ASSESSING STUDENT LEARNING OF LANDSCAPE PERFORMANCE

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1 ABSTRACT

Utilizing landscape performance as a framework to assess design sustainability continues to be a stronghold in the field. Teaching landscape performance principles is now a requirement for degree programs accredited by the Landscape Architectural Accreditation Board (LAAB, 2016), but there is a gap in the literature on assessment of student learning successes and challenges. The purpose of this study was to develop a pre- and post-survey tool to investigate interest, competency, and applicability of landscape performance in the landscape architecture curriculum. The survey was distributed to 35 students in a site design or technical course that included landscape performance learning objectives at the beginning of the fall 2017 academic term, prior to any instruction in landscape performance and at conclusion of the term. Quantitative and qualitative response coding and analysis was conducted over a month and a half following course completion. Students exhibited improvement in multiple dimensions of understanding landscape performance between the pre- and post-course, and students highly valued the landscape performance approach for making evidence-based design decisions. Students also gained in-depth awareness of the importance of organizational resource support and data quality to ensure success of the approach. Remaining challenges that emerged in student reflections include understanding the relationship of landscape performance with site analysis, as well as quantification methods and design creativity. This initial exploration of landscape performance pedagogy provides critical insights for effectively meeting LAAB requirements as well as informing further research needs for student preparedness and landscape performance teaching materials.

1.1 Keywords

Landscape Performance, Student Assessment, Curriculum, Landscape Architecture Pedagogy

2 INTRODUCTION

Landscape performance research and practice is a growing necessity for educating clients and stakeholders of the benefits of thoughtful sustainable design. Rating systems such as LEED and SITES have accelerated the need for practical understanding of measuring and communicating economic, social and environmental benefits and tradeoffs. The Landscape Architecture Foundation (LAF) has been key in collecting and dispersing information and resources to direct the profession of landscape architecture toward tools of evidence-based design to empower designers to view the landscape more holistically (ASLA, 2015). Similar to building performance, landscape performance is quickly becoming an expectation among design teams and clients. Twenty-first century landscape architecture is changing, and education programs must keep up.

The 2004 Landscape Architecture Body of Knowledge Study Report (LABOK) assessed the knowledge, time of acquisition, and command expected for various subjects of landscape architecture (ASLA, 2004). This report has directed many landscape architecture programs to better prepare students for successful entrance into the profession. Since the publishing of the LABOK study, Landscape Performance has become a critical skill, knowledge and practice for the profession. The LAF defines landscape performance as "a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability." (LAF, 2017b). Recent scholarship has supported the growth and integration of landscape performance into the profession and academia. Literature has focused on the use of landscape performance as a type of post construction/occupancy evaluation for establishing the benefits of the built landscape (see for example, Myers, Carney, & Whitlow, 2015; Ozdil, 2016; Wang et al., 2016; or, Yang, Li, & Binder, 2015, for calculation of ecological, social and economic benefits associated with landscape performance in built projects). Integration into the professional curriculum was completed with the inclusion of landscape performance as a core knowledge, skill and application area in the Landscape Architectural Accreditation Board (LAAB) 2016 Accreditation Standards (LAAB, 2016). Accordingly, the LAF has invested $50,000 over the past four years to support integration of landscape performance into landscape architecture curricula and to openly distribute resources for the benefit of landscape architecture educators (LAF, 2017a).

While programs work to meet the updated accreditation standards for the inclusion of landscape performance into curricula, academia and the profession must also seek to determine how these additional concepts impact student learning. While resources for assessing landscape performance of planned or designed projects already exist, such as Sustainable SITES or LAF Landscape Performance Series, there is a gap in literature and methodologies for evaluating student learning of landscape performance. As part of a continuous process in a student's education, assessment has been shown to support learning and increase the motivation for learning (Hernandez, 2012). Through assessment of student learning, programs can develop successful curriculum and teaching methods for the professional curriculum of landscape architecture (Brown, 1994).

An initial exploration of the student learning and pedagogical experience is needed to identify the benefits and challenges in this emerging area of landscape architecture curricula. How effective is the new landscape performance curricula at equipping students? Are students gaining the necessary knowledge and skills to critically apply landscape performance processes? To better understand how students are understanding and comprehending landscape performance, student learning should be evaluated for different dimensions of knowledge and cognitive processes (Anderson et al., 2001). An in-depth understanding of landscape performance would include factual, conceptual, procedural, and metacognitive dimensions of knowledge (Anderson et al., 2001). Factual knowledge includes knowing terminology and basic elements of the topic; conceptual knowledge includes principles and classifications; procedural knowledge involves subject-specific techniques and methods; and, metacognitive knowledge is awareness of one's own cognition and knowledge level (Anderson et al., 2001).

In this study, we evaluate different dimensions of landscape performance knowledge acquired by students over an academic term and explore the learning and teaching experience. A wide range of techniques are available to assess student learning (Suskie, 2009). This study utilizes techniques that provide both direct and indirect evidence of student learning and provides input for future teaching efforts and improved student learning. Direct assessment techniques examine evidence of learning through observable methods such as exams or projects, while indirect assessment gathers evidence through measures, such as self-reported data in surveys or interviews, that determine the perceived value, feelings, or extent of student learning (Suskie, 2009). The use of a pre-instruction and post-instruction survey tool allowed for the examination of the following research questions: "How is teaching landscape

performance effective in developing student knowledge;" and, "How do students reflect on their experience learning landscape performance?" The study contributes to the literature on landscape performance in two key areas. First, the findings contribute to the dialog of assessment of student learning in landscape performance and point to the need for continued studies, not only to drive student success but also continued professional development in teaching. Second, the findings support the need for further research in and development of teaching materials specific to landscape performance to prepare students for 21st century practice.

3 METHODS

This study uses a survey instrument for data collection to explore the research questions. The study's sample was drawn from one graduate course and two undergraduate courses taught in landscape architecture programs during the 2017 fall term. A total of 35 students (21 female, 14 male) participated in the survey from three universities. Eight graduate student respondents were from a technical course at the University of Arizona that covered landscape performance through the lens of site engineering topics. Nineteen undergraduate respondents were from an upper division studio course at Cal Poly San Luis Obispo that incorporated landscape performance with technical and theoretical approaches to site design. Eight undergraduate respondents were from an upper division, service-learning studio at Montana State University, focused on landscape performance in green infrastructure site design. The three courses varied in format and scope, but shared learning objectives directly related to building knowledge and application of landscape performance principles. These shared learning outcomes included student's ability to: define landscape performance and explain its importance to the landscape architecture profession; identify the types and concepts of benefits related to landscape performance; and utilize key resources and techniques for calculating performance benefits. The study utilized two surveys, pre-instruction and post-instruction, to better understand changes in student learning and attitudes of landscape performance. The first survey was distributed at the beginning of each course, prior to any instruction in landscape performance. The second survey was distributed at the conclusion of each course. Quantitative and qualitative response analysis was conducted upon course completion. Responses for both surveys were collected anonymously and voluntarily.

3.1 Survey Structure

The survey instrument, which combined direct and indirect measures of student learning, was designed to gauge student familiarity, knowledge and interest in landscape performance as an educational topic. Questions included two multiple choice questions to assess student familiarity with and self-assessed value of landscape performance, four open-ended questions to assess student level and dimensions of knowledge of landscape performance techniques, and two questions (one Likert-scale, one open-ended) to assess student reflection (Table 1). Because there is little existing research on teaching or learning landscape performance, inductive exploration through the open-ended questions was considered appropriate to investigate the research questions. The same instrument was used for both the pre- and post-survey.

Table 1. Survey questions.

Familiarity and Value of Landscape Performance
1. *How familiar are you with landscape performance?* o have never heard of it o have heard of it but don't remember any specifics o have some idea of it but not too clearly o I know what it is, and could explain what the basics o I know what it is and how to utilize it, and could utilize it within the studio project
2. *The importance of landscape performance to the profession of landscape architecture is:* o a very important and critical skill o very Important o important o somewhat Important but no more so than other concerns o not important o I don't have enough information

Level of Knowledge of Landscape Performance

3. *Imagine you are writing a press release. Define landscape performance in <u>two</u> sentences.*
4. *What types of impacts may be calculated or measured for a site design? Describe all types you may be aware of.*
5. *What data would need to be collected in order to measure those impacts? Describe for all impacts discussed in previous question.*
6. *Describe any potential limitations that should be considered when using landscape performance to evaluate a site design.*

Reflection and Self-Assessment of Understanding Landscape Performance

7. *Rate how well you understand the process for determining a site design's performance related to:*

	1 Not at all	2 A Little Bit	3 Somewhat Well	4 Well	5 Very Well
Plant species diversity	o	o	o	o	o
Human physical activity	o	o	o	o	o
Stormwater rates or volumes	o	o	o	o	o
Tree benefits	o	o	o	o	o
Percent impervious cover	o	o	o	o	o
Irrigation Volumes	o	o	o	o	o
Human restorative experiences	o	o	o	o	o
Operating energy	o	o	o	o	o

8. *My impressions of landscape performance are:*

3.2 Analysis

All data was reviewed anonymously without school identification and compiled into a Microsoft Excel spreadsheet for analysis. Analysis took place over one and a half months. For survey questions 1, 2 and 7 descriptive statistics were calculated and compared between pre- and post-survey data to determine change in student familiarity and value of landscape performance. Qualitative content analysis involved a grounded theory approach of iteratively moving between understanding the student responses and emerging insights on learning landscape performance (Glaser & Strauss, 1967). For questions 3 through 6 and 8, pre- and post-survey responses were randomized before content analysis was performed by three researchers. Responses for questions 4 and 5 were combined before randomizing to clarify response intent. In order to analyze level of knowledge, each researcher initially defined answers for questions 3 through 5 that represented high level, medium level, and low level of understanding or knowledge of landscape performance. Then, student responses were compared to the representative answers and assigned ratings on a 5-point scale. Ratings were averaged and categorized into three levels of understanding – high, medium and low. For questions 6 and 8 each student response was coded by three researchers for recurrent and meaningful themes related to the research questions, followed by re-coding to explore thematic patterns and categories (Boyatzis, 1998). Researchers resolved any coding discrepancies through open discussion and responses could be coded with multiple themes. Descriptive statistics were compared for themes between pre- and post-survey data.

4 RESULTS

General familiarity of landscape performance evaluated students' change in factual knowledge (Table 2). In the pre-survey for question 1, 40% of students had never heard of landscape performance or don't remember specifics and a mere 3% knew how to utilize it. However, 57% of students, had some idea or knew of it but not very clearly or with specifics. In the post-survey, 69% of students knew what it was and how to utilize it in a project, demonstrating a considerable improvement in multiple dimensions of knowledge. In question 2, nearly 75% of students thought that landscape performance was very important or critical to the profession even at the pre-survey. Even still, data in the post-survey showed an increase to 73% of students who thought it was a critical skill (the highest rating). Also, all students who did not

have enough information to answer the question in the pre-survey (20%) chose an alternative response in the post-survey.

Table 2. Familiarity and value of landscape performance

Question	Pre-survey	Post-survey
1. Landscape familiarity	*%*	*%*
Have never heard of it	20.0	0
Have heard of it but don't remember any specifics	20.0	0
Have some idea of it but not too clearly	34.3	2.9
I know what it is, and could explain the basics	22.9	22.9
I know what it is and how to utilize it within a studio project	2.9	68.6
2. Landscape performance importance for profession		
I don't have enough information	20.0	0
Not Important	0	0
Somewhat important but no more so than other concerns	0	0
Important	5.7	9.1
Very important	45.7	18.2
A very important and critical skill	28.6	72.7

In question 3, the greatest change from pre- to post-survey was in the percentage responses that demonstrated a high level of understanding, which went from 6.3% to 43.8% (Table 3). A high level of understanding was based on LAF's definition of landscape performance, which states landscape performance is "a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability (LAF, 2017b)." Two high understanding, representative student responses were, "Landscape performance is a measure of how well a landscape functions. It deals with site aspects related to social, economic and environmental benefits as well consideration of sustainability,"(3rd year, undergraduate post-survey) and "Landscape performance is the process of calculating quantifiable benefits of a design in context to performance goals and sustainability. The quantified data, provides credibility and reason to support the implementation of a design" (3rd year, undergraduate post-survey). Half (53.1%) of the students exhibited responses representative of low understanding at the pre-survey. A response rated as a low level of understanding did not mention the need for measurement or sustainability benefits, such as, "Landscape performance is how the landscape is used or utilized. This can be from people or how nature can take on the landscape" (4th year, undergraduate pre-survey).

Table 3. Level of Knowledge of Landscape Performance.

Question		Pre-survey	Post-survey
3. Landscape performance definition		*%*	*%*
Low understanding (avg. rating 1-2.33)		53.1	28.1
Medium understanding (avg. rating 2.34-3.33)		40.6	28.1
High understanding (avg. rating 3.34-5)		6.3	43.8
4. Types of impacts, and 5. Data needs to measure impacts			
Low understanding		55.9	21.9
Medium understanding		32.4	53.1
High understanding		11.8	25.0
6. Potential limitations			
Code Theme: node	*Description*	*Freq.*	*Freq.*
Data: quality	data accuracy reliability, or availability; human error; technical challenges	7	6
Data: benefit measurability	aspects of landscape architecture where measurement may not be feasible or attainable; underrepresented benefits	3	9
Data: temporal factors	timing-related measurement concerns; unforeseen changing site conditions	8	2

Data: place constraints	site or surrounding context conditions make it more difficult to attain LP goals; policy-related; climatic conditions	8	5
Process: organization resources	time, tools and equipment, monetary, and people resource needs; technical expertise; lack of interest in staff	4	6
Process: design freedom	limits design aesthetics or creative process; narrows scope	2	4
Process: goal alignment	client or programming goals do not align with LP targets; users or clients may priorities related to values and cultural factors different than LP goals	2	6
N.A.	unknown; no response; too unclear to assign code	5	0

Within questions 4 and 5, just over half (55.9%) of student responses were at a low level of understanding in the pre-survey. In the post-survey, while the high level of understanding responses increased, the majority of responses (53.1%) were only at the medium level of understanding (Table 3). Responses that listed elements of a traditional site inventory were evaluated as characteristic of a low level of understanding. For example, one student responded for types of impacts calculated or measured and data required, "Sun, weather, wind, human traffic, cars, different age and ethnicity groups. Amount of sun a place receives can be measured by observation or online data source (same goes for weather and wind) - look at past records of weather and wind, through observation, one can determine if the area is busy or not and determine peak time for traffic, demographics of an area can be determined through survey" (4th year, undergraduate pre-survey). To receive a high level of understanding rating, responses described specific impacts related to landscape performance metrics and indicate the need for pre- (baseline) and post-data. An exemplar student response was, "Runoff, Energy Use/Embodied, Biodiversity, Habit Quality, Drought Tolerance, Screening of undesirable view sheds, Increase in value of the property. Pre & Post Development Runoff, Total Embodied energy of all materials, # of Species, # of Native habitat species, Water use of Plant Material, % Screening of Parking lots & such, Appraisal before and after" (4th year, undergraduate pre-survey).

Question 6 responses revealed two coded themes: data and project process. The data theme includes four nodes that impact data collection or use in different ways. The process theme includes three nodes that relate to creativity, project goals or programming, and project management (Table 3). Most responses in both pre- (66.7%) and post-surveys (57.9%) represented the data theme. While the frequency of 'data quality' and 'place constraints' nodes remained steady between pre- and post-surveys, there was an increase in number of responses in the 'benefit measurability' node and a decrease in the 'temporal aspects' node. Notably, the frequency of responses in the process theme more than doubled between the pre- (20.5%) and post-survey (42.1%). Finally, five responses had no answer or unknown data in the pre-survey, which dropped to zero in the post-survey.

Table 4. Reflection and Self-Assessment of Understanding Landscape Performance.

Question	Pre-survey	Post-survey
7. *Understanding of process for determining performance*	*Weighted Avg. (5-pt scale)*	
Plant species diversity	2.97	3.94
Human physical activity	3.32	4.03
Stormwater rates or volumes	2.59	4.00
Tree benefits	3.03	4.09
Percent Impervious Cover	2.44	4.38
Irrigation volumes	2.09	2.78
Human restorative experiences	2.29	3.26
Operating energy (n=15)	2.07	3.00

8. Landscape performance impressions

Coded Themes	*Description*	*Freq.*	*Freq.*
Importance: design process	Useful for designer's work; useful tool to utilize in design process	6	13
Importance: profession	Increases awareness and purpose of LA practice; improves communication of design impact; future of the field	3	8
Importance: evidence	Justifies design decisions and project; generates public or client support; makes impacts tangible to non-experts	9	8
Importance: project sustainability	Improves project sustainability or multifunctionality; improves final outcome or project effectiveness	12	9
Learning experience	Recognizes value and desire to learn more; overwhelmed; too complex; time constraints on learning extent	2	3
na	Unknown; no response; too unclear to assign code	5	1

Student self-assessed level of understanding increased for every topic in question 7 between the pre- and post-surveys (Table 4). At the start of the courses, students felt they had the highest understanding for determining a site's performance related to 'human physical activity.' The stormwater rates or volumes' and 'percent impervious cover' topics had the greatest positive change while 'human physical activity' and 'irrigation volumes' had the least. At the end of the courses, students felt they only understood the process for determining 'irrigation volumes' a little bit to somewhat well.

Impressions of landscape performance in question 8 revealed that both in the pre- and post-survey, students' reflections were overwhelmingly positive and consistently noted its value for high-quality design processes, products, and the profession. There were only two student responses in the post-survey that represented negative or challenging factors of learning landscape performance. Coded themes primarily represented different aspects of importance, with a small frequency of responses related to the learning experience (Table 4). The 'design process' and 'profession' nodes had the highest change in frequency from the pre- to post-survey. Finally, when evaluating all responses regardless of code, descriptive phrases were considerably more effusive in the post-survey, such as: "extremely important," "needs to be widely used," "necessary and essential," "critical aspect," "crucial," and "it really matters." Whereas in the pre-survey, descriptive phrases included: "useful tool," "very important," and "important concept."

5 DISCUSSION

5.1 Student Learning

Data from pre- and post-surveys made evident that a variety of course types and activities can be successful as tools to teach landscape performance and improve student knowledge. Students improved in their understanding of landscape performance on multiple dimensions, even where existing knowledge of a topic was apparent prior to the course. Students' factual knowledge increase was seen in their definitions of landscape performance and perceived value of the method within the profession. Students' conceptual knowledge improved in terms of comprehending the types of landscape benefits and general characteristics of measurement. Students exhibited increased understanding of the implications of utilizing landscape performance methods on project management and resources, like time, money, expertise, and technology. They also noted potential impacts on client relationships and that the process could be a waste of resources if clients or partners were not on board. Students also clearly recognized the implications of data quality for a process that fundamentally relies on good data to work effectively. These patterns demonstrate procedural knowledge change, which are essential skills when working in practice and on interdisciplinary teams.

The extent and depth of student understanding of landscape performance also increased over the academic term. For example, while students recognized potential limitations when using landscape performance in the pre-survey, their responses more often related to site inventory methods and site condition constraints. After having utilized landscape performance principles in coursework, responses represented a more nuanced understanding of potential methodological issues. First, a pattern that emerged was students recognized the potential challenges when landscape benefits cannot be quantified effectively. Such as illustrated in this post-survey response, "a possible limitation would be focusing too much on the function of a site and not enough on the aesthetics of it. How the landscape functions is crucial but if a design isn't aesthetically pleasing people won't want to use it" (1st year, graduate post-survey). Second, students recognized the landscape performance method may inhibit aesthetic or cultural goals. One student wrote, "You could forget about people's needs and concerns, if you are in a mindset to create landscape performance, it may overshadow what people may want" (4th year undergraduate post-survey). These patterns make evident student's ability to critically analyze when they might question validity or application of a landscape performance approach.

Student's increased knowledge and positive impressions clearly support the continued training in and application of landscape performance in landscape architecture curriculum. Students noted, "After this class, I feel I have a new purpose for design. Now that I can calculate landscape performance to some degree, my designs will actually prove that it works," (3rd year undergraduate post-survey) and, "I want to use it in every design I create from here on out" (3rd year undergraduate post-survey). Students also articulated its importance for project sustainability and professional practice. Another student wrote, "I think it's a critical aspect of landscape design. It can enhance 'life expectancy' of designs. It guarantees/shows others not in the profession why we do what we do = communication is key" (3rd year undergraduate pre-survey).

5.2 Student Learning Challenges

While student learning relating to landscape performance clearly reached factual, conceptual, and procedural knowledge levels, the survey results also allude to learning challenges relating to interest, competency, and applicability of the material presented. Interest in the topic of landscape performance proved to be high among the surveyed students, yet questions about the balance of creative freedom and getting "caught up in calculations" emerged as a real concern. Similar to challenges found in landscape implementation courses, there is potential that heavily numbers-driven material may disengage certain student-learner types that may be less technically inclined. Appropriately reinforcing the opportunities of landscape performance in the design process is critical for continued learning success among the broadest population of students (see Future Directions).

The level of competency considering the complexity and depth of information, may also challenge learning in the limited time of an academic term. Post-survey comments describe the "often overwhelming number of functions a landscape has to perform" and that "it's a lot to comprehend in one semester." Many methods also rely on long-term observational sessions and complex data collection that reaches well beyond the scope of a single course. Students perceived the difficulty of securing information resources, and commented on the feasibility and accuracy as potential limitations to landscape performance. This may be indicative of the modest increase in understanding the process for determining a site design's performance related to 'human restorative experiences.' However, as one student put it, they became "optimistic and eager to learn more," and appreciated "learning the vocabulary and the tools," perhaps despite not having the opportunity for the full time-period needed for observation and data collection. This may also lead to opportunities of learning what to do in the complicated cases of practice, where client goals, budget, and data availability do not necessarily align with designer aspirations for landscape performance.

The difficulty in the delivery and assimilation of all of the applicable topics relating to landscape performance in a single academic term also presents itself as a learning challenge. In regards to covering the depth of landscape performance, it was observed that responses from question 5 lacked in-depth and specific responses to what data would need to be collected in order to measure impacts, which may indicate a need for a deeper view in collecting data and recognizing the reliability of information for specific subject areas. Concerning breadth of landscape performance, based on student self-assessment, understanding of irrigation volumes remained the primary category surveyed that showed only slight improvements in understanding between the pre- and post-surveys. The importance of water resource management is clear in landscape performance work and the SITES rating system, and of particular

importance to the regions in which the surveyed students are studying. Material relating to this area of landscape performance may not have been covered as fully as other topics, and suggests the potential need for prioritization of material covered, along with an appropriate balance of breadth and depth, and follow up in subsequent courses.

5.3 Limitations

The authors noted several limitations to the survey instrument and study. Variations in course content and instruction mechanisms (readings, presentations, assignments) among the authors may be responsible for variations in responses and impressions among students. While the authors relied on LAF educational resources for instruction, however, they may not have delivered the same understanding for key terms, calculation techniques and uses. As a result, some discrepancies were noted among the responses upon the first reading of open-ended questions. Response variation was normed during the reading and qualitative analysis. It should also be noted that landscape performance was utilized within existing courses. While all courses were studio and project based, the focus of the course was directed toward design, site engineering and service-learning at each of the universities respectively. The authors also note that the survey tool was not designed to quantifiably measure levels of student knowledge. Instead, survey methods pull from direct and indirect assessment techniques with a longer term goal of helping guide future teaching strategies, instruction techniques and student learning.

5.4 Future Directions for Teaching and Assessment of Learning

Teaching landscape performance offers tremendous potential for faculty to incorporate new content into existing courses, to develop new courses, to consider new teaching methods, and to help further student understanding of the potential and value of the designed landscape. LAF's 'Resources for Educators' (https://landscapeperformance.org/resources-for-educators) provides teaching materials for past courses funded through LAF's Landscape Performance Education Grant program and these materials provide a good starting point for educators. Survey results and author's reflection revealed several opportunities and future directions for teaching landscape performance including:

- A good assessment stems from and revolves around 'clear and important student learning goals.' (Suskie, 2009). Faculty teaching landscape performance may benefit from developing shared learning outcomes for future instruction and assessment in order to develop long term, reliable results of student learning.
- Development of assignments and templates that would allow students to collect and analyze data, calculate performance benefits and compare results. These tools would allow for increased understanding of methods associated with data collection and benefit calculation. Applicable assignments and templates would also address challenges associated with the quick pace of the academic term.
- Further clarification and direction on the differences between landscape performance and site analysis. Pre-survey results noted student understanding of landscape performance to be similar to site analysis in purpose, data collection and value. While results showed increased student learning, some post-survey responses still referenced site analysis terms, data types and uses.
- Continued exploration of landscape performance within the context of the design process. As noted in LAF's Case Study Briefs, landscape performance methods currently support post-occupancy evaluation of constructed projects (LAF, 2017c). Understanding how landscape performance can be taught in the context of project design and development will assist faculty in selecting appropriate courses for the inclusion of the subject. Additional research on how professional offices utilize landscape performance during project development is needed to address this direction.
- Additional efforts in assessing the learning of landscape performance are required. As an added knowledge, skill and application requirement to professional accreditation, program reviews will observe and evaluate if programs have included landscape performance in the curricular offerings. Continued assessment of learning may help facilitate individual student learning, assist programs better prepare for program review, and may offer faculty professional development and scholarship opportunities.

6 CONCLUSION

This study makes clear student interest in and enthusiasm for landscape performance concepts. In addition, the study demonstrates the value of utilizing pre- and post-surveys as a model to systematically assess student learning, teaching impacts, and potential needs for curricular changes, beyond traditional course evaluations. The findings identified specific areas where students struggled with learning landscape performance, which are critical to understand in order to make teaching approaches stronger. Author reflections, informed by student responses, urge for the generation of in-depth teaching materials or site cases to improve student learning and coursework rigor. Instruction can benefit through strategies such as emphasizing distinctions between landscape performance and site analysis, as well as emphasizing integration in the design process to enhance creativity rather than inhibit. The authors acknowledge the tremendous effort put forth by LAF to support the integration of landscape performance into the profession and academia. As continued research looks at best practices for measuring landscape performance benefits as well as case studies that validate landscape performance impacts in practice, future research should simultaneously consider best practices for the teaching and learning landscape performance.

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