



Learning Landscapes: Can Urban Planning and the Learning Sciences Work Together to Help Children?

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Overview

In the United States, children from under-resourced communities regularly enter formal schooling lagging behind their peers in language development, reading readiness, and spatial skills. These deficits predict later mathematical and vocabulary knowledge and can persist throughout life, affecting everything from occupational attainment to health outcomes. To address these gaps, policymakers have focused largely on schooling as the great equalizer. Yet, children in Western countries only spend 20 percent of their waking hours in school and there is little attention spent helping children engage in formative experiences in the other 80 percent. Additionally, by 2050 over 70 percent of the world's children will live in cities. How can developmental scientists, city planners, architects, and educators come together to address this “other 80 percent” of children's waking hours in places where most children live, for the benefit of children's development?

One answer is the Learning Landscapes initiative, which marries the learning sciences with urban revitalization to craft carefully planned play experiences that focus on learning outcomes, particularly for children and families from under-resourced communities. Playful learning, a broad pedagogical approach featuring child-directed play methods, provides a unique way to foster learning and engagement organically within the built environment. Learning Landscapes capitalizes on global momentum towards placemaking and putting the user experience first in the designing of public spaces. The initiative has already demonstrated efficacy through several well-documented projects. The Ultimate Block Party brought over 50,000 people to Central Park to engage in playful learning activities. Supermarket Speak made grocery stores hotspots for caregiver-child interaction by simply adding signs with interaction prompts to everyday “trapped” environments. Urban Thinkscape transformed a bus stop and adjacent lot into a hub for playful learning while families were waiting for public transportation. Finally, Parkopolis is a life-size human board game that fosters STEM (Science, Technology, Engineering, and Mathematics) and reasoning skills in public spaces. Most importantly, Learning Landscape takes a rigorous research-to-practice approach with implementation rooted in the science of learning and clear, measurable outcomes. This paper summarizes data from these Learning Landscapes projects while reflecting on lessons learned and exploring future directions.

Introduction

For decades, communities across the globe have been plagued by inequities between low- and higher-income families.^{1,2,3} Young children from under-resourced communities regularly enter formal schooling lagging behind their peers in areas such as language development,⁴ spatial skills,⁵ and early numeracy,⁶ and these deficits can set children's learning trajectories through formal schooling and beyond. To address such gaps before children start elementary school, U.S. policymakers have largely focused on early schooling, operating on the assumption that if children attend high-quality preschools, this may lessen—if not obliterate—the inequities.⁷ This

is indeed a key part of the solution, with high-quality preschool programs demonstrating meaningful advancement for children in a variety of United States cities.^{8,9}

However, given that children in Western countries only spend 20 percent of their waking hours in school,¹⁰ time in early childhood spent outside the classroom could offer important learning opportunities to supplement and extend school learning. Children spend a significant portion of the “other 80 percent” of their waking time in home and community settings. Community spaces, in particular, are often underutilized areas where opportunities for learning are overlooked. Might we be able to marry playful learning, a broad pedagogical approach featuring child-directed play methods,¹¹ with placemaking in ways that infuse underutilized community spaces with learning potential? This is the goal of Learning Landscapes: To transform everyday places into learning opportunities to maximize learning in “the other 80 percent” of time children spend outside of school and augment school learning for children from 0-8 years of age. By focusing on public spaces within cities—where 70 percent of children globally are projected to live by 2050,¹² the Learning Landscapes initiative aligns with the pushes for educational equity and urban redesign and renewal.

In fact, there is a global movement to revitalize public spaces in cities and to make them more child and family friendly. Placemaking undertakes these tasks by using a community-based approach to define shared values and goals for public space and reimagine how to use those spaces according to what is important to residents. Learning Landscapes is related to similar efforts including work outside the U.S. Initiatives such as Urban95 from the Bernard van Leer Foundation, designed to tailor urban environments to the needs of young children is one such alignment as is the Conscious Cities movement, started by architect Itai Palti and neuroscientist Moshe Bar in 2015. The latter aims to create intuitive, responsive, people-centric cities using cognitive science, artificial intelligence, and technology. Learning Landscapes extends this work in public spaces by turning ordinary city spaces into extraordinary opportunities for interaction, engagement, and learning, and at the broadest level enhances civic engagement and learning as we develop the concept of a conscious city that is responsive to the needs of its citizens.

Even though many cities are experiencing growth and revitalization, inequality and neighborhood segregation persists. These areas, in particular, are well positioned to profit from the concept of Learning Landscapes by attracting families to participate in high quality, science based experiences. The challenge is to unite these efforts around initiatives that are systemic, organic, and supportive of learning in both formal and informal environments, creating a “surround sound” learning experience. With early childhood research indicating the link between various playful learning approaches and increased skill development, now is the time to transform cities into holistic agents of change to support children’s learning.

These settings can be particularly well-employed to foster development of a breadth of 21st century skills, which Golinkoff and Hirsh-Pasek¹³ call the 6Cs: collaboration, communication, content (e.g., literacy, math, science), creativity, confidence, and critical thinking. The 6Cs highlight the need for 21st century education to focus on more than test scores and memorization; to be successful in today’s dynamic world, children need to exhibit the qualities embodied by the 6Cs to evaluate and apply knowledge in ways that meet the demands of a changing social and economic landscape. Learning Landscapes targets the 6Cs through changes in caregivers’ behaviors and attitudes toward playful learning. Caregivers gain an increased ability to support their children’s play by having quality conversation and interactions

with their children at Learning Landscapes installations. Children gain in play skills, school readiness, socioemotional skills, scientific curiosity, and school achievement.

This initiative brings together experts from the fields of education, child development, and urban planning and design to embed active, engaged, meaningful, and socially interactive learning opportunities in public spaces with an eye toward changing outcomes in the 6Cs. Learning Landscapes also takes a public health approach to education, embracing Rose's Theorem, which holds that a small dose of treatment disseminated widely to a large number of people has a larger net effect than more intensive treatment in a smaller population.¹⁴ These interventions are low in individual effort and broad in their reach aligning with best practices in prevention science¹⁵ and holding tremendous potential for widespread educational impact on children and families. We plan to bring new actors to the table and ultimately change the approach to urban planning by providing a sustainable model that can be supported by the city transportation budget, parks and recreation departments, and other public funding avenues. Public funds are already allocated to build bus stops, parks, and playgrounds. We seek to assist urban planners and placemakers to create structures that are child-focused and infused with learning sciences.

Why Playful Learning?

Playful learning is an umbrella term referring to a whole-child pedagogical approach to the promotion of academic, socio-emotional, and cognitive development, including free play, guided play, and games.^{16,17} Research shows that young children learn best in active, meaningful, engaged, and socially interactive contexts¹⁸—making play an ideal setting for enriching opportunities to augment children's educational development.¹⁹ During active learning, children are “minds on,” or actively participating in a task rather than passively observing, and they are thinking and reasoning rather than just mindlessly doing a task.^{20,21} Engagement in a learning activity is also essential, as studies have consistently shown that children learn more when they are paying attention rather than distracted.^{22,23,24,25} Additionally, children learn more effectively when learning material is meaningfully connected to their lives, or is related to something they already know, rather than presented abstractly and out of context.^{26,27} Finally, a wealth of evidence suggests that children learn more when they interact with others than when they do not.^{28,29,30}

To capitalize on the ways children learn best, playful learning includes the methods of free play, guided play, and games. Free play, whether with objects or pretend or physical, is fun and voluntary, involves active engagement, without extrinsic goals, and often incorporates make-believe.^{31,32} During free play, children can engage in discovery learning and practice social and other skills without constraints from adult involvement.³³ Henricks³⁴ described play as a “laboratory of the possible,” and as such, it appears that the flexible context of play allows children to encounter situations and enact behaviors that contribute to their scientific reasoning abilities³⁵ and to many of the C's, including creative innovation and critical thinking. For example, object play helps children to uncover how the world works in tangible, tactile ways,³⁶ including understanding cause-and-effect relationships³⁷ and discerning the causal structure of objects through learning about affordances of object features³⁸. Science learning is partially driven by scientific curiosity, or the uncertainty that lead children to explore an unfamiliar topic.³⁹ Children are motivated to discover how things work and to use object play to satisfy their

scientific curiosity by asking questions⁴⁰, devising spontaneous experiments, and learning about causal relationships through interventions.^{41,42,43}

Guided play retains many characteristics of free play, especially its enjoyable nature and the fact that it is child-driven, but adds an additional focus on a targeted learning goal.⁴⁴ Guided play involves children exploring their environment with adults through interactions focused on implicit learning goals.⁴⁵ It allows children to tinker in a constrained environment that encourages independent exploration informed by adult expertise.⁴⁶ Adults support a learning goal by using strategies including commenting and asking open-ended questions about children's ideas⁴⁷ and fostering the "serve and return" interactions that are critical for development. For instance, guided play improves language outcomes^{48,49} by providing a meaningful context for the use and extension of words. Additionally, Fisher and colleagues⁵⁰ found that guided play promotes children's learning about geometry and shapes better than didactic instruction or free play.

Finally, when games are combined with educational content, they enhance learning by increasing children's motivation, which increases their attention to content and helps them retain more information.^{51,52} For example, one United States-based study examined a board game, similar to *Snakes & Ladders*, that was combined with shared book-reading for the purposes of improving 4-year-olds' vocabulary knowledge.⁵³ Results indicated that children who played the experimental board game gained more receptive and expressive vocabulary knowledge than children in the control condition, who received equal word exposures but did not play the experimental version of the game. Similarly, Ramani and Siegler⁵⁴ found that playing a linear number board game improved low-income preschoolers' mathematical knowledge in the areas of numerical magnitude comparison, number line estimation, counting, and numeral identification.

Play experiences may also help connect individuals with the places around them and reinterpret ways to use public space.⁵⁵ In particular, playful learning can offer a unique way to foster learning and engagement with the built environment. Incorporating playful elements into architecture and public space also promotes curiosity and a desire to learn. This is critical because learning and development are significantly impacted by individuals' and families' environments.⁵⁶ The environment can influence internally-driven curiosity, through the creation of a *mise en place*—a disposition and readiness to engage in and explore a learning activity⁵⁷—while also encouraging caregiver-child discourse and engagement in activities involving language, mathematics, and spatial topics.

To ensure high quality playful experiences, it is also important to understand caregivers' attitudes about the links between play and learning. Many caregivers do not always see the connection between the two, since use of playful learning in preschool and kindergarten classrooms has dropped precipitously.⁵⁸ A false dichotomy prevails that portrays play and learning as mutually exclusive.^{59,60,61} Little research, however, has explored the ways in which caregiver attitudes can be enhanced or changed to align with scientific evidence about the importance of play.⁶²

Taking a Public Health Approach to Learning

By transforming public spaces into opportunities for playful learning, the Learning Landscapes initiative treats children's learning as a public health issue and not simply as an educational one. Advancements in neuroscience have enhanced our understanding of the impact

of poverty on brain development. Structural differences in the frontal and temporal lobes (i.e., reduced gray matter) could explain as much as 20 percent of the gap in standardized tests scores for children living under the poverty line.⁶³ Further, the structural brain differences associated with poverty have been documented in babies as young as 5-weeks-old.⁶⁴ As more and more research on the detrimental impacts of poverty on children's brain development emerges,^{65,66} it is becoming increasingly clear that a public health approach is warranted.

Thus, our approach is similar to the one taken by researchers who have examined the role of public spaces in increasing exercise opportunities. Several studies have demonstrated the important role of parks for physical exercise in the pursuit of improved population health.^{67,68,69} Putting exercise equipment in public parks increases the usage of the park and the physical activity level of the patrons in comparison to parks without exercise equipment.⁷⁰ The simple act of changing the public space resulted in measurable changes in people's behavior.

Although meaningful progress has been made within the United States education sphere, past approaches, both school- and home-based, in areas such as mathematics and reading, have not made but a small dent in reducing entrenched achievement gaps. One potential reason for this lag in impact is that a higher dose of exposure is likely necessary.⁷¹ By introducing playful learning experiences into "the other 80 percent," Learning Landscapes can create opportunities for additional exposure to learning. Although Learning Landscapes takes place in the real world and not in a laboratory, it is still possible to collect objective, real-time observational and survey data that demonstrate how families and children use the spaces and how interactions are affected by the installations. In the spirit of community-based public health research, projects within the initiative also include community members as paid data collectors. This helps to increase neighborhood buy-in and provides employment and job skills to motivated neighbors. At the same time, community data collectors are more likely to have a rapport with families visiting the Learning Landscapes sites and may more readily obtain consent for partaking in surveys than non-residents such as university research assistants.

The public health fitness equipment example suggest that there can be real change by targeting community contexts. Recent data are encouraging, suggesting that some of the more community-wide efforts like Vroom (an app designed to bring the science of brain development for young children to families and communities⁷²) or Too Small to Fail (a public awareness and action campaign from the Clinton Foundation and The Opportunity Institute that gives caregivers tools to talk, read, and sign with their young children) are part of the solution. Since 1998, the reading skills gap has been reduced by 16 percent and the mathematics skills gap has been reduced by 10 percent at the start of kindergarten.⁷³ One suggested reason for this reduction is an increase in engagement with caregivers, both in and outside the home. Learning Landscapes fits squarely within these types of initiatives.

The Science and Theory Behind How Learning Landscapes Improves Child Outcomes

Learning Landscapes is deeply informed by the latest findings in developmental science and guided by a theoretical model that embraces the need to alter environments in ways that will support caregiver attitude change and child outcomes. Learning Landscapes supports a two-generational, or 2Gen, approach. Research demonstrates the positive impact caregivers' educational level, economic status, and health have on children's outcomes. This effect also works the other way in that children's success has positive effects on caregivers' lives and

achievement.⁷⁴ 2Gen approaches have demonstrated success in supporting educational outcomes, social capital, and economic outcomes for families.⁷⁵

Our theoretical model (Figure 1) suggests impact at multiple levels including galvanizing support from community leaders for city-wide initiatives in early learning and galvanizing neighborhoods around more localized opportunities for learning.



Figure 1. Learning Landscapes Theoretical Model.

The model starts with the strategies of the project, including altering public space, encouraging positive use of public space, adding playful learning installations to the environment, and engaging and welcoming community members, families, and children. Learning Landscapes targets caregiver learning beliefs, caregiver-child communication, and interaction while at the Learning Landscapes sites, and community engagement, buy-in, and commitment. At the caregiver-child level, Learning Landscapes ultimately aims to increase both communication and interaction, which should be generalized to locations and situations not involving project sites. Finally, the end goal for the community is bold: We wish to transform neighborhoods into learning communities intentionally designed for play and learning. Throughout the process, moderators at all levels affect progress, including time of visit/year, child age, socioeconomic status (SES), caregiving attitudes, and the community factors of organization, safety, support, and involvement. These moderators are critical factors that will be addressed in the description of each Learning Landscape example project.

Learning Landscapes is multidisciplinary at its core and offers a new approach to “the other 80 percent” that supports the kind of learning that young children need for school success. It does so, however, in a fun and inviting way that is built upon the foundation of the learning sciences. By using installations in cities as agents of change, Learning Landscapes taps into the renewed focus on education while also contributing to the movement promoting family-friendly cities.

Promising Evidence from Seven Learning Landscape Sites

There is promising early evidence from small-scale pilots in seven cities across the United States, Switzerland, and South Africa. This is why we argue that it is timely and appropriate to scale the overall Learning Landscapes initiative, while continuing to test, evaluate, and adapt efforts based on the results. Learning Landscapes projects have been implemented in New York

City, New York; Philadelphia, Pennsylvania; and Wilmington, Delaware. They are also ongoing in Johannesburg, South Africa; Chicago, Illinois; and Seattle, Washington. The types of installations range from one-time large events in public spaces to short-term installations to permanent structures. In this section, though, we cover the evidence regarding these seven projects, we aspire to continue to develop the key principles that make Learning Landscapes effective so that others can adapt and adopt these approaches to different contexts. We also recognize that our pilots are not the only attempts to affect outcomes in this area, but coalescing projects around a singular initiative may make it simpler to collaborate across organizations and entities.

Ultimate Block Party: What is the Power of Pop-Up Event Programming

The Ultimate Block Party (UBP)^{76,77} served as the first pilot test for Learning Landscapes. UBP sought to transform caregiver attitudes about the relationship between play and learning in a community setting. The inaugural UBP event was held in Central Park, New York City on October 2, 2010, and attracted over 50,000 participants. UBP targeted caregiver knowledge of the science of learning through 28 activities, suggested by leaders in the learning sciences, that spanned eight play domains, including adventure, construction, physical, the arts, make-believe, technology, and language play.⁷⁸ All activities were based on research from the learning sciences about how to target specific skills. For example, during the University of Washington's Bilingual Bingo, families learned about the benefits of speaking more than one language for children's overall development.⁷⁹ UBP sought to impart four core messages to caregivers: (1) how play connects with learning; (2) the scientific basis for linking play to learning; (3) longer term benefits of childhood play; and (4) threats to play and lost opportunities. Scientists dotted the park dressed as "Play Doctors" to make clear the learning connections embedded within each activity. Event organizers also handed out 16,000 "playbooks," which described the ways to take home the learning happening at UBP.

An evaluation team, headed by researchers from Sarah Lawrence College and Yale University, conducted 292 in-person interviews (258 with UBP participants and 34 with a control group of caregivers in Central Park) and a web-based survey of 57 UBP volunteers. The goal of the evaluation was three-fold: (1) to measure the UBP event's success in conveying 4 core messages about play to caregivers; (2) to determine how well the UBP event's organization supported achievement of its goals; (3) to learn about people's general attitudes with respect to play in order to inform future strategy for UBP and other forms of play advocacy. With regard to the measurement of caregiver attitudes, the researchers designed a short survey featuring Likert scale items, open-ended questions, and demographic questions to assess caregiver attitudes and beliefs about play and learning.⁸⁰ Results suggested that caregivers' ability to represent different facets of the play/learning connection is a vital component in public awareness. Parental beliefs and attitudes about play significantly affect how parents play with their children and what opportunities for play they support in wider society.⁸¹ This awareness may have been strengthened through direct exposure to multiple forms of play.⁸² Results also demonstrated that caregiver attitudes about play could be changed after visiting as few as three playful activities and that the findings hold across a large ethnically diverse group. For example, one Latina woman exited the Bilingual Bingo activity holding her child's hand and proclaiming, "Until today, I never knew that having two languages was a good thing."

In the following years, UBPs have also taken place in Toronto, Ontario, Canada and Baltimore, Maryland.

The success of UBP demonstrated that the general populace is deeply interested in the construct of playful learning. This could be a conduit for changing attitudes, behaviors, and outcomes for children and families. Such findings emboldened us to then develop a more targeted approach to bringing the science of learning into community settings.

Supermarket Speak: How can “trapped spaces” be infused with learning opportunities?

UBP was a destination. Families had to make a special trip to Central Park to experience the playful learning activities. For the next instantiation of Learning Landscapes, we infused a space where families regularly go with opportunities for learning and interaction. Supermarkets are an example of a “trapped space” where people spend time waiting or going about daily activities in a closed space. To reach families while they do their grocery shopping, it is important to consider the ways in which adults navigate the store, being mindful that they likely want to get in and out as fast as possible, while also offering ways for adults to engage children in fun and educational interactions. At the same time, supermarkets are rich in opportunities to target language and mathematics skills, such as counting the number of apples a family would like to purchase or learning the names for fruits and vegetables. Thus, we asked how we might capitalize on these latent learning opportunities already present within supermarkets, in a project called Supermarket Speak.

We built playful learning into local supermarkets to spark increases in caregiver-child interactions.⁸³ Research demonstrates that everyday conversations between caregiver and child are important to language learning and predict school readiness.^{84,85} Additionally, increased quality and quantity of caregiver-child conversation can combat the language disparities between children from low- and higher-income backgrounds^{86,87,88} and the outcomes of rich conversation has unique effects on brain activity.⁸⁹ However, interventions that target caregiver-child interactions like workshops and home visiting programs are often expensive, labor-intensive, and difficult to integrate into disadvantaged families’ lives, resulting in high attrition rates.^{90,91} Moreover, they do not reach the large number of families that turn down the intervention.⁹²

In response to these challenges, our research team implemented a novel and subtle intervention—signage—which attempted to reach caregivers and children in supermarkets. Colorful, visually attractive signs (Figure 2) transformed the supermarkets into children’s museums and used these everyday environments as springboards for learning as well as caregiver-child conversations and interactions.

Signs were posted in three supermarkets in Philadelphia, Pennsylvania and Wilmington DE, in neighborhoods serving low- and middle-socioeconomic status families. Research assistants conducted naturalistic observations of adult-child groups when signs were and were not posted.

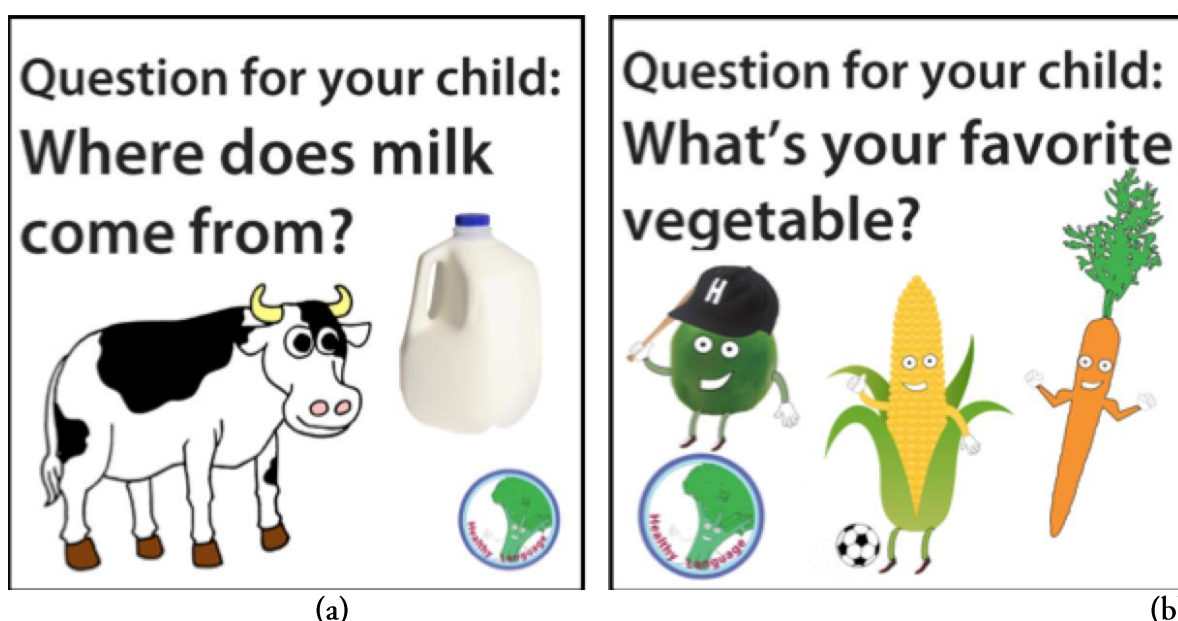


Figure 2. Example signs from Ridge et al. (2015): (a) dairy case sign; (b) produce aisle sign.

Then, a Total Interaction Score was computed for each adult-child group, composed of indicators of rich caregiver-child interactions including: amount and valence of interaction, number of adult and child-initiated questions, and types of language used (e.g., descriptive or informative). The coding scheme was derived from Dyadic Parent—Child Interaction Coding System, validated to assess quality of caregiver—child social interaction,⁹³ as well as other caregiver—child interactions.^{94,95,96,97}

Families shopping in the low-SES neighborhood interacted less when signs were not posted than families in the mid-SES neighborhood. Adding signs, however, resulted in families from low-SES backgrounds talking significantly more, and erasing the gap between them and mid-SES families. Overall, there was a 33 percent increase in these language interactions in the low-income neighborhood supermarket when the signs were up. In interacting with the child, adults used significantly more descriptive language, asked more questions, said the name of the product more, and showed the product more frequently. Children pointed to products more and asked the adult significantly more questions. The presence of the signs did not make a significant difference in caregiver-child conversations and interactions occurring in a supermarket located in a middle-income neighborhood. By using “trapped” spaces where caregivers and children go, we sparked precisely the kinds of interactions that build strong language and later literacy scores.

As a part of the “Talking is Teaching: Talk, Read, Sing” campaign of Too Small to Fail—in conjunction with the George Kaiser Family Foundation, CAP Tulsa, and Tulsa Educare—the Ridge et al.⁹⁸ study was replicated in Tulsa, Oklahoma and termed “Healthy Language.” Similar colorful, visually attractive signs (Figure 3) were posted in supermarkets in both low- and middle-income neighborhoods and Spanish-language signs were posted in a supermarket in a primarily Spanish-speaking neighborhood. These signs featured both language and mathematics prompts, with the addition of math prompts being novel for this iteration. Morris, Zapata, and Treat⁹⁹ led a team that observed 497 English- and Spanish-speaking caregiver-child groups before and after signage installation using the same type of observation methods as Ridge et al.¹⁰⁰ However, unlike in the Ridge and colleagues study, stores designated as low-income actually drew in more economically mixed groups of shoppers, as per shopper surveys. Furthermore,

amount of interaction in the signs-down conditions were higher at baseline than in Ridge et al., meaning that there were fewer opportunities for growth in caregiver-child interaction. As a result, no statistically significant differences were found in the number of conversational turns before and after signage installation. However, in this setting, researchers found a difference in the *quality* of conversation from pre-signage to post-signage. After the signage was installed, a greater percentage of adults said the name of products, used numerical language, and talked about colors than before the introduction of signage. Regardless of the presence or absence of signage, Hispanic caregiver-child groups demonstrated higher levels of interaction than non-Hispanic groups. The project is making adjustments based on the findings, and data collection is ongoing.

In Johannesburg, South Africa, South African Partners and researcher Sharon Moonsamy with her team from the University of the Witwatersrand are currently completing an additional replication of Ridge et al.¹⁰¹ The project is called “We Learn by Talking Together” or “Sifunda Ngokuthetha,” and signs with both mathematics and language prompts were posted in supermarkets in both low- and middle-income neighborhoods in English and isiXhosa.



Figure 3. Example sign from “Healthy Language” in Tulsa, Oklahoma.

Caregiver-child groups were observed using naturalistic observation, as in Ridge et al.,¹⁰² as well as shopper exit surveys asking adults with children which signs they noticed while shopping and what impact the signs had on their shopping experience. Data from this project will demonstrate the effectiveness of translating this intervention into an international context.

Finally, a recent replication is being conducted using signage that targets number usage. Under the direction of Dr. M. Libertus at the University of Pittsburgh, preliminary data suggest a 20 percent increase in the use of number talk and interactions around numbers when the signs are up rather than down.

Throughout its various iterations, this low-cost supermarket intervention fosters the type of caregiver-child conversations and interactions that have the potential to impact later language, literacy, and mathematics outcomes for children from disadvantaged backgrounds. Many families from low-income backgrounds do not have the means to regularly visit children’s

museums and other comparable spaces. By transforming a supermarket into a similar space for learning, the Supermarket Speak studies convert an everyday place into an enriching learning environment. In this way, supermarket speak harnesses “the other 80 percent” of children’s time to improve their academic forecast.

Urban Thinkscape: How can a bus stop be permanently infused with learning opportunities?

If supermarkets can prompt caregiver-child interaction and learning, then, in theory, public spaces can be equally effective locations for such activities. Today, our public spaces include places where people wait, often with children. Adults often use their phones or give their children phones or tablets to occupy them.¹⁰³ How can we transform places—from street corners to laundromats—where people gather into hubs for playful learning? Bus stops offer one opportunity to test this idea. We asked whether it might be possible to reimagine a bench as a learning opportunity instead of merely a place to sit and wait for a ride. Urban Thinkscape explored this possibility.

Urban Thinkscape marries architectural design with research from the science of learning. Designed in collaboration with architect Itai Palti of the Conscious Cities movement, it places beautiful and exciting learning opportunities directly within cityscapes in the places where people regularly go—at bus stops, on sidewalks, and in parks. Designs installed in the pilot cluster include: Puzzle Bench, Jumping Feet, Stories, and Hidden Figures. The designs were created to tap into active, engaged, meaningful, and socially interactive learning contexts while also targeting specific areas of learning, such as spatial skills, language development, and executive functioning.

Puzzle Bench uses the back wall of a bus stop to challenge waiting passengers to complete a series of puzzles (Figure 4). Fostered by puzzles, early spatial and mathematics skills are key predictors of both later mathematics and literacy abilities.^{104,105} The next design, *Stories*, asks children to balance from one narrative cue to another to create a story (Figure 5). This activity fosters the development of narrative skills, which impact children’s literacy outcomes.¹⁰⁶ With younger children, caregivers can ask them to identify the objects in each narrative cue, building vocabulary and language skills—both precursors to narrative development. The third design, *Jumping Feet*, morphs everyday hopscotch into an executive functioning activity (Figure 6). Executive functioning is an umbrella term for the control of cognitive processes, including working memory, flexibility, problem-solving, and planning. Children’s executive functioning abilities in early childhood predict later reading and mathematics achievement better than IQ scores.¹⁰⁷ In the Jumping Feet activity, shoe prints encourage children to jump, developing their ability to control impulses and think flexibly as they match the random pattern and think about their next step. Caregivers can also encourage children to switch up the pattern—signage suggest that they can try putting one foot where they see two and two where they see one, thereby targeting cognitive inhibition. Finally, Hidden Figures activates children’s curiosity by encouraging them to search in the metalwork and its shadow for images of food, animals, and any other objects they can locate (Figure 7). This activity sparks scientific curiosity by introducing a level of uncertainty about how the design creates different images at different times of day. As the sun moves across the sky, different shapes are revealed on the ground below. Building this kind of curiosity leads to exploratory behavior and helps children become strong problem solvers¹⁰⁸. Children can also develop spatial skills by figuring out how the images are projected onto the ground.

The development of Urban Thinkscape started with the principles of how people learn most effectively and how those principles relate to specific content areas of interest. Neighborhood selection for Urban Thinkscape started examining demographic factors and community resources to identify a needy geographic area. The researchers and the William Penn Foundation identified the West Philadelphia as the place to implement Urban Thinkscape due to its Promise Zone designation, since there was a cross-sector effort already in place to organize entities around building neighborhood capacity. The Promise Zone includes 35,315 residents with an overall poverty rate of 50.78 percent, nearly double the city's rate of 25.7 percent.

The director of the Promise Zone Initiative identified key, active neighborhood associations and community groups within the Promise Zone. These groups included Belmont Alliance Civic Association, West Powelton/Saunders Park RCO, and Mantua Civic Association. He shared with these groups an overview of the proposed Urban Thinkscape project, including written material, and gauged interest among leaders of the associations and groups in attending a meeting with leadership team members.

Leaders of neighborhood associations and community groups who had expressed interest were invited to attend two meetings of community leaders that was facilitated by the project team. The goal of these meetings was to introduce community leaders to the project and foster buy-in. The following topics were covered:

- Asked what they want to see happen for children and families in the community
- Introduction to the concept of Urban Thinkscape
- Questions and comments about Urban Thinkscape
- Asked for ideas about where installations could be placed
- Asked for feedback on proposed designs

Additionally, two community focus groups were set up by the Action for Early Learning program at Drexel University in collaboration with the People's Emergency Center. The meetings were hosted at the Rowan House of PEC. Family ambassadors recruited participants, each of whom received a gift card. The goal of the focus groups was to elicit feedback on site selection and designs and gain an understanding of community needs and interests. The following topics were covered:

- Asked about opportunities to improve neighborhood for families and kids
- Introduction to the concept of Urban Thinkscape
- Asked for ideas about where installations could be placed

The leadership team took steps to assure the focus group participants' concerns and desires for the neighborhood children were heard. We wrote an op-ed for a local public radio station that reflected the input from the participants for increased programming during out-of-school time. We also connected the Family Ambassadors with the READ! by 4th program because library programs were noted as a priority.

The feedback received from these meetings was given top priority during discussions with city leaders, and as a result, a privately owned lot located in the Belmont neighborhood was selected as the location of the first cluster of Urban Thinkscape designs. The lot is situated near the location where Martin Luther King, Jr. led the "Freedom Now" rally on August 2, 1965. The decision to group designs in a cluster was based on findings from the Ultimate Block Party, which showed that it takes exposure to as few as three activities in a group to change caregivers' attitudes towards playful learning.¹⁰⁹

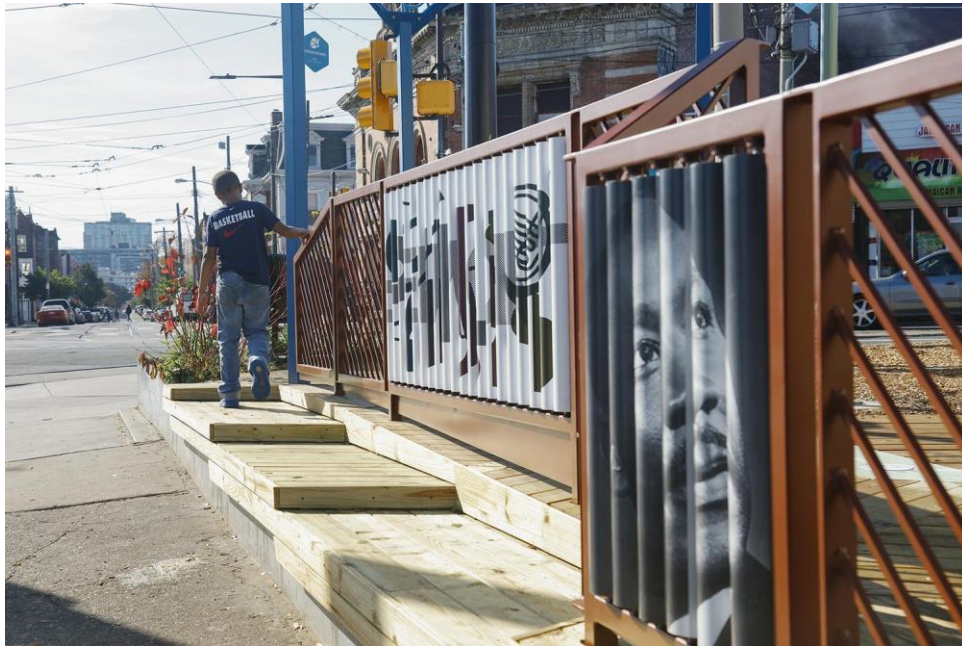


Figure 4. Puzzle Bench design at Urban Thinkscape.



Figure 5. Stories design at Urban Thinkscape.



Figure 6. Jumping Feet design at Urban Thinkscape.



Figure 7. Hidden Figures design at Urban Thinkscape.

One other critical piece of the project involves community data collectors. Community members are collecting pre- and post-implementation observational and survey data at both the Urban Thinkscape site and a control site playground in the same area. Community members received payment and job training as a part of their participation in the project. Through the observations and surveys, community data collectors gather information about the following goals of Urban Thinkscape: (1) Families will be more engaged and interactive with the public space; (2) Caregiver-child discourse around public spaces will be increased along with enhanced

family interaction; and (3) Families will begin to understand and change their attitudes regarding the links between play and learning.

Across both Urban Thinkscape and a control site playground, 280 adult-child groups were observed. The control location was chosen since it is one of the playgrounds closest to the Urban Thinkscape site within the Promise Zone area. The goal was to select an existing playspace location where we might capture caregivers and children interacting naturally around play. At pre-test, data demonstrated that fewer types of language and fewer conversations in general were heard at the future site of Urban Thinkscape than the control playground (Figures 8 and 9).

Post-test data revealed that the installation of the designs resulted in significant increases in specific types of adult and child language use at the Urban Thinkscape site and in comparison to the control site playground (Figure 8). These data also demonstrated that caregivers and children were having longer conversations at the Urban Thinkscape site after the installations were placed than they were previously—and in comparison to the control site playground. It is also worth noting that the introduction of the Urban Thinkscape designs was related to a significant increase in the percentage of caregivers who followed their children's focus, either verbally or non-verbally, during the course of their interactions at the site (Figure 10). This means that caregivers were engaged with their children in ways that supported the contributions of the children and are critical for the development of children's communication foundation.¹¹⁰

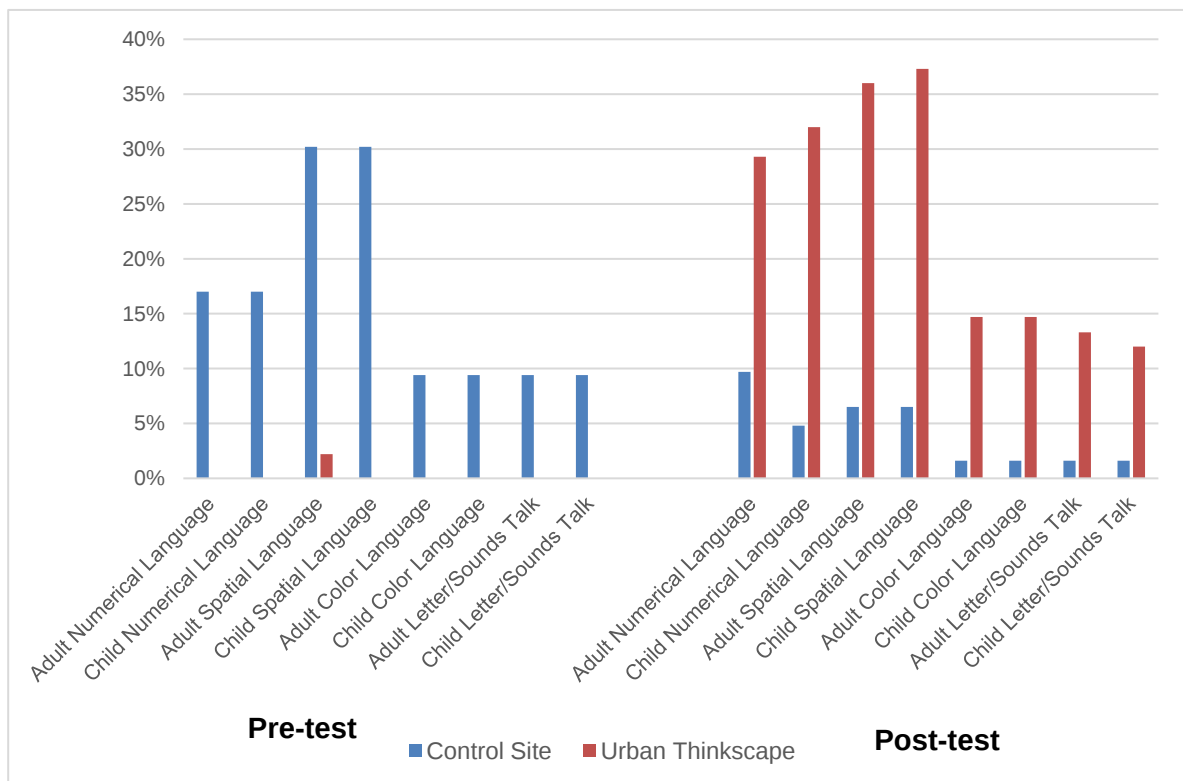


Figure 8. Percent of caregiver-child groups using specific language categories at pre- and post-test.

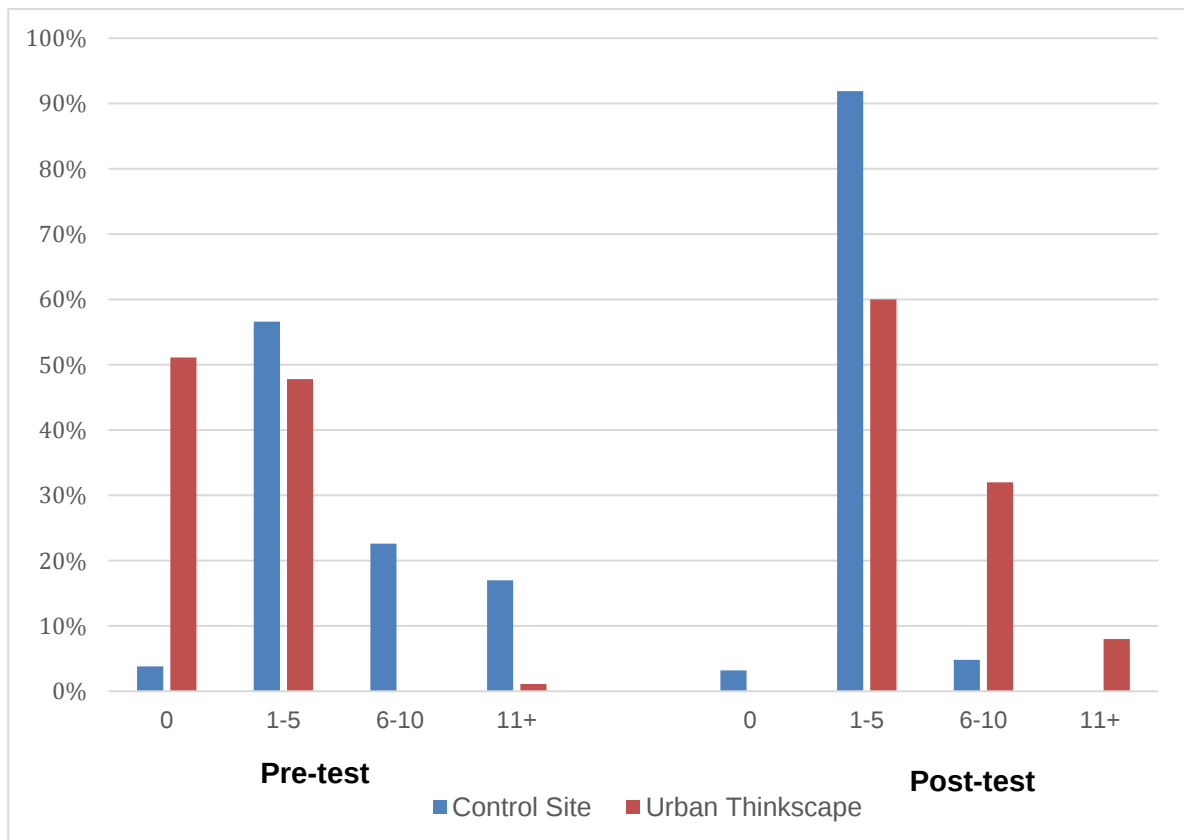


Figure 9. Percent of caregiver-child groups within each range of conversational turns at pre- and post-test.

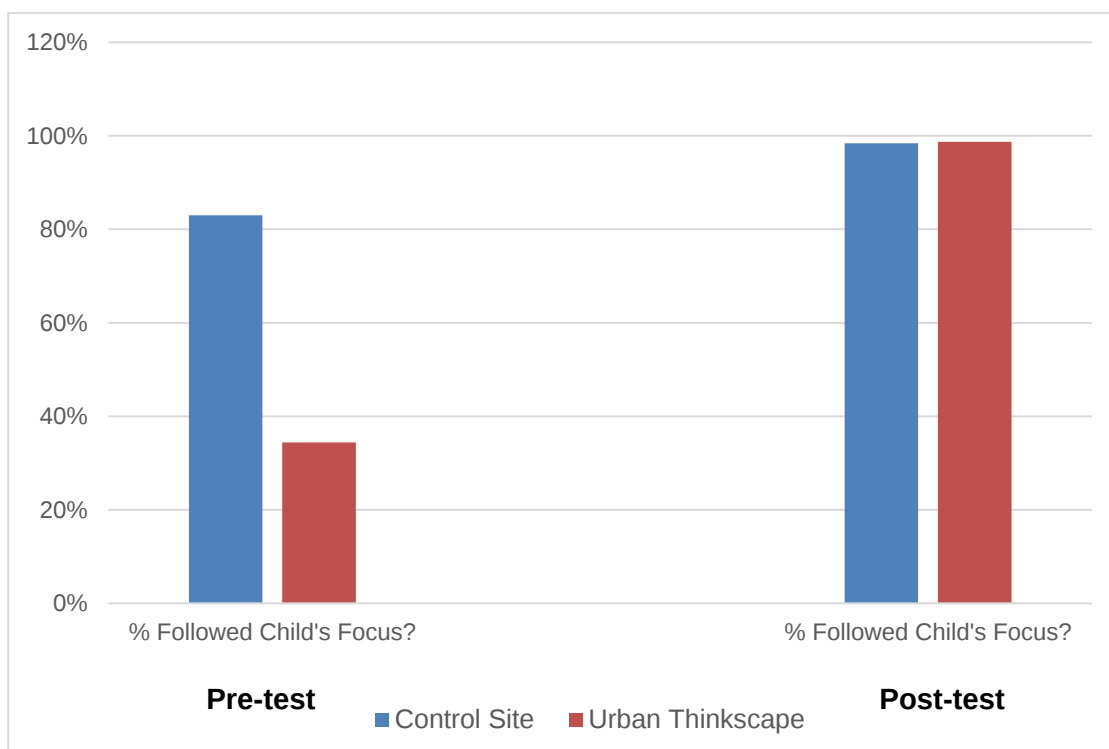


Figure 10. Percent of caregivers who followed their child's focus during an interaction at both pre- and post-test.

Through these findings, Urban Thinkscape has demonstrated initial proof of concept: the hypothesized changes in caregiver-child use of the public space and interactions were seen after the designs were installed. The next step for Urban Thinkscape is collecting additional data regarding the boost that adding simple, additional signage can provide for increasing caregiver-child interaction. Song et al.¹¹¹ demonstrated that including information to inform the caregiver how an activity is educational puts the parent in a frame of mind to notice educational opportunities—they begin to see the area as a learning space for their children.

Parkopolis: Can we enrich public spaces even further by building in more opportunities for talk about academic concepts?

The above Learning Landscapes projects test the ability to change caregivers' attitudes towards the connection between play and learning, increase caregiver-child discourse and interactions, and engage communities as true partners in the process. Might it be possible to build specific academic competencies that children typically learn in school, in the context of parks and playgrounds? Research demonstrates that games can build key academic skills outside of school.^{112,113} In the latest iteration of Learning Landscapes, we enrich public spaces with math and science learning opportunities using our life-size playful learning board game—Parkopolis.

In Parkopolis, children roll dice to advance around the board and draw cards that engage them in different mini-games and activities. Derived from cutting-edge research in the science of learning, Parkopolis is designed to promote engagement and STEM dialogue between caregivers and children. The games and activities that compose Parkopolis are designed to apply principles derived from rigorous research to this new challenge in a manner that is sustainable and scalable.

Research demonstrates that playing linear numerical board games promotes children's math development^{114,115} and that children learn more effectively when they engage with their whole body^{116,117,118} rather than when they learn in more passive contexts. Further, fractions are a particularly difficult concept for children in formal school¹¹⁹; thus, our game incorporates a redesign of dice that includes fractions—and the spaces of the game board are divided into fourths—this way children can advance two and a half, or three and three-quarters spaces and have an embodied fraction learning experience.

The activities in Parkopolis were born from the scientific literature targeting critical STEM skills that predict later school success; such as, patterns,^{120,121} numeracy and spatial skills,^{122,123,124} geometry,¹²⁵ measurement,¹²⁶ and fractions.^{127,128} See Parkopolis and fraction dice designs in Figure 11.



(a)



(b)

Figure 11. Parkopolis: (a) game board; (b) fraction dice.

Parkopolis also pulls from domain-general learning skills that help children learn regardless of the academic content. This includes executive functioning (i.e., working memory, cognitive flexibility, and inhibition¹²⁹), approaches to learning (i.e., strategic planning, persistence, open-mindedness, sustained focus, communication, and cooperation¹³⁰), and fluid reasoning, which is the capacity to think logically and solve novel problems, critical for scientific and computational thinking.^{131,132} Finally, Parkopolis promotes physical activity and gross motor skills, which have empirically-demonstrated benefits for children's cognition and health.^{133,134} To generate the game cards we pulled directly from the literature and contacted leaders in the field to ensure the most relevant content was represented. For example activity cards, see Figure 12.



Figure 12. Example activity cards from Parkopolis targeting measurement (a), and executive functioning (b) appear in both English and Spanish.

The first pilot study of Parkopolis was conducted across 3 summer camps in Lausanne, Zurich, and Zug, Switzerland, in August 2017.¹³⁵ We observed 35 small groups of children either playing Parkopolis or playing an outdoor game of their choice. In total, we observed 158 children for their language, engagement, and approaches to learning. Observers rated children’s STEM language use (e.g., numeracy language, fraction language, spatial language, measurement language) on a Likert scale ranging from 1 (0 utterances) to 5 (16+ utterances).

Compared to the control condition, children playing Parkopolis used significantly language about whole numbers, fractions, space and geometry, measurement, and made more observations (see Figure 13). Similarly, children playing Parkopolis were more engaged, showed greater confidence in dealing with complexity, and persisted more in working with difficult problems, compared to the control condition.

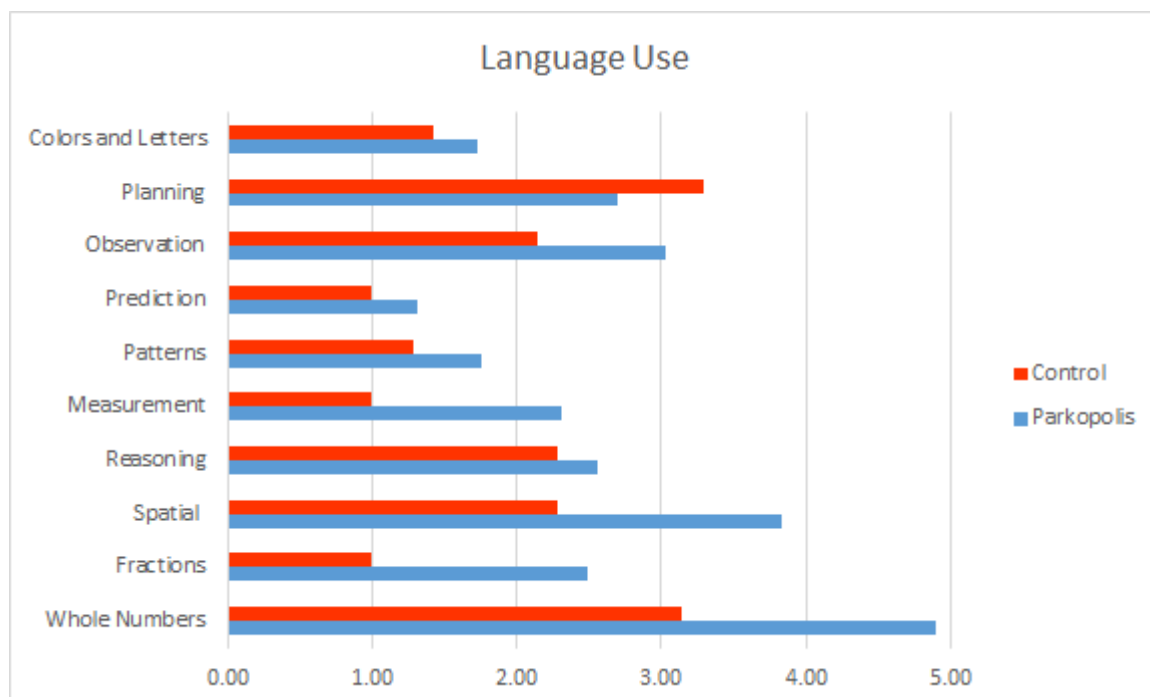


Figure 13. Mean language use in the Parkopolis and Control conditions on a 5-point Likert scale (1 = 1-5 verbalizations, 2 = 6-10, 3 = 11-15, 4 = 16-20, 5 = 20+).

These pilot data demonstrated that Parkopolis successfully targeted STEM content. It also showed that the game engaged children and provided a platform for them to exercise their approaches to learning and executive functioning skills. A key development goal of Parkopolis was to design the game to be so intuitive that children and families could play with minimal written instruction and no supervising staff to explain or facilitate it.

While encouraging, this pilot study also had several limitations. First, the concept for the game was designed for installation in urban low-income environments. However, the campers in this study came from families that could afford to send them to a private summer camp. Further, children were on the older end of the age spectrum that we intend to target with Parkopolis, which is the general age range for Learning Landscapes projects in general.

Nonetheless, the pilot study accomplished its main objective to test whether children would play the game with minimal guidance and whether there would be targeted learning advantages. A larger version of Parkopolis is now open at the Please Touch Museum in Philadelphia, Pennsylvania. We chose to partner with Please Touch because they serve a high percentage of low-income families and they get thousands of visitors per week. We are currently conducting a 12-week evaluation study of Parkopolis at the museum compared to another STEM focused exhibit at the museum. We are coding for STEM language and parent-child interactions, as well as parent attitudes and beliefs about the connection between play and learning. Preliminary results suggest that children and caregivers playing Parkopolis are using significantly more numeracy, fraction, pattern, planning, and reasoning language, as well as more questions and physical activity compared to the control exhibit.

What Have We Learned?

Learning Landscapes projects can promote learning and interactions among children and families from low-income communities, while instilling community pride and civic engagement. The Learning Landscapes initiative takes an innovative approach by joining the pursuit of educational equity with the development of conscious cities to transform unexpected places into opportunities for playful learning. Drawing from principles of the science of learning on how people learn best with playful activities, Learning Landscapes projects target academic content and 21st century skills in non-traditional ways.

We began by asking if we could bring people together in a public space to explore playful learning in the Ultimate Block Party. UBP showed us that families are eager to learn more about stimulating their children outside of school, and that interacting with as few as three playful learning activities can change their views of the potential for learning through play.¹³⁶ Next, we asked how trapped spaces, like supermarkets, could be infused with learning opportunities. Supermarket Speak demonstrated that signage in the places families spend their time can produce a meaningful boost in caregiver-child interactions in low-income neighborhoods.¹³⁷ Building on that investigation, we extended playful learning opportunities into public spaces. In Urban Thinkscape, we refined our model for community engagement and showed that urban revitalization and playful learning can be married to spark learning and interaction.¹³⁸ Finally, pilot data from Parkopolis suggest that we can embed even more sophisticated content into such public space installations. Parkopolis elicited the intended STEM language, engagement, and

approaches to learning skills in an unsupervised setting that may generalize to city parks around the globe.

These projects are encouraging examples of how to add learning opportunities into the many city revitalization movements mobilizing globally. Learning Landscapes shows enormous promise for how we might capitalize on “the other 80 percent” of time when children are awake and not in school. If we are to move the needle on the glaring gaps between low- and middle-income children, city-wide initiatives like Learning Landscapes must be designed as part of the solution. Only with bold efforts will we have a large enough dose to help all children thrive.

Key Learnings from Learning Landscapes

- 1. Family and community participation and buy-in must be obtained and fostered from project outset.**
 - a. Engage parents and communities from the start to build local ownership and ensure that every space is designed based on the needs and wants of the actual “end-users”.
 - b. Build coalitions and partnerships across various disciplines and sectors to leverage the diverse resources and skills of various actors needed to incorporate playful learning principles into everyday public and private spaces as a matter of course.
- 2. Keep interventions simple yet science-based.**
 - a. Ensure interventions are as simple as possible without sacrificing quality. Ensure cost structures are affordable to implement and maintain at scale for whoever will eventually take it up, be it government, private sector and/or communities.
 - b. Adhere to the scientific principles of “how” children learn and to the 6Cs of “what” children learn both of which are driving the learning gains, and should be replicated across contexts while adapting the rest of the model to local context.
- 3. Make interventions iterative and build on past experience.**
 - a. Build in an iterative learning process so that each city can continue to adapt and evolve based on the latest, most robust evidence emerging from ongoing scientific studies and practical experience.
- 4. Build on to existing infrastructure as much as possible to increase sustainability.**
 - a. Infuse playful learning activities into existing city infrastructure rather than creating new parallel structures that will likely be unsustainable. This requires engaging key decision-makers from the start and understanding their incentives and priorities—both those who are likely to champion an initiative and those who stand to lose from it.

Next Steps: Scaling Up Learning Landscapes Approaches

To date, we have only looked at the impact of individual projects on caregiver-child language and interactions. As we build these installations into the fabric of the city, we hypothesize that Learning Landscapes will also engender neighborhood-level effects, including building community knowledge of how young children learn best, the importance of play for

learning, and the potential for turning public spaces into hubs that encourage children’s learning and educational outcomes.

Right now, Philadelphia serves as the living laboratory for testing the expansion, adaptation, and replication of Learning Landscapes on a city-wide, national and global level. The combination of educational challenges around the world with the recognition that business as usual will not address the scope of the problem provides an opportune moment to maximize the 80 percent of time children spend outside of the formal classroom and to augment school-learning. There is clear demand from other cities in the U.S. and around the world to learn from Philadelphia’s experience to draw key insights, based on rigorous evidence, for infusing deliberate learning opportunities into public and “captive” spaces. The potential to expand and adapt these playful learning approaches to a wide range of contexts, including both low- and high-resource communities, is tremendous. Therefore, we intend to capture what actors in Philadelphia do to unite around the common activity of supporting children’s development and learning through transforming city spaces and sharing these lessons learned from the process both within and outside of Philadelphia. This includes designing the installations not only for impact but also for cost efficiency and sustainability. By identifying and codifying the core drivers behind the effectiveness of these installations, other cities can build on what has been tried and learned in Philadelphia and in turn, further contribute to the growing evidence base around playful learning.

The table below identifies the short-term next steps for the Learning Landscapes initiative. The overarching theory of change guiding the initiative is to experiment and learn from not only Philadelphia as the Learning Landscape initiative’s laboratory but a range of other projects across the U.S. and the globe. This type of learning could be facilitated by a strong community of practice where actors share designs, community engagement approaches, scaling plans, tracks impact and potentially monitors a small set of shared indicators across interventions. Secondly, the central lessons from the pilots, including how to successfully scale them across communities, could be distilled and codified for policy uptake. Broad dissemination, including policy advising and implementation training in particular for city-wide actors that influence urban planning and design, could help support the sustainable uptake of the Learning Landscapes approach.

Phase	Activities
1. Learning from pilots	· Determine impact · Outline the process · Determine scaling process · Develop communications strategy across projects
2. Codifying learning for policy change and implementation	· Determine outcomes to codify · Decide which constituents to reach and how best to reach them · Take steps to sustainably change practice and policy

3. Dissemination to key stakeholders	· Outreach · Training and technical support · Networking · Community practice · Movement building
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Transforming cities into deliberate playful learning opportunities requires considering scale from the start. Research and experience repeatedly demonstrate that even the most effective pilots do not automatically scale, but rather, any sustainable and equitable expansion must be carefully designed and planned for from the outset. This requires a combination of technical and political strategies.

Ultimately, the intention of Learning Landscape is to help maximize outcomes for children and communities through the development of a new approach where learning sciences and placemaking cross-fertilize each other. Rather than focusing on spreading and scaling individual initiatives, Learning Landscapes hopes to contribute to a stronger ecosystem of evidence-based efforts that promote children’s learning and development. This requires thinking beyond individual pilots and institutional agendas and instead focusing on collective action needed to strengthen the field overall. We argue that this requires three interrelated efforts going forward:

1. **Generation of robust evidence on playful learning:** While the data shared in this paper is an important contribution to the field of playful learning, as a community we need to continue to build the evidence base and gather data that builds continuous learning. This includes developing a few shared metrics across sites that measure not only improvements on child-caregiver language and interaction but also on community-level impact such as revitalizing neighborhoods and reinvigorating cities. Tight feedback loops are needed so that information collected from these and other installations and initiatives continue to inform and shape efforts to transform cities into playful learning hubs.
2. **Development of a coordinated global movement around playful learning:** The task of improving children’s learning outcomes, urban renewal, and other complex social challenges require the combined efforts of all. Therefore, we need a strong, coordinated network of actors collectively pooling their expertise, resources, and skills around a shared vision and aligned incentives. Collaboration and knowledge sharing is crucial to ensure that we are building on experiences and not re-inventing the wheel. This requires a central hub to help coordinate efforts, connect partners, codify learning emerging across various sites, and disseminate findings in a way that can help to inform policy change and sustainably scale efforts.
3. **Provision of training and technical support to implement playful learning initiatives:** Large-scale transformative change faces both an information and action gap—more information is often required on *what* is working as well as more guidance around *how* it is achieved. In the case of Learning Landscapes, we have found that in addition to generating, distilling, and sharing more knowledge, other actors and cities

require implementation support, such as in the form of guidelines, tools, and technical assistance. This type of targeted support would enable other cities to create their version of Learning Landscapes while still adhering to some fundamental principles and maintaining quality.

Collective action around these three recommendations would help advance Learning Landscapes' vision to help all families support children to thrive and develop the breadth of skills needed to lead healthy, safe and productive lives by leveraging learning sciences and placemaking to transform public and trapped spaces that are easily accessible to families and children.

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