for themselves.

Liberia has instituted free compulsory primary education to ensure that financial hurdles do not prevent children from going to school. However, quality of education is a concern. Children struggle to overcome cognitive stressors from home to focus on their academics. Moreover, parents are unable to support children in their studies. The Liberian Civil War interrupted the education for an entire generation, who are now parents of elementary-aged children. Slightly above half of Liberian adults are literate (IMF, 2011). Along these lines, impoverished children often struggle to concentrate at home because they do not receive proper nutrition at home.

## **More Than Me Academy**

MTM has worked to transform the education outcomes for some of the most disadvantaged girls in Liberia. MTM started in 2007 as a program that offered scholarships for girls from West Point to go to school but realized that girls faced too many disruptions in the schools (e.g., travel, poor teaching quality, distractions from other students, etc.). By launching MTM as an independent school in September 2013, MTM hoped to better control the student experience. Looking to the future, MTM plans to relocate the school to the outskirts of Monrovia and create a boarding school to further improve the student experience (Kerppola & Johnson, 2014).

MTM developed several key interventions to create an effective learning environment. First, MTM increased the quality of teaching by assigning two teachers to each classroom: one Liberian and one American. Teachers trained in the United States help raise the standard of teaching, while having a Liberian teacher helps maintaining cultural relevancy in the classroom. In the future, MTM aims to train more Liberian and West African teachers, so that the girls have local role models.

MTM has stratified classrooms by academic performance and behavior, rather than age. Well-performing students can often be distracted by poor behavior in the classroom. MTM has devised six classrooms, where students are assigned based on academic and behavioral performance. The six classrooms were named Courage, Vision, Achieve, \_\_\_\_\_, Excellent, and Power, with Courage being the lowest level class and Power being the highest.

MTM serves its students breakfast and lunch every day. Before MTM, children in West Point were lucky to have one meal a day. These two meals not only encourage attendance, but also improve attention in the classroom through increased nutrition and associated health benefits.

MTM also intervened by focusing on core academic skills that are lacking in the student's skillset. In its first year, MTM focused its curriculum on reading, writing and math in order to establish a strong foundation in these skills for each cohort. Students study these topics from 8am – 12pm. Students will continue with the same class and teacher year after year in order to develop a strong, supportive learning environment. In the coming years, MTM hopes to incorporate a more complete science and technology curriculum. In addition to the academic content, MTM students participate in a variety of extracurricular programming in the afternoon. Programming includes art, music, and yoga, along with history, literature and health education for the advanced classes. Extracurricular programming allows the students time for self-discovery and confidence building.

As described in the introduction, our project team was invited to help redesign the MTM schoolyard to help MTM students overcome trauma, build resilience and determine their futures for themselves. We established the following project goal as we embarked on this project: MTM needs a sustainably designed schoolyard that reduces operational costs and maximizes self-sufficiency, while at the same time creating an environment that offers students a learning experience that facilitates integrated, creative and life-long learning.

## **Methodology**

Human centered design (HCD) is a design approach that prioritizes human needs, capabilities and behavior (Norman, 2013). HCD is derived from participatory design, which includes users in the design process to incorporate their opinions and preferences (Yamauchi, 2012). HCD takes a step further, where designers try to uncover the tacit needs of the user, rather than their conscious preferences. HCD practitioners believe that humans are effective in identifying the symptoms of a problem, but they may or may not

be able to diagnose the actual cause of the problem. HCD tools and methods have been developed to uncover the cause of a particular design challenge.

As it relates to the MTM schoolyard project, we relied on HCD methods because we were engaging with a community, who did not have a definitive vision for how to use the schoolyard space. Moreover, most of the MTM students had never experienced play in a schoolyard. As such, they could not accurately describe their opinions or preferences about the prospective schoolyard. HCD practitioners have developed multiple frameworks for HCD tools and methods. We relied primarily on the methods from IDEO, Stanford d.school, *Designing for Growth*, and *101 Design Methods* (d.school, n.d.; IDEO.org, n.d.; Liedtka, 2011). For purposes of this paper, we will primarily use terminology from the *Human Centered Design Toolkit* developed by IDEO.org because this field guide offers rich resources for operating in a low resource context (IDEO.org, n.d.).

The HCD process begins with the *Hear* phase, where the designers examine the behaviors, interests, needs, and aspirations of the users. In this phase, designers gain empathy for users by observing, interviewing and, in our case, playing. Through these activities, designers are able to collect user stories, understand their worldview, and gain insight into the needs, barriers and constraints of the user group.

Next, the HCD process moves into the *Create* phase, where designers aim to synthesize the information collected during the Hear phase and translate into insights. In turn, the designer uses these insights as the launch pad for rapid prototyping, where designers aim to generate a broad range of ideas and concepts for the design challenge. Designers will test these designs with users to observe how they engage with the concept and receive feedback. Through this phase, designers should narrow down to a handful of workable solutions for the design.

Finally, the HCD process concludes with the *Deliver* phase, where designers aim to transform the design concepts into feasible and viable solutions that are implemented in the community. Our project was interrupted before we could reach this phase, so we will not elaborate on this process.

## **Data Collection and Analysis**

Prior to our field visit to Liberia, we conducted extensive cultural research to understand the context in which we would be working. We met with other project teams, who had worked in Liberia, to learn about their experiences. Additionally, we read a number of books and articles and watched several documentaries to understand the history of Liberia and how it has shaped Liberian culture and society. All in all, this background research established a baseline understanding of Liberia, which would help us communicate more effectively with the community members with whom we would be working. With any HCD project, cultural research is an important starting point to understand the values of the community where you will be working.

### *Hear Phase – Empathizing with the MTM Community*

We spent a week in Liberia immersed in the More Than Me context and community. While at MTM, we aimed to uncover the tacit needs of the staff, faculty, and students. Knowing that MTM's primary mission was to help students overcome trauma, build resilience and determine their futures for themselves, we sought to understand how the current space at MTM either helped or hindered this mission. To that end, we used *Hear* techniques to uncover how the students learn, play and rest at MTM.

By being immersed in the school experience for four days, we were able to observe the patterns and behaviors of the students and adults throughout the school day. As new visitors to Liberia and MTM, we were truly able to absorb the experience through a 'Beginner's Mindset', in that we were not biased in how we experienced the school and its space. In addition to our observations, we developed separate activities to engage with faculty and staff, and in turn, the students.

We interviewed fifteen faculty and staff to understand their perspectives and priorities on the MTM schoolyard. We interviewed both American and Liberian teachers, the principal, the nurse, the cook, the finance and operations team, the school social workers, the program coordinators, and the extracurricular (e.g., art and computer science) teachers. In these interviews, we asked about the role of each of interviewee at the school, how he or she interfaced with the students and his or her views on how the schoolyard should be used. We did not focus our conversations solely on the playground because we were probing for unidentified needs, which may not be elicited from a direct conversation about the schoolyard space.

We recognized that it would be challenging to elicit ideas and opinions from the students, knowing that their mental models for learning, playing and resting are limited to their experience in Liberia. Further, the MTM students struggled to articulate or communicate effectively because of the weak education system prior to MTM. For example, even the highest performing MTM students were reading at 4-5 grade levels behind a similar-aged average American student. Moreover, Liberian children in poor households are conditioned to defer to authority. In these contexts, drawing, modeling, and other forms of play can be particularly effective in revealing the thought patterns and cognitive needs of children (Baek & Lee, 2008).

As mentioned earlier, MTM has organized its students into six grades based on academic aptitude and behavior, rather than age. During our site visit, we organized workshops with four different classes in order to uncover the tacit needs of the students. In each of these workshops, we developed activities where the students could express their viewpoints and thoughts through creative, kid-like play. There is strong precedent for using drawing, prototyping and other crafting with children to elicit their interests and needs (Baek & Lee, 2008; Druin, Stewart, Proft, Bederson, & Hollan, 1997; Moraveji et al., 2007).

We held our first workshop with Courage class, which was one of the classes with very low reading and writing skills. We began the workshop by asking the girls to color in

coloring pages of necklaces to spark the girls' creativity. Then we asked each girl to draw what made them happy, in order to capture ideas about places that made them feel safe and content. However, we discovered that the students felt limited in this task – though we could not decipher whether they felt limited by their creative thinking, drawing skills or both. Comparable aged children in developed countries eagerly draw independently. Yet these students initially felt at a loss as to what to draw. Then they started the few items that they had been taught to draw, such as a house, an apple, a car, a cup, a tree, etc. Nearly all twenty students drew a variation of these items. In sum, we were unable to glean tacit needs from this group since we could not dissociate their true feelings about happiness from their duplicative drawings.

We held our second workshop with the Achieve class, which was a grade level higher than the Courage class. With this class, we embarked on an active, walking journey through the schoolyard, pausing at several key areas to ask the students what they thought of when they considered the space. A few of the spaces that were considered were a brightly colored mural near the front of the property, a small wooden stage on the east side of the school, and the back of the building near the kitchen. We found that the students were effective in describing their likes and dislikes of each area. For example, they explained that they loved the bright colors of the mural. In turn, they described that they did not like the sharp gravel throughout the schoolyard because it had garbage, glass shards and rusted metal mixed in. They were also able to evoke emotional thoughts and memories related to specific spaces. For example, on the wooden stage, they explained how they loved the space because that was the place where they spent time with friends. We also observed that the students grew restless and bored with the activity after about 30 minutes, indicating that after a long day of school their directed attention was significantly fatigued.

We held our third workshop with the Excellent class, the second highest performing class in terms of academics and behavior. In this workshop, we asked the students to prototype their ideal schoolyard. This activity, arguably the most successful of all of the workshops, was well received by the students and yielded interesting results. We brought a wide variety of crafting materials, including tissue paper, yarn, cardboard rings, colored glue, stickers, pipe cleaners, etc. The students were highly engaged throughout the workshop and developed unique models of their ideal schoolyard. We noted that many of the models had features that allowed the students to spend time with friends, though at the same time, many models had quiet spaces for reading and being alone. Nearly every model included trees or flowers. A handful of models suggested concepts for shade, whether with a tree or a tent. Lastly, there were many models with opportunities for play, whether a swing, seesaw, or kickball field. Overall, we found this activity to be very rich in discovering the tacit interests of the students.

We held our last workshop at MTM with the Power class, which is the most advanced class in both academics and behavior. We engaged the students in a camera study with the goal of capturing their daily activities. We gave a disposable camera to six pairs of students and asked them to take pictures of things that make them happy and record their reflections on those moments. Unfortunately, the students did not follow-through on their

note taking, so we were unable to capture their exact thoughts and ideas for each photo. However, we found that the students mostly took photos of people, including classmates, friends, family, and teachers. We interpreted these photos to demonstrate that close relationships were very meaningful to the students.

In addition to interviews and workshops, we spent our time at MTM observing the community to understand the day-to-day flow of activities, energy levels, and behaviors. We witnessed number of key themes from the time on site. First, we found that students were calm, well behaved in the mornings, yet over the course of the day, the students became increasingly rowdy and misbehaved. Moreover, we observed a domino effect in the students' behavior, where one student's outburst would lead to another's. Because the MTM building was rather small, teachers did not always have an extra room to put misbehaving girls to quell the distraction. Further, teachers would often become frustrated and escape into one of the rooms to restore themselves. All in all, the tight quarters at MTM escalated stress and irritability among both students and teachers throughout the day.

We observed that during lunchtime, the students preferred to play on the front porch of the school, a confined space of approximately 45 square yards. Students preferred to play in this area both because it was flat and shaded during lunch. We also saw that many of the smaller girls would like to hide behind doors or underneath stairs in order to find some quiet space.

Finally, we observed that hygiene and cleanliness were difficult to maintain at MTM. The school has a bathroom that has access to running water. However, the students were unaccustomed to the water from the faucets, and they would play with the water incessantly. As such, MTM turned off water access and now provides water in buckets from a rain catchment barrel.

In sum, we collected a wide range of qualitative data points from our observations, interviews and workshops. Through these diverse interactions, we could effectively understand the needs of the MTM community. Altogether, our ethnography yielded interesting insights not only for our project, but also for our methodology. We will explain these insights further in the Discussion section.

### *Create Phase – Synthesizing our Observations*

Next, we shifted to the *Create* phase, where we synthesized our on-site ethnography of the MTM community into insights that would establish design criteria for the MTM schoolyard. In this phase, we used a number of tools to distill our observations and interviews, including an empathy map, journey map, and personas.

An empathy map allows designers to disaggregate observations into four categories of what users think, feel, do or say. The empathy map highlights incongruences between these four categories, which in turn can identify design opportunities (d.school, n.d.). A journey map diagrams the user's process through an experience. We created journey

maps for both a teacher and a student in order to capture how the user is feeling when they enter the site, how their experiences might affect their perception of the site, and how they use the site features. A persona or profile of a user allows designers to combine observations into one composite character, who represents the shared experiences of the users.

Through these tools, we developed a problem statement to establish an actionable design challenge based on our ethnographic research. The problem statement should focus the designers on the key needs of the client, without restricting the potential. Specifically, we used the Design Criteria worksheet from *Designing for Growth* by Jeanne Liedtke to both summarize our problem statement, or design goal, as well as user perceptions, physical attributes, functional attributes, constraints, expected outcomes, success metrics and project planning. Figure 1 illustrates the problem statement and design criteria we established for this project.

Figure 1: Sustainable Design Criteria for MTM Schoolyard

More Than Me! Sustainable Design Criteria	
Design Goal	More Than Me needs a multifunctional, aesthetically pleasing and durable space that allows for play, restoration, hygiene, shade, expression, safety and sisterhood.
User Perceptions	- Not enough space for all the activities on the site - Not safe enough for the kinds of play that happen in the schoolyard
Physical Attributes	- Safe play surfaces to reduce injuries - Low-cost, upcycled materials
Functional Attributes	- Multifunctional spaces that allows for different uses throughout the day - Portable or transformable to not only encourage dynamic play, but also to allow for moving from current MTM location
Constraints	- MTM will likely not stay in current location for more than five years
Expected Outcomes	- Re-designed schoolyard that maximizes the well-being of the MTM community - Create a sustainable site that facilitates multi-functional use through natural group-oriented and individual meditative spaces - Completed site design, construction documents, and implementation timelines
Success Metrics	1. Did we create a space that maximizes the capacity of the MTM program? 2. Did we create a space that serves the evolving needs of the MTM community? 3. Did we create a space that inspires and empowers the More Than Me students? 4. Did we create a space that is self-sustaining and long-lasting?
Project Planning	Marianna Kerppola and Sydney Johnson will perform research, assessment, and design phases through April 2015. We will be supported by our advisors Bob Grese, MSLA, Shelie Miller, PhD., and Jose Alfaro, PhD.

The synthesis process uncovered a wide range of design opportunities. First, we noted that discipline issues arise because there are not enough collaborative play spaces or activities. Next, we found that there are few spaces for students or teachers to be alone. Third, we learned that ten percent of nurse visits are due to physical injuries in the schoolyard. Fourth, we observed that the students are unable to learn proper hygiene habits when there is no functional place for them to wash their hands. Fifth, we saw that students spend a majority of their free time on the front patio because it is the only available shaded area. Sixth, we witnessed how students build self-confidence when they perform among their fellow classmates. Finally, we heard that the students need opportunities to collaborate and develop a sense of sisterhood.

As a low resource school, it is not surprising that we uncovered a broad range of design opportunities. Moreover, we could not eliminate any one of these needs in the schoolyard design knowing how important each one would be to the cognitive development of the MTM students. We also identified a number of design constraints. We recognized that the needs of the schoolyard would evolve over time. As such, we would need to develop multi-functional solutions that would allow MTM to reach all of their goals. Further, we learned that MTM may not stay in its current location, so we would need to consider portable or modular designs. In sum, we established the following problem statement: *MTM needs a multifunctional, aesthetically pleasing and portable space that allows for play, restoration, hygiene, shade, safety, expression, and sisterhood.*

### *Create Phase – Developing Design Concepts*

Once we established our problem statement, we transitioned toward generating ideas for design solutions. In HCD, teams should not limit or judge ideas generated, but rather collect ideas on paper, which can then be combined into creative solutions.

In order to develop ideas for multifunctional schoolyard design, we explored *A Pattern Language* by Christopher Alexander, a preeminent architect who believes that people and communities should design their houses, neighborhoods and cities because community members are best able to identify their architectural needs (Alexander et al., 1977). In *A Pattern Language*, Alexander's teams collected hundreds of design archetypes and elements that promote community building, way-finding, and exploration. Based on the design criteria for the MTM schoolyard, we were able to cull through the patterns to identify elements that would allow us to achieve our design goals. Figure 2 below highlights the patterns tied to the MTM schoolyard design criteria.

**Figure 2: Sustainable Design Patterns from *A Pattern Language* (Alexander et al., 1977)**

<b>Element</b>	<b>Need</b>	<b>Description</b> (Alexander et al., 1977)
Staircase as a Stage	Play, Expression	A staircase is not just a way of getting from one floor to another. The stair itself is a space, a volume, a part of the building. Treat the whole staircase as a room. Flare out the bottom of the stair with wide steps so that people can naturally use the stairs as seats.
Stair Seats	Play, Expression, Safety	Wherever there is action in a place, the spots which are the most inviting, are those high enough to give people a vantage point, and low enough to put them in action. Stair seats allow people to congregate and sit to watch the goings on.
Adventure Playgrounds	Play, Sisterhood	Any kind of playground, which disturbs or reduces the role of imagination and makes the child more passive, more the recipient of someone else's imagination, may look nice, but it cannot satisfy the fundamental need which play is all about. Instead, set up a place with raw materials of all kinds, where children can create and recreate playgrounds of their own.
Quiet Backside of Building	Restoration	Quiet backside of a building give people time to pause and refresh in a more natural situation. Make sure this area receives sunlight, but is protected from noise by walls and distance and buildings.
Roof Garden	Restoration	Create natural landscapes in dense urban environments
Outdoor Room	Restoration	Build a place outdoors, which has so much enclosure around it, that it takes on the feeling of a room, even though it is open to the sky. To do this, define it at the corners with columns, perhaps roof it partially with a trellis or a sliding canvas roof, and create 'walls' around it with fencing, sitting walls, screens, hedges, or the exterior walls of the building itself.
Garden Seat	Restoration	Make a quiet place in the garden -- a private enclosure with a comfortable seat, thick planting, sun. Pick the place for the seat carefully; pick the place that will give you the most intense kind of solitude.

Child Caves	Restoration	Children love to be in tiny, cave-like places. Wherever children play, around the house, in the neighborhood, in schools, make small "caves" for them. Tuck these caves away in natural leftover spaces, under stairs, under kitchen counters. Keep the ceiling heights low -- 2.5 ft - 4 ft -- and the entrance tiny.
Sitting Wall	Restoration	Surround any natural area and make minor boundaries between outdoor area with low walls, about 16 in high and wide enough to sit on, at least 12 min wide.
Access to Water	Restoration, Hygiene	Water plays a fundamental role in our psychology. Collect rainwater in open gutters and allow it to flow above ground.
Half Hidden Garden	Restoration, Safety, Sisterhood	If a garden is too close to the street, people won't use it because it isn't private enough. But if it is too far from the street, then it won't be used either, because it is too isolated.
Garden Wall	Restoration, Shade	Gardens don't give enough relief from noise unless they are well protected. Form some kind of enclosure to protect the interior of a quiet garden from the sights and sounds of passing traffic.
Trellised Walk	Restoration, Shade	Where paths need special protection or where they need some intimacy, build a trellis over the path and plant it with climbing flowers. Use the trellis to help shape the outdoor spaces on either side of it.
Canvas Roof	Restoration, Shade	Build canvas roofs and walls and awnings wherever there are spaces, which need softer light or partial shade or partial protection from mist and dew. Build them to fold away, with ropes or wires to pull them, so that they can easily be opened
Communal Eating	Sisterhood	Without communal eating, no human group can hold together. Give every social group a place where people can eat together.
Reception Welcomes You	Safety	Arrange a series of welcoming things immediately inside the entrance. Place the reception desk so that it is not between the receptionist and the welcoming area, but to one side at an angle, so that he can get up and walk toward the people who come in, greet them, and then invite them to sit down.
Entrance Transition	Safety, Expression, Sisterhood	The more changes and transitions a house entrance has, the more it seems to be "house-like." Make a transition space between the street and the front door. Bring the path which connects street and entrance through this transition space, and make it with a change of light, a change of sound, a change of direction, a change of surface, a change of level, perhaps by gateways which make a change of enclosure, and above all with a change of view.
Sitting Circle	Sisterhood	Create a well-defined area with paths running past it, but not through it, and placed so that people naturally pass by it, stop and talk. Place each sitting space in a position which is protected, not cut by paths or movement, roughly circular, made so that the space itself helps to suggest the circle -- not too strongly -- with paths and activities around it, so that people naturally gravitate toward the chairs when they get in the mood to sit.
Small Public Squares	Sisterhood, Expression	Communities need areas to gather and celebrate, but too often, these areas are too large. Open places should be very small, ideally a diameter of 60 ft.

In turn, these patterns were combined to create multi-functional and modular design concepts for the MTM schoolyard. For example, we combined Staircase as a Stage, Stair Seats, Canvas Roof, Communal Eating and Small Public Squares into a concept for an amphitheater covered with a canvas roof, where students could view performances, eat a meal, attend a class or sit and chat with friends.

We combined Quiet Backside of Building, Outdoor Room, Garden Seats, Sitting Wall, Half Hidden Garden, Garden Wall and Sitting Circle into a concept for a keyhole garden that could be used as an outdoor classroom, an area for quiet reflection, or an opportunity to grow food.

We combined Adventure Playgrounds and Child Caves into a concept for a collaborative and modular playground, where students could creatively transform objects in new play experiences. This would allow students at different developmental levels to release energy in a safe way.

We combined Outdoor Room, Garden Wall, Trellised Walk, Reception Welcomes You and Entrance Transition into a concept for an outdoor structure covered in vines that would provide the students and staff with a space to relax and be restored. This outdoor room would provide the user with shade and physical separation from the other spaces. It could also be used as an outdoor classroom or cafeteria. These features would ideally improve access to green space by using natural materials wherever possible.

Finally, we combined our concept for the keyhole garden and Access to Water into a concept using aquaponics that would provide a soothing sound of running water. Additionally, the aquaponics could be connected to a foot-pump powered hand washing station, where students could wash their hands outside before eating.

Ideally, we would have been able to share these design concepts with MTM to get their feedback and adjust them accordingly. However, Ebola had spread to Monrovia in June 2014, and by July, MTM had to close its doors to prevent the spread of Ebola among the students. In turn, MTM staff and administration began fighting Ebola in Monrovia, and thus were unable to continue sponsoring the schoolyard redesign project.

## **Discussion**

Through interviews, workshops and observations, we confirmed that MTM critically needed space for restoration. From a qualitative perspective, we witnessed how both teachers and students became increasingly irritable over the course of the day, suggesting extended directed attention fatigue. We were surprised to find that not only did the students require restorative space, but so did the MTM teachers. Misbehaving students requires increased directed attention from teachers and thus causes directed attention fatigue. If teachers do not have space to restore themselves, then they are unable to teach effectively, again, distracting from desired education outcomes. All in all, we maintain that integrating nature into the MTM school environment would help alleviate directed attention fatigue for the entire school community.

Environmental psychologists have performed extensive experiments exploring the cognitive benefits of nature with children in developed countries. We recommend replicating these experiments in low resource, developing country contexts to understand whether nature has the same benefits for children in different socioeconomic conditions. We believe this research could result in low cost solutions for improving education outcomes for students in developing countries.

We also determined that the human-centered design process was valuable for uncovering needs of MTM community – particularly of the students, who were otherwise unable to effectively express themselves. Overall, the interactive workshops were effective – though there remains opportunity to further tailor the workshop activities to the skillset of each class. In our drawing exercise with the Courage class, we realized that students with particularly low literacy and/or cognitive development might not be able to translate abstracts concepts, such as happiness, into drawing. That said, we witnessed this with a group of 20 students, where many other factors may be at play. Nonetheless, we

recommend further research on how to extract tacit knowledge from children with low literacy and/or cognitive development.

In our literature review, we only found one journal article that provided insight into using participatory design with children in developing countries (Hussain 2010). In this article, Hussain explained how adult designers struggle to understand the needs of children – particularly with marginalized children. However, HCD methods can not only help designers in developing better solutions for these children, but also, marginalized children can feel deeply empowered by the HCD process because they are able to express their thoughts and feelings in a deeply empathetic environment. Additionally, Hussain concludes, “When working with underprivileged children in developing countries, awareness of using opportunities for increasing their perceived psychological empowerment should be given extra consideration” (Hussain 2010).

In practice, many NGOs and social enterprises use HCD methods. However, little of this practice is documented in academic literature. We highlight an opportunity for sustainable development, environmental psychology and/or education researchers to expand the academic discourse on using HCD methods with children in developing country contexts.

## **Conclusion**

Retrospectively, we would have completed this entire project onsite. HCD requires ongoing iteration and exploration of idea, which becomes challenging when communicating across continents. As a result, we were unable to fully engage the MTM community through each stage. For future projects, we recommend having a design team on site for 3-6 months to complete the Hear, Create and Deliver phases. For example, in the Create phase, designers could co-create inexpensive and mutable prototypes with the community to ensure their vision and ideas are accurately reflected in the project outcomes. In contrast, designing from afar risks creating solutions that are not useful in practice.

Developing green, natural schoolyards has not only short-term benefits for directed attention restoration, but also long-term benefits in building environment stewardship among students. Studies have shown that urban children have a significant shift towards pro-environmental behaviors when frequency of contact with nature is increased (Corraliza, Staats, Ruiz, & Collado, 2015). Similarly, field-based urban ecology curricula can increase environmental stewardship of youth (Barnett et al., 2006). As a result, natural, restorative environments in schoolyards can help shape future environmental stewards.

## References

- Alexander, C., Ishikawa, S., Silverstien, M., Jacobson, M., Angel, S., & Fiksdahl-King, I. (1977). *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press.
- Baek, J.-S., & Lee, K.-P. (2008). A participatory design approach to information architecture design for children. *CoDesign*, 4(3), 173–191.  
doi:10.1080/15710880802281026
- Bagot, K. L., Catherine, F., Allen, L., & Toukhsati, S. (2015). Perceived restorativeness of children's school playground environments : Nature, playground features and play period experiences. *Journal of Environmental Psychology*, 41, 1–9.  
doi:10.1016/j.jenvp.2014.11.005
- Banerjee, A., & Duflo, E. (2012). Top of Class. In *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. Philadelphia: PublicAffairs.
- Barnett, M., Lord, C., Strauss, E., Rosca, C., Langford, H., Chavez, D., & Deni, L. (2006). Using the Urban Environment to Engage Youths in Urban Ecology Field Studies. *The Journal of Environmental Education*, 37(2), 3–11.  
doi:10.3200/JOEE.37.2.3-11
- Berman, M. G., Jonides, J., & Kaplan, S. (2008a). The cognitive benefits of interacting with nature. *Psychological Science*, 19(12), 1207–1212.
- Berman, M. G., Jonides, J., & Kaplan, S. (2008b). The Cognitive Benefits of Interacting With Nature. *Psychological Science*, 19, 1207–1212.
- Corraliza, A., Staats, H., Ruiz, M., & Collado, S. (2015). Effect of frequency and mode of contact with nature on children's self-reported ecological behaviors, 41.  
doi:10.1016/j.jenvp.2014.11.001
- d.school. (n.d.). *d.school: Bootcamp Bootleg*. Palo Alto. Retrieved from <http://dschool.stanford.edu/wp-content/uploads/2013/10/METHODCARDS-v3-slim.pdf>
- Danks, S. (2010). *Asphalt to Ecosystems: Design Ideas for Schoolyard Transformation*. New Village Press.
- Druin, A., Stewart, J., Proft, D., Bederson, B., & Hollan, J. (1997). KidPad: A Design Collaboration Between, Children, Technologists, and Educators. *Design Briefings*, 97, 463 – 470.

- Evans, G. W., Lepore, S. J., Shejwal, B. R., & Palsane, M. N. (1998). Chronic residential crowding and children's well-being: an ecological perspective. *Child Development*, 69(6), 1514–1523. doi:10.2307/1132129
- Faber Taylor, A., Kuo, F. E., & Sullivan, W. C. (2001). Coping with ADD: The Surprising Connection to Green Play Settings. *Environment and Behavior*, 33(1), 54–77. doi:10.1177/00139160121972864
- Gulwadi, G. B. (2006). Seeking Restorative Experiences: Elementary School Teachers' Choices for Places That Enable Coping With Stress. *Environment and Behavior*, 38(4), 503–520. doi:10.1177/0013916505283420
- IDEO.org. (n.d.). *Human Centered Design Toolkit*. IDEO.org. Retrieved from <http://www.designkit.org/resources/1/>
- IMF. (2011). *Lift Liberia Poverty Reduction Strategy Second Annual Progress April 2009 – March 2010*. Washington, DC.
- IRIN. (2009, November). LIBERIA: Disease rife as more people squeeze into fewer toilets. *IRIN: Humanitarian News and Analysis*. Retrieved from <http://www.irinnews.org/report/87110/liberia-disease-rife-as-more-people-squeeze-into-fewer-toilets>
- Johnson-Sirleaf, E. (2008). *2008 National Population and Housing Census: Preliminary Results*. Monrovia, Liberia.
- Kaplan, R. (2001). The Nature of the View from Home: Psychological Benefits. *Environment and Behavior*, 33(4), 507–542. doi:10.1177/00139160121973115
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(1995), 169–182. doi:10.1016/0272-4944(95)90001-2
- Karlan, D., & Appel, J. (2012). To Learn: The Importance of Showing Up. In *More Than Good Intentions: Improving the Ways the World's Poor Borrow, Save, Farm, Learn, and Stay Healthy*. New York: Penguin.
- Kerppola, M., & Johnson, S. (2014). Interviews with More Than Me! Academy Staff. Monrovia, Liberia.
- Kristof, Nicholas; WuDunn, S. (2009). *Half the Sky: Turning Oppression into Opportunity for Women Worldwide* (Reprint ed.). New York: Vintage.
- Kuo, F. E., & Sullivan, W. C. (2001). Aggression and Violence in the Inner City: Effects of Environment via Mental Fatigue. *Environment and Behavior*, 33(4), 543–571. doi:10.1177/00139160121973124

- Liedtka, J. (2011). *Designing for Growth: A Design Thinking Tool Kit for Managers* (First Edit.). New York: Columbia University Press.
- Millennium Development Goals. (2010). Republic of Liberia Progress , Prospects and Challenges towards Achieving the MDGs.
- Moraveji, N., Li, J., Ding, J., Woolf, S., Arbor, A., & Corporation, M. (2007). Comicboarding : Using Comics as Proxies for Participatory Design with Children, 1371–1374.
- More Than Me Academy. (2015). More Than Me Academy.
- Newman, L., & Dale, A. (2009). In praise of mundane nature. *Alternatives Journal*, 35, 32–35.
- Norman, D. (2013). *The Design of Everyday Things: Revised and Expanded Edition* (Revised Ed.). Basic Books.
- Polgreen, L. (2005, October 29). Youth Power in Liberia: From Bullets to Ballots. *New York Times*. Monrovia, Liberia. Retrieved from [http://www.nytimes.com/2005/10/29/international/africa/29liberia.html?pagewanted=all&\\_r=0](http://www.nytimes.com/2005/10/29/international/africa/29liberia.html?pagewanted=all&_r=0)
- United Nations. (2008). United Nations Girls' Education Initiative. Retrieved March 9, 2015, from [http://www.ungei.org/whatisungei/index\\_211.html](http://www.ungei.org/whatisungei/index_211.html)
- United Nations Population Fund. (2012). *Population Matters for Sustainable Development*. New York. Retrieved from <http://www.unfpa.org/publications/population-matters-sustainable-development>
- Wells, N. M. (2000). Effects of “Greenness” on Children’s Cognitive Functioning. *Environment and Behavior*, 32(6), 775–795.
- Yamauchi, Y. (2012). Field Informatics, 123–138. doi:10.1007/978-3-642-29006-0