
TIME FOR LANDSCAPE PERFORMANCE 2.0? LESSONS AND TRAJECTORIES IN RESEARCH, EDUCATION, AND PRACTICE

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ABSTRACT

Over the past fifteen years, landscape performance has become a recognizable disciplinary emphasis in landscape architecture research, education, and practice, with many notable accomplishments in each domain (Whitlow et al., 2021). In research, numerous studies have examined what performance criteria to measure and how (LAF 2024; Chanse et al. 2022; Canfield et al. 2018a; Ozdil & Stewart, 2015). In education, landscape performance has been incorporated into courses across program curricula (Zawarus, 2022; Hendrix et al., 2020; Barnes et al., 2018). In practice, many firms have integrated aspects of landscape performance in project workflows and post-occupancy evaluations (LAF, 2020). For landscape performance to continue as a disciplinary emphasis, critical reflection on its current state is needed to reveal existing challenges and tensions, identify areas for improvement, and inform new opportunities and trajectories. Informed by data and observations from our respective practices and individual experiences as two academics, a landscape architecture practitioner, and a non-profit program manager, who have been central to the development and growth of landscape performance, we present snapshots of the status of landscape performance and suggest what is needed for its future as Landscape Performance 2.0. Our research revealed that critical adjustments are needed, especially in scientific outlook and rigor, funding, professional integration, and technology among other items revealed, for landscape performance to remain relevant in landscape architecture practices. Reflection on its current state is also critical for landscape performance to remain a disciplinary emphasis and advance as a core body of knowledge that integrates research, education, and practice. Our study aims to present a snapshot of the status of landscape performance in research, advocacy, education, and practice, as perceived and documented by the authors; to identify and examine challenges and tensions within landscape performance; and, examine how landscape performance might need to evolve or adapt to remain relevant in landscape architecture practices. What opportunities and trajectories are needed if we advocate for a new version, Landscape Performance 2.0?

Keywords

Landscape performance assessment, post-occupancy evaluation, case studies, professional practice, teaching, research, advocacy, challenges, trajectories

1 INTRODUCTION

Within the past decade, landscape architecture (LA) has experienced a period of reflection, reckoning, and reimagining. Much of this has been driven by concerns about sustainability, the impacts of climate change, biodiversity loss, natural disasters, environmental and social justice, economic stability, globalization, as well as evolving technology, and becoming a STEM (Science, Technology, Engineering, and Math) based discipline (Bowring & Swaffield, 2013; LAF, 2017; LAM, 2020; ASLA, 2024; ASLA, 2024a). Such factors will undoubtedly influence LA education and practice in the coming years. A similar introspection can also be seen in landscape performance studies (Ndubisi et al., 2015; Ozdil, 2018; Whitlow et al., 2021).

Over the past fifteen years, landscape performance (LP) has gained recognition as a disciplinary emphasis in LA research, education, and practice, with significant accomplishments in each of these domains (Whitlow et al., 2021). However, critical reflection on its current state is needed for LP to remain a disciplinary emphasis and advance as a core body of knowledge that integrates research, education, and practice. Our study aims to present a snapshot of the status of LP in research, advocacy, education, and practice, as perceived and documented by the authors, who have been central to the development and growth of LP; to identify and examine challenges and tensions within LP; and, examine how LP might need to evolve or adapt to remain relevant in LA practices. What opportunities and trajectories are needed if we advocate for a new version, Landscape Performance 2.0?

2 BACKGROUND

The published history of performance (project evaluation) research, especially in architecture fields, dates back to the mid-20th century, with the emergence of scholarly literature focused on user behavior and the use of architectural space (see, for example, Hall, 1966; Van der Ryn & Silverstein, 1967). Here, user behavior and performance are acknowledged as critical dimensions of the final stages of the design processes that inform future professional practices. For example, Sanoff and Conn (1974), referring to Cooper's work (1971) and others, argue the role of human behavior in transforming the physical environment and the need for systematic inquiry into the functioning of humans and how they connect with the physical environment. As allied fields continually adapted evaluation techniques and broadened their reach, primarily through environmental psychology and behavior studies in the 1980s, the Post Occupancy Evaluation (POE) framework emerged as a recognizable approach for project assessment. During this period, POE was defined as the assessment of the performance of physical design elements in each in-use facility (Preiser et al., 1983 [2015]).

The seminal work of Whyte concerning the *Social Life of Small Urban Spaces* (1980) and Gehl focusing on *Life Between Buildings: Using Public Space* (1987) started bringing observational studies to the outdoor built environment. Influenced by the POE framework, evaluation studies gained greater adaptation in LA literature in the early 1990s (see example Bookout et al., 1994). Specifically, Marcus and Francis' work in *People Places* in 1998, followed by Francis's *A Case Study Method for Landscape Architecture* in 1999, elevated the definition, adaptation, and role of case study and POE for LA projects. The case study approach has appealed to the LA profession due to its simplicity in adoption and ability to accommodate in-depth study of multiple qualities within a single project (Francis, 1999; Yin, 2009). Some argue that the single case study approach is critical for design research, but broader systematic analysis across multiple cases with generalizable knowledge is also needed to advance the profession (Ozdil, 2008).

Since the turn of the 21st century, design literature has seen a marked increase in evaluative case studies, including the case study efforts by various design environment disciplines, including the Urban Lands Institute, U.S. Green Building Council, U.S. Environmental Protection Agency's Best Management Practices, the Sustainable Sites Initiative, the Cultural Landscape Foundation, and most significantly the Landscape Architecture Foundation (LAF) (Ozdil, 2016). While the case study approach has gained momentum in LA and broader literature, LA research has started to expand the trajectory of evaluative methods (such as Francis, 2003; Calkins, 2005; Ozdil, 2008; Lovell & Johnston, 2009), and criticism emerged regarding the impacts of performance-based design (Meyer, 2008).

Perhaps the most pivotal moment for the advancement of LP in the U.S. occurred when the LAF launched the Landscape Performance Series (LPS) in 2010 and the Case Study Investigation (CSI) program in 2011. The LPS highlighted LP research as an important disciplinary priority and an opportunity for collaboration across landscape architectural research, education, and practice. It also demonstrated the importance of interdisciplinary collaborations, incorporating other disciplines, like ecology, civil engineering, architecture, horticulture, public health, urban planning, economics, and other social sciences (LAF, 2024).

After the launch of the LPS, several other foundational milestones for LP occurred in research, education, and practice, establishing LP as a recognizable disciplinary emphasis in LA (Whitlow et al., 2021). In 2013-14, the Council of Educators in Landscape Architecture (CELA) developed an opportunity to support LP as a research pedagogy by adding the "Landscape Performance Track" to the annual conference content areas. By 2016, the Landscape Architectural Accreditation Board (LAAB) included LP as one of the "Assessment and Evaluation" topics to be covered in the professional curriculum section of the revised LAAB Accreditation Standards (LAAB, 2016). This addition was partly due to advocacy from the CELA and the LAF's Education Committee. Then, in 2018, the LAF published its guidebook as a resource for LP evaluations, which built on early efforts in the CSI program (Canfield et al., 2018a). Since then, LP research and education have pursued more focused performance measures, while also being impacted by the COVID-19 pandemic, as well as technological advancement following this period.

Considering the beginnings and trajectory of LP as a disciplinary emphasis, this paper critically reflects on the present state of LP as a core body of knowledge shaped by the integration of research, advocacy, education, and practice.

3 METHODS

This paper followed a mixed-method inquiry (Deming & Swaffield, 2011) benefiting from primary and secondary data sources. Three sets of data were used from three different sources. The first data set was collected from the CELA presentations (abstracts), conference papers, and Landscape Research Record (LRR) publications from 2014-2024 to understand the emergence, growth, and nature of LP research within the CELA. In the LA discipline, especially in the U.S., research, education, and practice primarily manifest through the operations of the CELA. The second data set was collected from the LAF's records, internal documents, the LP website, and its published case studies. This data included critical insights and numbers about funding, activities, and resources that the LAF has provided to support LP over the past fifteen years. This data was used to understand the role of LP advocacy in supporting research, education, and practice. The third set was collected from three round-table discussions among the authors, as subject-matter experts on the development and advancement of LP, and from their panel presentation at the 2024 CELA conference. These semi-structured discussions enabled the authors to openly discuss their experiences, perspectives, observations, concerns, and ideas about LP. Content from these discussions, layered with the data from the CELA and the LAF are analyzed and synthesized to inform and structure the paper's findings, discussion, and conclusions. Although this paper relies heavily on qualitative data from its authors' perspectives, experiences, and expert opinions, doing so was an intentional delimitation. Similarly, although the CELA and the LAF do not cover the entirety of the research, scholarship, creative activity, education, and practice in LP, they are some of the most robust platforms for supporting and disseminating its critical content.

4 LANDSCAPE PERFORMANCE: A SNAPSHOT

This section provides an overview and perspectives on the state of LP in research, advocacy, education, and practice. We focus on the role of the CELA in research and the LAF in advocacy because these institutions have been central to the development and advancement of LP over the past 15 years.

4.1 Research: The CELA's Role

The CELA, whose mission is to support educators in advancing the LA profession, has been one of the most robust platforms in North America for reviewing critical content areas and knowledge domains for over one hundred years. The CELA initiated the annual conference track system in 2008-2009 to cluster

LA knowledge into content areas. The track system is administered by the CELA's Vice President for Research and Creative Scholarship (VPR) and supported by the CELA Board selected scholarly experts who serve as track chairs, overseeing external peer-review and providing editorial and management of abstract submissions, conference presentations, and manuscript submissions for their respective tracks. Each track covers a specific content area representing either established or emerging disciplinary emphases. When the track system was launched, there were 11 tracks at the annual conference. However, the total number of tracks has changed over time, varying between 11 and 16 from 2009 to 2024.

In 2013-2014 the CELA added a LP Track to its annual conference to motivate and support research in this emerging content area. This addition followed the LAF's establishment of its Landscape Performance Series (LPS) in 2010 and the CSI program in 2011. Since the LP Track began, it has accepted papers, panels, and posters that explore the impact of LA projects of various types and scales through the observation and measurement of environmental, economic, and social benefits (see such as Burgess et. al., 2014). The LP track, with slight variations in the track definition during this period, has also become a venue for presenting and publishing case studies, methods of observation or measurement, predictive models of benefits, new research on the benefits of landscape, and theoretical frameworks for LP (CELA, 2024). Due to LP's relevance in academic and professional practice, the track has become one of the three conference tracks in the CELA that provides session attendees with LA Continuing Education System (LA CES) credit.

Given that one of the authors served as VPR for the CELA, and two have served as Co-Track chairs for LP in various periods, these authors have in-depth knowledge and data to report on the status of LP research in the LP Track of the CELA, including data on total presentations, publications, and authors since 2014. A critical delimitation is that LP-related research is not restricted to the LP track. If the primary emphasis of a presentation or paper fits better within another content area, or if the authors' interests lay within another content area, they may choose to include their LP research in a different track.

From 2014 to 2024, the LP track has produced roughly 203 out of 3553 estimated peer-reviewed presentations (oral, panel, or poster), resulting in an annual average of 20.3 double-blind peer-reviewed presentations at each of the annual CELA conferences, which is roughly 6% (from 5 to 13% depending on the year) of the total number of accepted/published abstracts in the CELA during this time. The highest number of LP presentations (27) was in 2019. The presentation trends of the track seem to be steady, if not slightly increasing, after the COVID-19 pandemic years (2020 and 2022). Approximately 309 unique authors (including co-authors) have been involved with the LP track and twenty-three of these authors have been involved with four or more presentations. Eighteen of these authors have been involved with three or more presentations, while the rest have been involved with two or fewer (See Figure 1).

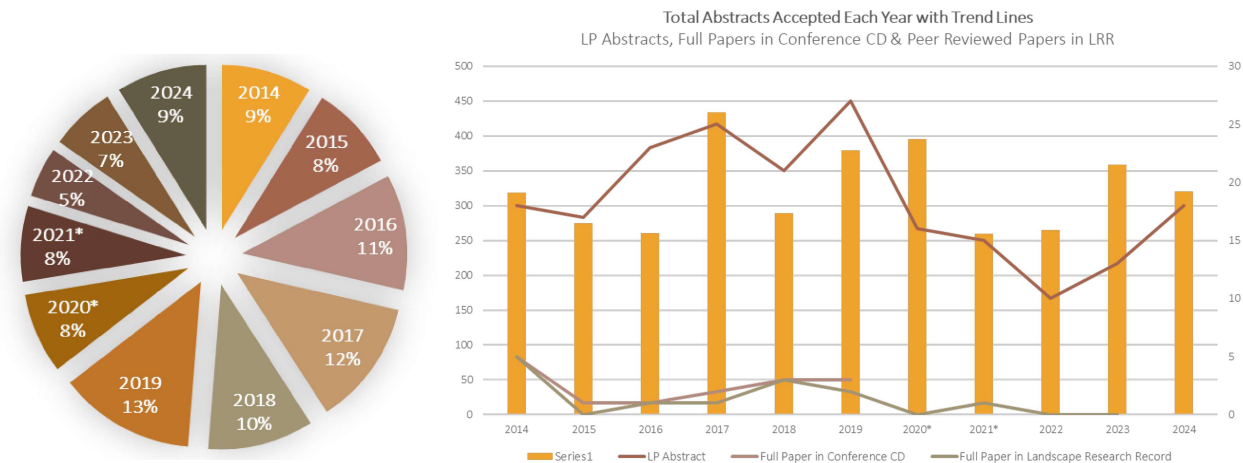


Figure.1 (Left) Percent of Landscape Performance track abstracts from total accepted abstracts at annual CELA conferences, (Right) Total abstracts accepted for the CELA each year with LP publication trend lines between 2014 and 2024 (COVID Pandemic influenced 2020-22 numbers).

In addition to a relatively steady number of annual abstract submissions in the LP track, presentations have led to 13 full papers published in the LRR, which is the double-blind peer-reviewed publication of the CELA conference, and 15 full papers published in non-peer-reviewed CELA conference papers. As demonstrated by the numbers, the acceptance of full papers in LP has slightly declined since 2014. Although some LP papers may have found their place in other peer-refereed outlets, like Landscape Journal, the publication of LP papers through the LRR and the CELA conference papers (discontinued in 2019) has been relatively limited. This change in the number of published papers may be partly due to the publication of the CSI's LP case studies and methods documents on the LAF's LPS website (LAF, 2024). Furthermore, over the years, the CELA track co-chairs and reviewers have sought more originality while avoiding duplication between the CELA and the LAF sources. It is important to note that the COVID pandemic impacted LP research and subsequent submission trends (see Figure 1).

A review of the titles, abstracts, and keywords from the early LP track presentations, conference papers, and LRR publications revealed that early content, not surprisingly focused on the background, definition, and early methods of post-occupancy evaluation (POE) and LP. Many of the early LP authors sought to develop performance criteria, measurements, and quantification methods, which were of interest to early LP adopters. Some of the earlier assessment procedures and methods were influenced by past decades' case studies, POEs, and behavioral and visual quality assessment studies. The CELA outlets have also included a number of presentations and publications with expanded findings from the LAF's CSI program and LPS case studies. Such work primarily concentrated on environmental factors such as stormwater, Low Impact Development (LID) strategies, Best Management Practices, plants and planting design, and the impact using secondary data. Research in this period also concentrated on social and economic factors but mostly from secondary sources, except for studies that sought out original data (Burgess et al., 2014). After LP's early establishment in the CELA outlets, in recent years, the research content started to include detailed reviews of procedures and methods for LP, integration of LP into design, and a focus on topics such as sustainability, green infrastructure, and ecosystem services, within the context of LP. Social and economic performance research and LP education gained greater focus during this period too.

Just before the COVID pandemic period (2020-2022), LP research seemed to start focusing more on climate change, heat-island effects, health and well-being, and justice issues. To support a growing interest and research in these content areas, new CELA tracks emerged through the early 2020s. Post-pandemic, LP also saw a concentration of work that focused on the impact of COVID and the use of parks, plazas, and open spaces during the pandemic. Most recently, LP has seen an emerging concentration of presentations and papers on technology and the use of technology, with terms and

research related to big data, modeling, simulations, monitoring, artificial intelligence, augmented reality, and the use of micro-sensors and drones (see such as Yang et al., 2023; Zawarus, 2022).

For the past fifteen years, the individual case studies produced by the LAF's CSI program have been continuously fed into the CELA presentations and publications. Although there were attempts, discussions, and critiques about the need to explore more comprehensive research through multiple cases, the focus seems to remain on in-depth individual cases. The research in this period focused on post-project completion conditions, but there has been an evolving interest in bringing performance to different stages of the design process. There have always been strong attempts to quantify things, but performance research typically concentrates on secondary data and models produced in allied disciplines (such as i-Tree, 2024). Stormwater and green infrastructure-related research have increasingly found their place in LP studies. Landscape architects, LP researchers included, have long been interested in social factors, behavioral observations, and visual quality methods, which perhaps can be attributed to early work that influenced LA and environmental design fields (such as Whyte, 1980; Kaplan & Kaplan, 1989). Economic factors have been on the radar for LP research even before this period (see such as Ozdil, 2008). Still, LP researchers have been mostly reluctant to adopt and/or develop methods to demonstrate financial impact beyond the indirect effects of landscape improvements.

Overall, LP research within the past fifteen years in the CELA was in its infancy, but nonetheless impactful in supporting the establishment and growth of LP as a disciplinary emphasis and content area. The early authors developed a foundation to expand LP research and integration into education and practice.

4.2 Advocacy: The Landscape Architecture Foundation's Role

Over the past 15 years, advocacy for the development and growth of LP as a disciplinary emphasis in research, education, and practice has been primarily supported by the LAF. The LAF is a non-profit organization that aims to support the preservation, improvement, and enhancement of the environment by investing in research, scholarships, and leadership initiatives that increase collective capacity to achieve sustainability and cultivate the next generation of design leaders (LAF 2004). As such, early on, the LAF recognized a discrepancy between how landscape architects described their work, often in terms of features, and the many environmental, social, and economic benefits their work offered. The LAF then identified a need for increased resources and support for LP measurement and communication of landscape benefits. In 2010 the LAF initiated the LPS to support the growth of LP as a core body of knowledge and to serve as a hub of resources for advancing its integration into research, education, and professional practice. The LAF funds three annual research programs, including the CSI program, which generates content for the LPS.

Since 2010, the LPS has gained widespread recognition among different audiences, with a yearly visitor count to the website of approximately 75,000 per year, depending on the year. To assess the impact and reach of the LPS at its ten-year mark, in 2021 the LAF issued a survey to its entire email contact list. The survey was designed to gauge progress toward two key goals of the LPS: changing LA practice to design for and document LP, and integrating LP into LA education. 132 LAF contacts responded to the survey. The survey responses indicated a significant increase in performance planning, evaluation, and reporting across LA practice, education, and research. It showed that LA firms most notably integrate LP in their practices by communicating their work in terms of benefits and designing for performance. It also demonstrated that LP activities benefitted respondents' practices in terms of how they convey their work to clients and career opportunities. Though the survey provided an insightful snapshot, knowing the full extent to which LP has been integrated into professional practice and curriculum remains difficult to measure.

The CSI program started in the fall of 2011 with a targeted and ambitious goal to identify relevant metrics and methods for LP evaluations. Since then, the program has become much more than a means of generating data. Importantly, it fosters collaboration and provides LP training and education to faculty, students, and participating firms. In this way, the CSI program is helping to bridge the gap between academia and practice. The LAF has distributed almost \$700,000 to students and faculty through the CSI program since 2011. Between 2014 and 2017 the LAF also provided LP Education Grants (in coordination with ICPI) to educators seeking to develop LP curriculum and resources. Additionally, grant funding also supported the development of "Evaluating Landscape Performance—A Guidebook for Metrics and

Methods Selection” (Canfield et al., 2018a), which draws on lessons learned from the early years of the CSI program. Beyond supporting the CSI program, the LAF’s advocacy for LP occurs through in-person and online lectures to university courses and professional design firms, studio critiques for LP-related university courses, conference presentations, and providing support to scholars investigating LP topics.

The CSI program has seen significant participation as of 2024, with 145 student research assistants, 125 faculty fellows, and 110 firms, several of which have participated multiple times. As of 2024, over 200 LP case studies have been published on the LPS website. In addition to providing evidence for sustainable site design advocates and serving as project precedents, the LP case studies have been part of numerous scholarly studies as well (see such as Canfield & Hahn, 2023; Yang, 2020; Wang et al., 2016; and Luo & Li, 2015). Other benefits of the CSI program include knowledge generation and the scholarly dissemination of case study outcomes to other venues.

The LAF initially aimed to comprehensively integrate LP into professional practice. In 2023, the LAF conducted round-table discussions with eight firm leaders, who were at the forefront of implementing LP into professional practice, to understand how LP was being integrated. It was found that integrating LP into all projects presents structural and financial challenges for many firms. Some firms use LP as an advocacy tool for clients, while others use it to guide their project work and support mission-based practice. Design teams have utilized LP outcomes to advocate for sustainable landscapes to other disciplines, such as architects, engineers, and planners. Instead of just focusing on creating impressive benefit statements, some firms use LP findings to inform future projects and close the loop between generating and applying performance information. Some firms integrate LP for specific situations, projects, or clients, while others use it selectively at different project stages, focusing on post-occupancy evaluation or informing design decision-making. Although individual firm efforts have been documented and discussed, it is challenging to determine the extent to which the broad range of LA firms utilize LP.

The widespread benefits of the LPS and the CSI program are clear, and there are now numerous academic, student, practitioner, and stakeholder advocates for LP. Though the LAF has been a hub for facilitating and funding LP research collaboration and education, LP now has a foundation and reach beyond the LAF. Despite this, funding and support may be among the most significant challenges for LP’s continued advocacy and advancement. Though the LAF and the CELA have been central to LP’s advancement, other philanthropic, state, and federal agencies are emerging as viable funding sources for LP. With this, LP is well-positioned to continue expanding in reach and impact.

4.3 Education: Observations from Teaching

Observational, evaluative, and case study methods have been part of LA education for decades. However, many LA students are increasingly challenged to use LP to estimate the effectiveness and impacts of their projects. For example, several high-profile, multi-disciplinary student competitions, including the U.S. Department of Energy Solar Decathlon collegiate competition, the Urban Land Institutes Hines Competition, and the U.S. Environmental Protection Agencies’ Rainworks Challenge, require some performance estimation as part of their deliverables. Such competitions provide a platform for LA students to collaboratively study LP’s various environmental, social, and economic aspects.

LA education has been advancing its core competencies in LP in parallel with LP research and practice over the past 15 years. Central to this advancement has been funding, resources, activities, and venues provided primarily through the CELA and the LAF. While the CELA created a venue for both students and academics to share and publish their research through the LP track, the LAF created two funded programs to actively integrate LP in student education and research (the CSI program and Landscape Performance Education Grants). The education grants supported educators in their efforts to incorporate LP into LA curriculum and helped develop an online collection of materials, including syllabi, reading lists, sample student assignments, and reflections on their pedagogical approaches and experiences in teaching LP (LAF 2024a). Another critical funding stream has been the LAF’s CSI program, which annually funds university students to work collaboratively with faculty fellows and firm liaisons to prepare case studies for the LPS. By participating in the CSI program, students gain first-hand experience using various data collection and analysis methods, writing LP benefit statements, and preparing a case study brief. Based on post-program feedback surveys conducted by the LAF, students who participated in the CSI program have reported that the experience helped them feel well-suited to engage with LP in

professional practice, share their knowledge of LP, and even initiate research initiatives and communication.

Many faculty members who participated in the early years of the LAF's CSI program were early adopters and key proponents of LP education (for example, see LAF, 2024a). These early proponents were crucial in advocating for LP to be included in the Landscape Architecture Accreditation Board's (LAAB) Accreditation Standards. In 2016, the LAAB added LP to the Professional Curriculum under Learning Outcomes in Skills and Competencies: "Landscape performance, i.e., the ability to define and measure the impact of a design on its environmental, social, and economic goals based on measurable outcomes; identification of types of data to measure project impact(s); and use of performance metrics to measure performative impacts of a project" (LAAB 2021 Accreditation Standards). This incorporation meant all bachelor's and master's level programs seeking accreditation renewal must demonstrate how LP is addressed in their curricula.

Programs across the U.S. have since integrated LP into their curricula through lectures, seminars, studio courses, and competition participation (Ozdil et al., 2023; Zawarus, 2022; Hendrix et al., 2020; Barnes et al., 2018). Some have even created LP-focused courses, like at North Carolina State, The University of New Mexico, Kansas State University, and others. For example, the Landscape Performance Lab at Kansas State University is a 3-credit hour course that introduces students to the scientific process and methods for assessing LP (Canfield & Hahn, 2023). The content and assignments cover two main knowledge domains: sustainable site design and LP. Students learn to acquire, organize, and analyze specific data using qualitative and quantitative methods to inform sustainable site design and conduct a post-occupancy performance evaluation. They also learn about sustainable site design practices (Calkins, 2012) and how to develop performance-based goals and measurable objectives. The course introduces various open-access methods/tools, including the Gehl Institute's Public Life tools, Pathfinder's Carbon Calculator, the U.S. Environmental Protection Agency's Stormwater Calculator, and several iTree assessment tools. Students initially practice using these methods/tools on local sites before later applying them to their concurrent site design studio project. Their assessment findings help inform their design decision-making and project how their designs may perform in the future. This hypothetical exercise shows how LP can span across the design process.

LA education is happening outside curricula as well. For example, to support education for practitioners, the ASLA published an LP guide and metrics primer as part of their LATIS technical paper series (McCoy, 2018). There are also numerous webinars, workshops, and LP-focused lectures, many of which are offered for the LA Continuing Education System (LA CES) credits. In the coming years, the STEM designation of LA will likely add new elements to the LP content and coverage discussions in LA curriculum and practice.

4.4 Practice: Observations from the Profession

The advancements of LP in research, advocacy, and education have supported the development and growth of LP in professional practice. Over the past fifteen years, several firms have worked to incorporate aspects of LP into their project workflows, with some adopting LP as a core aspect of their identity and values (Design Workshop, 2024; Olin, 2024; Sasaki, 2024; SWA, 2024; LAF, 2020; Ozdil et al., 2018). LP and post-occupancy evaluations have enabled the LA profession to assess and better understand various environmental, social, and economic benefits of built work. Quantified benefits allow designers to understand the positive impacts that built projects deliver to communities and surrounding environments. Equally important is the need to learn from any sustainability-related shortcomings or harmful impacts a project may have on its surroundings. Often, landscape architects must justify to clients why investing in LA services matters and make a case for individual components of a proposed design. Because many clients are accustomed to basing decisions on data and evidence and they need to understand the return on investment before approving costs, LP has helped firms to develop defensible arguments that support a design proposal and communicate LA's value more broadly.

To incorporate LP into professional practice, design firms have had to learn how to develop measurable goals, research performance benchmarks, and more rigorously capture existing condition data in anticipation of a post-occupancy performance evaluation. Due to these additional activities in the design process, design teams have had to modify their approach to the scoping of work, sequencing of project

phases, and judicious deployment of staff hours. As part of the contracted scope, fee, and schedule of a typical design and documentation project, the effort begins with an analysis phase and fairly rapidly moves into concept and schematic design, followed by design development, construction documentation, and construction administration. The design firm's contract usually ends at implementation, and sometimes even earlier if the client decides to have a local firm or design-build contractor complete the documentation for construction. When a design contract ends, the project staff are assigned to the next project, and there is no fee remaining to reconvene the design team for a future post-occupancy study. However, projects incorporating LP must allow for more time in the analysis phase as a lead-up to design. During this phase, staff must collect in-depth data, study precedent projects, identify benchmarks, establish design goals, and select relevant metrics. This initial process is critical for informing design decisions and setting up the project for a future post-construction performance evaluation. Yet, the funding and resources needed for a comprehensive existing conditions analysis spanning environmental, social, and economic contexts and future evaluation activities are typically beyond a project's initial scope and fee. Few clients are willing to fund a future performance assessment. Thus, additional project fee or external funding, like what the LAF's CSI program provides, is needed to conduct an LP evaluation.

Those integrating LP into the design process typically collect primary data and analyze existing conditions on the project site. However, due to time constraints, the data may not be as rigorous as that collected from a longitudinal study. However, data gathering by the design team builds intelligence about the site that informs design goal-setting and decision-making. Sometimes, data collected by the design team can help make the case to clients for additional consultants to be hired to add specific expertise to the design team, such as a traffic consultant, biologist, or ecosystem services mapping expert. Informal data gathered by the designer can also help to advocate for a particular design solution, material choice, or product selection. In addition to in-house data-gathering, landscape architect practitioners often use data captured from citizen scientist platforms like eBird or iNaturalist. Though many firms have bolstered their primary data collection and analysis efforts on the front-end of projects, it remains challenging to resource and fund LP evaluations on the back-end. Yet, to continually advance LP, more widespread incorporation into projects is needed, which will likely require adjustments to how projects are scoped and funded (See Figure 2).

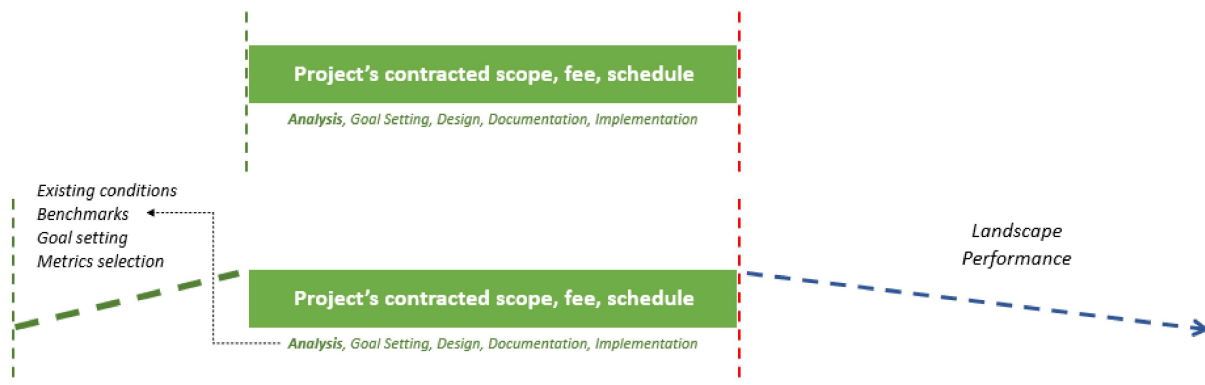


Figure.2 A typical design project timeline, with a clear beginning and end to the contracted scope, fee, and schedule, compared to a project that incorporates LP, which requires additional time and resources for analysis and research as part of the early project phases and for evaluation of performance post-contract.

5 SYNTHESIS: CHALLENGES AND TENSIONS

Despite LP's establishment as a disciplinary emphasis and its notable accomplishments over the past 15 years, to ensure its continued advancement as a core body of knowledge shaped by integrating research, advocacy, education, and practice, it is critical to acknowledge current challenges and tensions with LP. Our review of LP data from the CELA and the LAF and our round-table discussions revealed eight primary areas of challenges and tensions within LP. Although we discuss each of the eight areas individually,

there is interconnectedness and overlap across them. In response to these challenges and tensions, in section 6.0, we suggest opportunities for improvement and future trajectories as Landscape Performance 2.0.

5.1 Definition and scope

The LAF's definition of LP as "a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability" has been widely adopted by many within LA (LAF, 2024 [2012]). However, despite LP becoming a recognizable term among LA academics, students, and professionals, its precise definition, meaning, and scope remain elusive, especially for those outside the discipline. Some argue that the term lacks a precise definition, which should be revisited (LAF, 2024b). It is also realized that LP's definition and scope are subject to interpretation depending on who practices LA and how LP is being used. However, some confusion about LP may not have to do with the term's definition but rather with its meaning and coverage, which has created ambiguities about scope, timing, and evaluation methods. For some, LP is associated with a data-driven design and evaluation process, while for others, the term is explicitly correlated with the LAF's definition and operations. LP has become synonymous with benefits, metrics, data collection, and analysis focusing on environmental, social, and economic factors. Part of the challenge concerns the emphasis on "benefit," which seems to exert implicit bias in LP's intent. It is realized that the definition, meaning, and coverage of LP presents ambiguities and challenges for LP both as a disciplinary emphasis and as a professional service in LA (LAF 2024b).

5.2 Knowledge creation

Knowledge creation in LA is typically a result of both academic and professional practices, originating primarily from research, scholarship, and creative activities. Knowledge creation may include applying academic knowledge to practice and assessing innovation and lessons learned in professional practice to improve disciplinary foundation. Our inquiry showed that academic practice embraced LP relatively quickly because of its close relationship with rigorous research, whereas professional practice started incorporating LP primarily because of its potential to inform projects and support professional advocacy. That said, LP, as an area of scholarly inquiry and professional service, had to respond to these two directions of interest and, therefore, the potential challenges created by these dual perspectives. The idea of designer (professional) versus scientist can be a contentious topic in LP knowledge creation. Some favor LA's artistic and aesthetic design roots and argue that LP metrics should not influence or measure their work. Though, LP is not intended to replace designers' expertise or dictate a design's aesthetic and experiential qualities. Yet, there has been some criticism and pushback that metrics limit a site's story and aesthetic expression, but others embrace both approaches. Data collected through LP can help inform decision-making and reduce subjectivity. LP should be seen as a valuable counterpoint to the notion that good design only comes from designers' intuition.

Methods: As a discipline, LA is steadily building its methods for scientific and professional inquiry, which rely heavily on research in allied fields, such as biology, ecology, horticulture, agronomy, engineering, sociology, and urban economics. Since LP research is mainly driven by tools, procedures, and methods adapted from such allied fields, critical review, testing, and maturation time are needed within academic and professional practices, which can present challenges and debate. There is concern about data availability, quality, type, and integrity for evaluative studies, especially within academic research. There is a clear distinction between primary and secondary data, which novice researchers may not be familiar with. First-hand (original) data, such as water quality samples and plant counts, is captured specifically for the research project. In contrast, archival or secondary data is acquired from sources external to the research project, such as carbon sequestration of a specific tree species. Most assessments in LP research rely heavily on secondary data. Furthermore, many assessment methods utilize online assessment tools (i.e., i-Tree), simulations, or models calibrated by archival and secondary data, which creates concern about the reliability of modeled findings. Also, the diversity of professional services LA provides enriches LA practices but also creates complexities about data collection and applicability across different project types, geographies, and design scenarios. There are also growing concerns about the value and limitations of the LPS case studies themselves, including an inability to do meaningful comparative studies across cases and the total number of cases being insufficient to explain larger phenomena.

Objectivity and rigor: Our inquiry also reveals challenges and tensions regarding the objectivity and rigor of LP. These concerns typically arise from the availability of quality and original data and methods, a heavy focus on documenting LP “benefits,” and from the varying interests and voices within LP research. LP research typically requires coordination between client/stakeholder and professional and academic-practitioner. Although objectivity and rigor are underlying principles for all parties, the depth of inquiry and commitment are subject to resources, time availability, and values carried by each party for any project evaluation. It is also realized that focusing on benefits inherently presents a dilemma about objectivity regarding scientific integrity. As previously stated, LP evaluations rely on metrics, assessment methods, and instruments mostly borrowed from other disciplines, which are often questioned for their rigor, applicability, and adaptability in LA. For performance evaluations to be accessible and understandable to a wide array of audiences, many LP metrics and methods are “easy to use” for non-experts. Primary data collection and assessment are time- and resource-consuming, making it difficult for evaluators to visit a site multiple times over a long period. Because of this, most LPS case studies provide a one-time snapshot of a site’s performance as a starting point for clients and the public to understand LP benefits. This approach has been criticized for not being scientifically rigorous and reliable. Some contend that performance can only be measured through empirical and longitudinal academic studies, though many of the LP case studies include thoroughly analyzed and well-documented findings. The availability of information and timeframe are usually the most significant factors for deciding which metrics and methods to use to measure performance, which could bias an evaluation process and findings. Another criticism goes back to data validity, questioning if scientifically valid data can be collected by the given personnel and equipment within the provided time frame of an LP evaluation.

Embracing failure: One of the most critical concerns is how academic and professional practitioners embrace failure in knowledge creation, LP adoption, and communication. Not all procedures, methods, and tools used in LP research produce meaningful results; however, the outcomes of such scientific inquiry reveal both success and failure. Transparency, clear communication, and biases must be addressed to advance knowledge. LP evaluations often identify areas where a project is not performing as expected, possibly due to improper maintenance, storm damage, faulty equipment, or unpredicted use. While some professionals, firms, and clients are willing to share their project failures, others are not. However, learning from failure can be extremely valuable for improving design and documentation processes, construction practices, and maintenance specifications. This shift from being an all-knowing practitioner to someone who is constantly investigating and learning can be challenging but needed.

5.3 Funding and support

It is challenging to secure funding for research in LA, which is concerning for advancing knowledge creation and academic and professional practice. Direct state, federal, or philanthropic funding is often limited for an individual LA project or comprehensive evaluation that seeks to generate original and reliable knowledge to inform the discipline. Though the LAF’s CSI program is a critical step toward being able to fund research in practice, the services needed for the comprehensive integration of LP into a project are still considered “extra.” Some argue that it is challenging enough for landscape architects to get paid to design and implement something of high quality, let alone integrate LP at an additional cost. Firms have to question whether LP is integral to the project or an extra. Is it baked into the process or an appendage to the process? Despite good intentions, LP is typically extra, and it is not possible to integrate it into every project as a standard. For specific clients, client representatives, or developers who must justify everything spent on a project, a design team can support them with LP data to help them make the case about the value of the project and why the landscape budget cannot be cut, for example, why tightened tree spacing is needed. Perhaps the challenge here is to educate clients to work with firms that engage in evidence-based design processes rather than a process heavily based on design intuition and experience.

5.4 Professional practice

Regarding the professional practice of LP, there are several issues to note, namely the integration, timing, client, and project typology. Over the past 15 years, the use of LP in professional practice seems to be happening more for select projects rather than holistically across all projects, which was an early aspirational vision of the LAF. Instead, LP occurs more often for select projects and at select stages of the design process and post-occupancy. That said, holistic integration into projects is complex, partly because

of varying professional services, potential liabilities, and costs. As discussed, incorporating LP into a project's scope rarely involves a separate fee. Beyond supporting clients, design teams have also used LP outcomes to make the case for sustainable landscapes for other disciplines, such as architects, engineers, and planners. Instead of intensively focusing on creating a thorough metric or benefit statement that can be shown to any decision-maker, there is also a growing desire among firms to use LP to improve practice. Some are starting to use LP as a tool to do better work as part of a mission-based/ethos-based practice. Furthermore, LP may not be suitable for every project because it requires more time and resources on both the front and back ends. Another approach for firms interested in incorporating LP may be to allocate additional in-house resources to one project a year and conduct a deeper analysis, setting the project up for future performance evaluation. However, this approach may not be feasible for smaller firms with tight margins and fees. LP has the potential to be integrated into more projects, but firms must determine how doing so fits within their culture and business model.

5.5 Collaboration and partnerships

Collaboration is crucial for enhancing LP's quality and rigor. Through our inquiry, we found at least two dimensions of collaboration in LP, each with strengths and challenges. One is the multidisciplinary collaboration needed for LP and the other is the collaboration required among academics and professional practitioners, clients, and project users when conducting a performance evaluation. Earlier, we noted that LP primarily borrows some of its procedures or methods from allied fields, which can present challenges for those employing them, especially if specialized knowledge or expertise is needed. Also, bridging the gap between practitioners and academics and research and design remains a critical concern. The CSI program promotes partnerships during the post-occupancy evaluation stage; however, having front-end collaboration to set up a project for a future evaluation would be valuable. Though such collaboration efforts may produce well-rounded results, true partnership takes time. Ideally, experts from diverse fields, such as ornithologists, sociologists, or biologists, can be involved in the initial goal-setting and data-collection stages of integrating LP into a project. Although this type of collaboration may require a fee, it can offer invaluable insights to inform the project's design and evaluation later on. Even without formal funding, practitioners and academics can collaborate when it is mutually beneficial to both parties. Such collaborations could include piloting emerging technologies and sensors, developing new data collection protocols and methods, or initiating longitudinal studies.

5.6 Education and training

For the past fifteen years, there has been a growing effort among accredited LA programs to incorporate LP education through curriculum and research pedagogy. Our research revealed that some programs have done so within a distinct course, while others have added LP content into various existing courses. During this period, it should be noted that many accredited programs sought to reduce the total number of credit hours in both undergraduate and graduate curricula to better align with the credit hours required for other allied professional degrees. Though LP education is being integrated into the curriculum, it can expand, especially with the recent designation of LA as a STEM discipline. An important consideration for integrating LP into the curriculum relates to the format of the content and when in the curriculum it is presented. Without prior exposure to fundamental site analysis and site design, some aspects of LP may be too abstract for students to comprehend fully. The course format and particular assignments can also impact what aspects of LP can be covered. For example, if LP is integrated into a comprehensive site design project, students may better understand how LP can be used at various stages across the design process. Though many resources are available for students and practitioners, one of the most significant challenges for LP education lies in educating project stakeholders, clients, allied professionals, and end users about the benefits of sustainably designed landscapes and the more excellent value of LA as a whole.

5.7 Innovation and technology

Another challenge for LP is that technological advancements within LP have lagged behind innovation and adoption in allied fields. Within the lifetime of LP, there have been exponential advancements in the number and type of technologies that can be integrated into evaluation research. That said, new tools and modeling and simulation software are emerging almost daily, enabling design teams to make data-driven and evidence-based decisions more quickly when integrating LP into projects. For example, Autodesk is currently working to develop more plug-ins to support this, while software such as Revit enhances

collaboration. Online technologies also advanced timely access to original and big data for comprehensive LP efforts. In addition, micro-sensors, remote sensing technologies, and drones are becoming more affordable and mainstream, allowing firms to work with clients and obtain permission to conduct in-depth evaluations and long-term monitoring. This means that performance evaluations could be conducted over a more extended period with the desired scientific rigor without constant site visits. Firms can partner with interns, students, and faculty to help analyze and interpret the data. Investing in sensors and developing a data protocol can be replicated to other sites. While the effectiveness of Artificial Intelligence (AI) in supporting LP is mainly unknown, it requires close monitoring. Perhaps the overall concern with technology is to what level LP research and researchers are ready to be early adopters to learn and adopt these technologies in their workflow.

5.8 Knowledge dissemination and advocacy

Perhaps one of the most critical concerns and tensions is the track record of LP publications, which has been relatively low since 2010 despite strong communication and advocacy efforts. While the CELA LP track shows a robust number of peer-reviewed presentations, scientifically motivated full-paper publications are scarce in CELA-publication outlets such as the LRR. There seems to be a challenge in building these presentations into peer-reviewed publications. Another concern is case study publications and their in-depth but relatively narrow scope explaining larger phenomena to inform the discipline. The LAF produces open-source and widely accessible case study research online, but many regard the LPS case studies as advocacy pieces due to their focus on benefits and successes. It has also been realized that there are some duplications of case study publishing in both the LAF and scholarly outlets. Although the empirical evidence remains to be shown, the authors of this paper can also testify anecdotally that peer-review publications are low in numbers beyond the LA outlets, creating concerns about LP's wide acceptance or appeal as an emerging scholarly inquiry. There also seems to be value in reporting on single projects and cases by designers, firms, and clients. Such self-propelled efforts are often taken as communication and marketing pieces. Our inquiry showed that although professional advocacy is a much-needed dimension of the profession, there remains to be quality, rigor, and broader dissemination needs in both scientific and professional outlets for LP to stay relevant, if not ever-increasing its place in practice.

6 WHY LANDSCAPE PERFORMANCE 2.0?

LP has advanced as a disciplinary emphasis in LA over the past 15 years. However, given the challenges and tensions we found through our research, future actions are needed for LP to renew its tenets and mature as a core body of knowledge. As briefly covered above, this research prevailed in eight distinct but interrelated areas of challenges and tensions, namely Definition and Scope, Knowledge Creation, Funding and Support, Professional Practice, Collaboration and Partnerships, Education and Training, Innovation and Technology, and Knowledge Dissemination and Advocacy, which raise the need for critical adjustments and opportunities for new trajectories. Landscape Performance 2.0 is envisioned as an adjustment, advancement, and evolution of LP in research, advocacy, education, and practice.

LP's definition, meaning, and coverage are still ambiguous and should be refined through collaborative efforts between academic and professional communities. LP's future progress and potential for broader reach may hinge on such refinements. Though the roots of LP extend back decades, the most commonly used definition of LP was authored by the LAF. In addition to the LAF's strong advocacy of LP, this authoring has perhaps created some misconceptions about the LAF being gatekeepers of LP's scope and advancements. This misconception needs clarification. Indeed, the LAF and the CELA have been strong supporters and advocates of advancing LP research, education, and practice. However, LP's future and forward trajectories are not determined by or hinge on the involvement of these organizations. LP has become a recognizable disciplinary emphasis with many opportunities for continued knowledge creation. LP should continue so long as evidence-based practices are valued within LA practice.

For education, expanding applied learning opportunities will be essential for expanding LP's reach. Faculty and students have a tremendous opportunity to use their campus spaces as outdoor learning laboratories where hands-on education and training can occur by directly applying many qualitative and quantitative assessment methods (Ozdil et al., 2023; Canfield et al., 2018b). Another benefit of using campuses as a learning laboratory is the potential for interdisciplinary collaboration and the development

of long-term studies, which could also have a public outreach component. Additionally, as the CSI program has done, there need to be more opportunities for students to gain valuable hands-on LP experience outside the classroom. Beyond expanding education and training to students and practitioners, perhaps most critical is educating clients, stakeholders, decision-makers, and the public about the value and need for sustainable landscapes informed by evidence-based design.

Paramount to LP's advancement is increasing and broadening the creation and dissemination of LP-based evidence and knowledge supported by original, rigorous research and scholarship. Furthermore, building upon experiences with case study methods into new territories using comprehensive methods and techniques (i.e., integrating big data) with multiple projects will likely elevate LP's broader acknowledgment and bring opportunities for multidisciplinary collaboration and dissemination. It is critical that landscape architects not be consumers but early adopters, if not innovators, of technologies relevant to LA academic and professional practices in their workflow. Most importantly, there is a strong need to be more transparent and learn to embrace the failures and successes of our work. The shift from being all-knowing practitioners (academic or professional) to those who constantly investigate, learn, and foster collaborations and synergies is crucial for strengthening and advancing LA as a discipline and area of practice.

Central to a LP 2.0 will be research and scholarship funding and support. Funding provided by the LAF, the CELA, professional firms, industry partners, sponsors, and philanthropic donors will be necessary for advancing LP in academic and professional practice. Advocating for additional resources and lobbying for funding and support from private foundations and local, state, and federal agencies should be pursued, especially considering the implications of LP in contemporary society and the built environment. Though we found some of this type of funding starting to occur, more is needed. Funding is also needed for LP to advance in professional practice. Expanding the integration of LP into more projects and more firms will be difficult without additional client fees, internal research programs, or grant funding. Collaborative partnerships between practitioners, faculty, and students are critical for advancing LP. Such partnerships may be a way to reduce costs associated with incorporating. However, it must be recognized that students and faculty need funding to support their work and compensate for their time.

Though LP may not be valued by all practitioners or suited for all projects, selective and strategic integration of LP should be a priority, especially for firms seeking to use evidence-based design. As the LA profession evolves, the types of projects and clients may change, which may be an opportunity to focus LP's integration into specific sectors. Mission-driven clients can be great partners if LP aligns with their ethos and supports their goals. Clients who are long-term landholders, such as institutions, universities, and municipal park systems, may also be more inclined to support LP because they want to learn from their projects and use the findings to inform and improve future work. Such clients want to know how a project is performing and how it fits into their collection of land holdings. New types of clients and projects will likely influence the academic and professional practice in LP 2.0.

In addition to expanding the use of LP in professional practice, its influence in education may need some focus, considering the LA designation as a STEM discipline with roots in arts. Though the LAAB standard is an important statement on the academic value of LP knowledge and skills, not all faculty within a program may be well versed in or even subscribe to it (see, for example, Meyer, 2008). This sentiment is also echoed in professional practice as well, with some strong proponents for data-informed design, others are less enthusiastic about the widespread use of metrics to assess the value of design, feeling that LP may compromise the creative aspects of the design process and ultimately hinder the aesthetic expression and experiential qualities of a site. The strengths and challenges of LA lie within its grounding in artistic and scientific fields (see Nassauer, 2023). Again, LP is not intended to be a prescriptive or proscriptive practice, nor is it assumed that it can replace a designer's expertise and intuition; instead, LP is an opportunity to explore how design can intentionally generate outcomes and bring together education, research, practice, and even creative scholarship into a collaborative. Therefore, constant reminders of LP's mission, purposes, methods, and outcomes should be shared in academic and continuing education, if not through educational opportunities provided for clients, stakeholders, communities, and users.

7 CONCLUSION

This research reflected critically on the present state of LP and envisioned its continued advancement as a core body of knowledge shaped by integrating research, education, and practice. We sought to provide a snapshot of LP's status in academic and professional practice, as documented by literature, the CELA, and the LAF, and perceived by the authors who have been central to the development and growth of LP as a disciplinary emphasis. We documented accomplishments, challenges, and tensions through our inquiry and suggested new opportunities and trajectories as Landscape Performance 2.0.

Perhaps the core argument of this paper prevailed through the eight themes, which can be further expanded to more themes related to challenges and tensions that may come from other rigorous research efforts beyond the sources highlighted here. We learned from our inquiry that we approach and understand LP from different perspectives. We engage with LP in various ways, represent different voices in our practices, and experience different tensions and challenges. Given this, we have continued to realize that the core mission of LP is to provide the necessary evidence and knowledge to advance LA as a discipline and area of practice. This paper advocates for advancing LP into 2.0 to deepen and push forward the disciplinary emphasis. We acknowledge that LP is still in its infancy in many ways, though its roots extend back decades. With any emerging body of knowledge, there will be starts and stops, successes and challenges. However, it is noteworthy how much traction and widespread awareness LP has achieved in fifteen years. LP will continue in new and improved ways as long as there are advocates for its value and use in academic, professional practice, advocacy, and funding realms.

In conclusion, our collective desire to advance LA in part evidence and knowledge-based activity has become one of the main drivers of LP efforts within the past fifteen years. Knowledge creation, dissemination, and advocacy are central to its cross-domain integration. Our research revealed that synergies among research, education, and practice have shaped the LP body of knowledge, and those synergies will call for new action items as LA becomes a STEM discipline. That said, it remains to be seen, beyond establishing the foundation of the next generation of LP research in LP 2.0, what the implications of such inquiry may be to the discipline's roots in arts. Perhaps that is the subject for follow-up research.

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