Learning Landscapes: Where the Science of Learning Meets Architectural Design

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ABSTRACT—*Rich learning opportunities in and out of school are critical for children to develop positively. Learning Landscapes is a new initiative that marries the fields of urban design and developmental science to bring playful learning opportunities to places where children and families spend time. Through this initiative, we have transformed parks, bus stops, grocery stores, and other public places into venues for playful learning interactions. In this article, we review the research on these projects, and map the vision and next steps of this initiative. By bringing learning opportunities to children and families who need it most, our goal is to equip parents and educators with the contexts and tools they need to support all children in developing the skills for success in school and life.*

KEYWORDS—*playful learning; STEM education; urban design*

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To prepare children for success in school and life, we must foster their academic skills (e.g., math, language, literacy, and science) and their 21st century learning skills (e.g., communication, collaboration, critical thinking, creative innovation, and confidence; Golinkoff & Hirsh-Pasek, 2016). Largely, efforts toward this goal have focused on improving quality and expanding access to early childhood education (Burchinal, 2018). While early education is critically important, even children attending programs full time spend only 20% of their waking hours in school (Meltzoff, Kuhl, Movellan, & Sejnowski, 2009). In this article, we ask how we might use the other 80% of children's time to create learning opportunities for families.

One bold answer is to combine the latest evidence from the science of learning with the global cities movement, which is designed to make cities more livable and friendly to families. What if we could infuse spaces and objects (e.g., benches) with designs informed by the latest science of learning? What if ordinary environments were crafted in ways that sparked the kind of active, engaged, and meaningful social interactions that support effective learning (Hirsh-Pasek et al., 2015)? Today, more than half the world's children live in cities. By 2050, that number is projected to rise above 70%. By marrying urban planning and developmental science, we can embed playful learning opportunities in places where children and families naturally spend time together. We are developing this approach through a series of projects that fall under the umbrella of Learning Landscapes. We have data from pilot projects transforming parks, bus stops, libraries, and grocery stores—in the United States and abroad—with playful learning installments that spur multigenerational interactions among families. In this article, we summarize our research on Learning Landscapes and map our vision for bringing playful learning opportunities to cities in a scalable and sustainable way.

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A PUBLIC-HEALTH APPROACH TO EDUCATION

We have written about the benefits of Learning Landscapes for children from low-income families (Hassinger-Das, Bustamante, Hirsh-Pasek, & Golinkoff, 2018), but we also recognize the importance of these projects for all children. From a strengths-based perspective, Learning Landscapes are meant to interact with families' knowledge—the information and skills already present in their households (Moll, Amanti, Neff, & Gonzalez, 1992)—to produce meaningful play and learning experiences for children in the places families spend time. We also pull from classic approaches to public health. For example, Rose's theorem holds that a small-dose intervention disseminated to a large group of people has a greater net impact than a more intensive intervention provided to a smaller group (Rose, 1981). Learning Landscapes installments are low in individual effort (i.e., once installed, they require no staff or facilitators); by placing them in densely populated urban environments, we ensure exposure to many children and families. Both these factors align with best practices in public-health prevention science (Frieden, 2010).

Public health also provides successful models for altering public spaces to promote positive behaviors. For example, installing exercise equipment in public parks increases people's use of parks as well as their level of physical activity (Cohen, Marsh, Williamson, Golinelli, & McKenzie, 2012). Similar light-touch interventions (e.g., installing signs that remind pedestrians of the benefits of exercise, placing art and music in stairwells) have increased the rate at which people use stairs (Boutelle, Jeffery, Murray, & Schmitz, 2001; Dolan et al., 2006). Learning Landscapes builds on these models to bring opportunities for playful learning and parent–child interactions into public spaces through engaging and aesthetically beautiful installments.

LEARNING LANDSCAPES' THEORETICAL MODEL

Learning Landscapes aligns with several other initiatives, such as Urban95 from the Bernard van Leer Foundation and the Conscious Cities movement. Urban95 considers how 3-year-olds (who are typically about 95 centimeters, or 37 inches, tall) experience cities, and challenges decision makers to change the design of cities to be friendlier to their youngest residents. Similarly, Conscious Cities works to create responsive, people-centric cities through cognitive science and technology.

Learning Landscapes adds a critical layer of playful learning to this drive to improve cityscapes for their inhabitants. Play experiences may help children and families connect with the spaces around them (Sumerling, 2017). Playful learning consists of three types of play: free play (no direct adult involvement), guided play (developmentally appropriate support by adults toward a learning goal), and games (rule-based activities with targeted or tangential learning goals; Hassinger-Das et al., 2017). All three capitalize on contexts in which children learn best, contexts that are active (not passive), engaged (not distracted), meaningful (linked to children's lives), and socially interactive (Hirsh-Pasek et al., 2015). Play also encourages the development of a breadth of 21st century skills (Golinkoff & Hirsh-Pasek, 2016).

The theory of change (Figure 1) suggests that Learning Landscapes aims to affect individual, family, and communitywide outcomes. Based on this theory, the project alters public space; encourages positive use of public space; adds playful learning installations to the environment; and engages and welcomes community members, families, and children. Learning Landscapes targets the learning beliefs of caregivers, dyadic interaction and communication at the sites, as well as community engagement, buy-in, and commitment. The goals of the initiative are to embed playful learning opportunities in public spaces with an eye toward developing 21st century skills. An earlier project, the Ultimate Block Party (Grob, Schlesinger, Pace, Golinkoff, & Hirsh-Pasek, 2017; Zosh, Fisher, Golinkoff, & Hirsh-Pasek, 2013), which took place in Central Park in 2010, demonstrated that families are interested in playful learning activities. We wanted to take this premise a step further and create activities where families live and work. In this article, we review three of the Learning Landscapes projects.

LEARNING LANDSCAPES PROJECTS

Supermarket Speak: Can Signs in Trapped Spaces Increase Parent–Child Engagement?

Research demonstrates the importance of discourse and engagement between caregivers and children in building academic skills. The quality of the communication foundation caregivers and children construct together, which includes not only the amount of words heard but also engaging and responsive interactions between caregivers and children, is largely responsible for language growth (Adamson, Bakemen, Deckner, & Nelson, 2014; Hart & Risley, 1995; Hoff & Naigles, 2002). Similarly, talking about math is a stronger predictor of children's acquisition of number words than their socioeconomic backgrounds (Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010). As such, discourse and engagement between caregivers and children can affect a variety of developmental areas.

For our Supermarket Speak project, we first selected three supermarkets in the Philadelphia, Pennsylvania and Wilmington, Delaware areas, in neighborhoods of both low- and middle-socioeconomic status (SES; Ridge, Weisberg, llgaz, Hirsh-Pasek, & Golinkoff, 2015). Researchers installed signs in the dairy and produce aisles that offered examples of questions parents could ask their children while they shopped. Research assistants observed shoppers to determine the amount of interaction (e.g., conversational turns, gestures) families used before and after the signs were installed. The signs made no difference in supermarkets in middle-SES neighborhoods, but in stores in low-SES areas, adults and children interacted 33% more when the signs were posted than when they were not (Ridge et al., 2015).

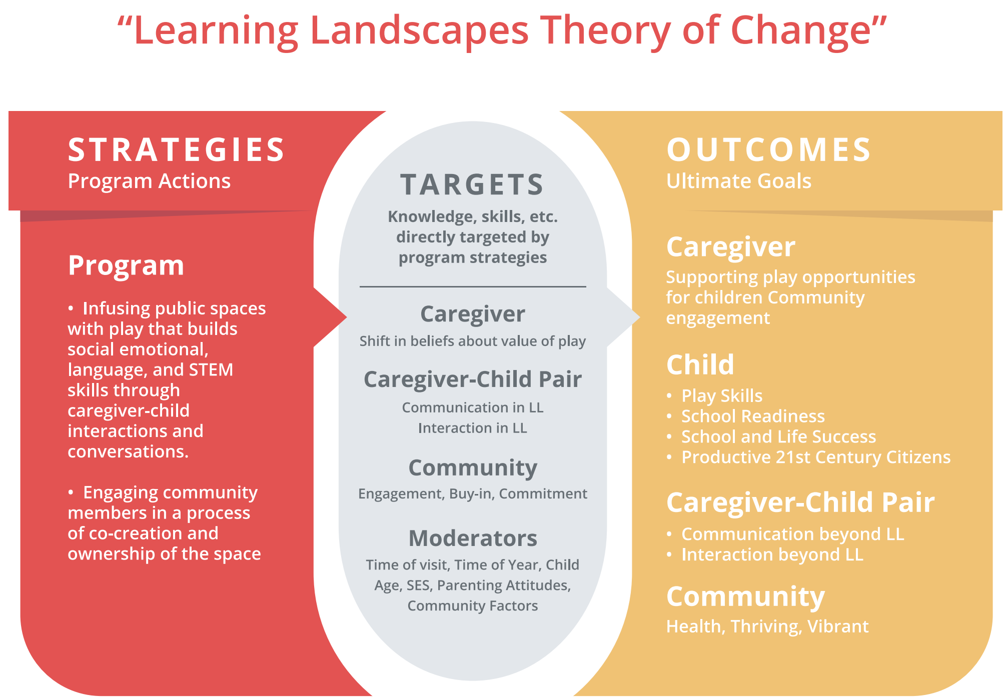

Figure 1. Learning Landscapes theory of change explains the strategies, targets, and outcomes of Learning Landscapes installations. [Color figure can be viewed at wileyonlinelibrary.com]

Replication of this work is being tested in the United States and internationally, with funding from several foundations.

Urban Thinkscape: How Can Outdoor Public Spaces Be Infused With Playful Learning Opportunities?

The success of Supermarket Speak led us to question whether similar results could be generated in outdoor public spaces. For our next project, Urban Thinkscape, we placed four installations—designed by architect Itai Palti in collaboration with community members—at a bus stop and adjacent lot in West Philadelphia, Pennsylvania. Community partners made key decisions throughout the process, from selecting the project site to contributing to the design. First, the research team hosted a meeting of the leaders of local registered community organizations to ask what needs they wanted addressed for children in their community. In these discussions as well as in subsequent focus groups with community members, we also asked community members to help select the location of Urban Thinkscape and provide feedback on conceptual drawings of the designs. Once the feedback was incorporated, we contracted with Public Workshop, a local organization committed to creating opportunities for community members to be part of designing their cities, to build one of the installations; more than 100 community members were involved in building the installation. We also formed a project advisory committee that included members of city government (e.g., parks and recreation department, mayor's office, streets department), local nonprofits, academics, and the community leaders mentioned earlier. These community and project advisory groups came together to shape the design and vision for Urban Thinkscape. Additionally, several community members were hired by the project to observe and evaluate the installations. Our efforts to provide job training, employment opportunities, and ultimately a sense of pride in and ownership of the installment were driven by what we heard from the community in our meetings.

Designs installed in the pilot cluster included Puzzle Bench, Stories, Jumping Feet, and Hidden Figures (Figure 2). The designs were created to tap into active, engaged, meaningful, and socially interactive learning contexts (Hirsh-Pasek et al., 2015), while also targeting specific areas of learning, including spatial skills, language development, and executive functioning. Puzzle Bench used the back wall of a bus stop to challenge children and caregivers to complete four puzzles. The kind of early spatial and math skills fostered by puzzles are important predictors of later math and literacy abilities (Verdine, Golinkoff, Hirsh-Pasek, & Newcombe, 2017). The design called Stories asked children to jump from one narrative cue to another to create a story. Narrative skills are a crucial aspect of literacy development (Tabors, Snow, & Dickinson, 2011). The third design, Jumping Feet, reconfigured hopscotch into an executive functioning activity. The design, fashioned after the happy/sad task used to study executive function skills (Lagattuta, Sayfan, & Monsour, 2011), features a pattern of one foot pad and two feet pads that require children to inhibit their movements. Signs suggest that users try to "put one foot where there are two feet and two feet where there is one foot." Executive functioning skills in early childhood predict later reading and math outcomes more successfully than IQ scores (Zelazo, Blair, & Willoughby, 2016). In the Jumping Feet design, children jump from shoe print to shoe print, exercising cognitive flexibility as they match the random pattern of feet on the ground. Signs suggest to adults that they encourage children to switch up the pattern (e.g., use two feet when there is one foot and one foot when there are two feet) to further build inhibitory skills. Finally, Hidden Figures taps into children's curiosity by encouraging them to find images of food, animals, and other objects in a metalwork structure. This activity ignites scientific curiosity by asking children to resolve their uncertainty about how the metalwork creates different pictures at different times of day. Aligned with the sun's movement across the sky, different shapes are revealed on the ground. Scientific curiosity helps children become more successful problem solvers (Bjorklund & Gardiner, 2010). Urban Thinkscape produced significantly more language and parent–child interaction than a traditional playground in the same neighborhood (Hassinger-Das, Bustamante, Hirsh-Pasek, Golinkoff, Magsamen et al., 2018).

Parkopolis: Can We Further Enrich Public Spaces by Building More Sophisticated Content?

Parkopolis (Figure 3) is a life-sized board game that endeavors to enrich public parks and play spaces with opportunities for learning about science, technology, engineering, and math (STEM) traditionally found in school. Parkopolis provides embodied learning opportunities that nurture cognitive and social development in a playful and physically active context. Children who play Parkopolis roll dice to advance around the board and draw cards that provide challenges and activities. Games can be a powerful tool for learning academic skills outside school (Hassinger-Das et al., 2017). Specifically, playing linear numerical board games promotes children's math development (Siegler & Ramani, 2008), and children learn more effectively when they engage with their whole bodies (Dackermann, Fischer, Nuerk, Cress, & Moeller, 2017) than they do in more passive contexts. Learning fractions is a common stumbling block for children (Jordan, Resnick, Rodrigues, Hansen, & Dyson, 2017); Parkopolis redesigned dice to mix whole numbers and fractions so children can advance two-and-a-half or four-and-three-quarters spaces.

The activities in Parkopolis (Figure 3) draw on research on early STEM learning, targeting skills such as patterns (Rittle-Johnson, Fyfe, Loehr, & Miller, 2015), numeracy and spatial skills (Geary, Bailey, & Hoard, 2009), geometry (Verdine et al., 2017), measurement (Szilágyi, Clements, & Sarama, 2013), and fractions (Fuchs et al., 2016). Parkopolis also targets domain-general learning skills like executive functioning (i.e., working memory, cognitive flexibility, and inhibition; Diamond & Lee, 2011), approaches to learning (i.e., strategic planning, persistence, open-mindedness, sustained focus, communication, and cooperation; Fantuzzo, Gadsden, & McDermott, 2011), and fluid

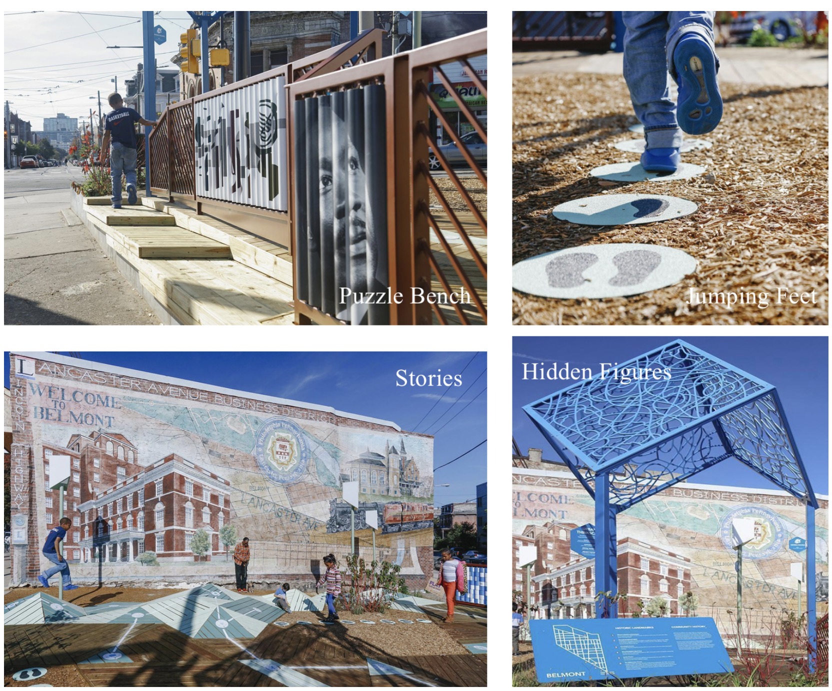

Figure 2. The Puzzle Bench, Jumping Feet, Stories, and Hidden Figures installations in the Urban Thinkscape project in Belmont, West Philadelphia. [Color figure can be viewed at wileyonlinelibrary.com]

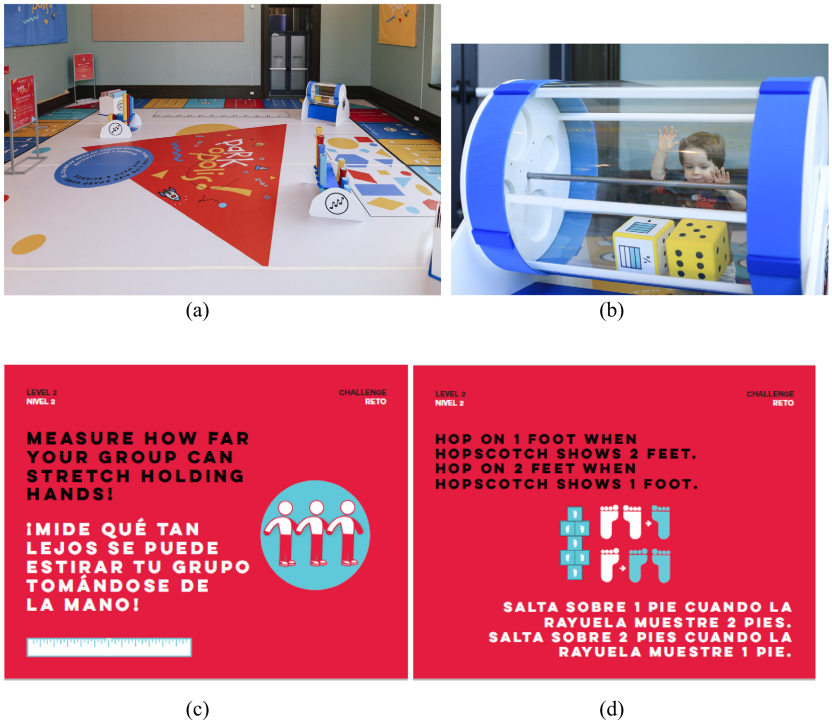

Figure 3. **Designs for Parkopolis: (a) game board, (b) fraction dice, (c) cards targeting measurement, and (d) cards targeting executive functioning. [Color figure can be viewed at wileyonlinelibrary.com]**

reasoning (i.e., logical thinking and problem solving; Green, Bunge, Chiongbian, Barrow, & Ferrer, 2017).

In the first pilot study, children playing Parkopolis used significantly more STEM language (e.g., whole number, fraction, spatial, and measurement language); made more observations; and showed greater engagement, confidence, and persistence working with difficult problems than children in a control condition who were asked to invent their own game in an outdoor space (a proxy for what children may do at a park without Parkopolis; Hassinger-Das, Bustamante, Hirsh-Pasek, & Golinkoff, 2018). A larger version of Parkopolis is being tested at the Please Touch Museum in Philadelphia, Pennsylvania. This next iteration uses signs that encourage children and families to reflect on the learning (e.g., “Math language builds math skills: Talk about numbers, fractions, counting, adding, and subtracting”), which can make learning more engaging and improve retention (Hirsh-Pasek & Golinkoff, 2016). Children and caregivers who played Parkopolis used significantly more numeracy, fraction, pattern, planning, and reasoning language, as well as asked more questions and engaged in more physical activity than when they took part in another STEM-focused exhibit at the museum (Bustamante, Hirsh-Pasek, & Golinkoff, 2018).

NEXT STEPS AND IMPLICATIONS

Learning Landscapes projects demonstrate how architectural design features grounded in the science of learning can organically enhance the ability to promote learning and interactions among children and families. Learning Landscapes takes a strengths-based approach by leveraging families’ excitement about increasing their role in educating their children outside school in an open-ended way that feels natural and comfortable. One reason Learning Landscapes projects do not include signs that tell parents and children how to interact is that we do not believe the goal of these projects is to fit families into what has primarily been a White, middle-class model of success. Rather, the efficacy of the projects relies on families bringing their own knowledge and experiences to bear on the installations, in combination with simple prompts and suggestions for conversation and interaction. Learning Landscapes marries the pursuit of educational equity with urban revitalization to transform unexpected places into conduits for playful learning.

The next step in this initiative is to transform Philadelphia into the first playful learning city, which will serve as a lab for iterative testing and improving new Learning Landscapes installations, and as a model for national and global dissemination. We are building on the model of community and city engagement started in Urban Thinkscape. By concentrating Learning Landscapes installments in one area, we hope to reach a saturation point where the increased play and interaction extend beyond the installments and engender a community-level shift in adults’ beliefs around play and learning, and in children’s educational outcomes. During scale-up efforts in Philadelphia, we will identify core components and key stakeholders necessary for successful implementation. We have found that community engagement and co-creation, local ownership of installments, simple and intuitive designs, consideration of cultural context, and a base in the science of learning are pivotal drivers of success. Our aim is to develop common measures, trainings, and approaches to foster community partnerships, and to provide a hub where different initiatives that have reached proof of concept can be shared with and adapted by other communities.

Throughout this process, we have paid special attention to impact, efficiency, and sustainability. We strive for a model in which philanthropic dollars are required only to achieve one-time proof of concept for specific projects, after which Learning Landscapes installments can be embedded into city budgets for building and maintaining public spaces. Cities already spend money on bus stops and parks; Learning Landscapes provides a new model for cities to build public spaces that put children and playful learning at the center of designs.

Learning Landscapes is a natural experiment that engineers social spaces to promote interactions that, in turn, foster family interaction, talking, and thinking about language, literacy, mathematics, and science. This initiative presents a new platform for informal learning that has implications for all children and might enhance educational outcomes of low-income children, who typically have less access to enriching STEM experiences like children's museums, specialized electives, and afterschool programs.

CONCLUSION

As we strive toward an educational model that supports learning and development for all children, citywide initiatives like Learning Landscapes can be an evidence-based part of the approach. Only with bold efforts can we administer a large enough dose of community-based playful learning activities to help all children thrive. Cities in the United States and abroad want to infuse learning opportunities, based on rigorous evidence, into public and captive spaces. By honing a model that is effective, scalable, and sustainable, we hope Learning Landscapes spreads play and learning to cities all over the world. Ultimately, we aim to maximize learning in the 80% of time children spend outside school; foster 21st century learning skills; and prepare children to be the thinkers, inventors, and global citizens of tomorrow.

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