Reflections and Evaluation of Integrating Landscape Performance into BLA 4th Year Studio Curriculum

Phillip Zawarus
Assistant Professor of Digital Fabrication & Design
Landscape Architecture Program
University of Nevada, Las Vegas

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Overview

The LPEG was instrumental to the integration of landscape performance metrics by providing measurable resources, precedent studies, and collaborative opportunities between other fellow LPEG recipients and UNLV's BLA Program for the Landscape Architecture Design studio course. The student outcomes from this course ran parallel with the Program's mission of commitment to education, community outreach, and the complex planning and design challenges that face extremely arid regions. The refined course objective, through this grant, expands upon sustainable practices to include performance-based elements, principles, theories and design strategies of landscape architecture in the Mojave Desert.

The main goal of the studio course was to introduce students to the quantifiable metrics and characteristics of desert ecological conditions that scale from the Southwest Region of the United States to the sub-watersheds within the Las Vegas city boundaries. This introduction of environmental systems established a framework for students to develop responsive solutions in an evidence-based design program. Students were challenged to incorporate, into their standard workflow procedures of analyzing and designing a project site, advanced computational methods and resources that included calculators, advanced geographic information systems (GIS), and parametric modeling to assist in the development of performative benefits. From this process, students were able to assess, communicate, and evaluate the significance and implication of landscape performance design practices incorporated into their design narrative. The following evaluation report provides the course workflow process of disseminated exercises, the goals and objectives, deliverables and methods, student work outcomes, instructor assessment and reflections, and future improvements.

Workflow Process

This workflow process for this studio course follows the principles of John Lyle's *The Alternating Current of Design Process*[1] in order to sequentially propose and dispose ideas of landscape performance in a responsive methodology. This preference allows for the conclusion from each exercise to establish a framework for the next exercise of the design process, while maintaining the ecological integrity and function. As a design instrument, this process provides an iterative refinement of a student's design vision throughout the entirety of the semester, rather than containing disconnected objectives.

The procedure of introducing students to the topic of landscape performance and the implications within a desert environment involved a cyclical process of proposing and disposing design strategies in response to the evidential outcome from an environmental system analysis. The first wave in the process was for the students to depict their vision of how performative landscapes would transform traditional infrastructure and land use conditions with little constraint, so not to impede their creativity but still maintain the integrity of desert ecologies (Exercise 1.0). Next, students studied case studies from the Landscape Performance Series website to research, evaluate, and critic the performative benefits of existing projects to influence and inspire their own design vision (Exercise 2.0).

At the next phase, students worked together to compose a structure web of the environmental network between hydrology, vegetation, soil, climate, terrain, and wildlife. This exercise showcased the symbiotic relationship between these different environmental systems and the common variables that resulted in ecological services such as stormwater management, microclimate, erosion control, and others (Exercise 3.1). With a fundamental understanding of environmental networks in a generalized setting, the next step was the application of this method in the contextual scaling from the southwest United States,

[1] Lyle, John Tillman. 1985a. "The Alternating Current of Design Process." Landscape Journal. 2 (1).

to the Las Vegas metropolitan valley, and lastly to sub-watersheds adjacent to wash segments. Groups were formed to examine the three environmental systems of hydrology, vegetation, and soil and how the conditions of each change and interact with other systems dependent on land use typology (Exercise 3.2).

The outcome from this comprehensive system analysis provided guidelines for potential challenges and opportunities within their designated site along a segment of the Las Vegas wash network to implement green infrastructure strategies for reduction, mitigation, conveyance, and filtration of stormwater runoff and other supplemental environmental, social, and economic benefits (Exercise 4.0). These guidelines for green infrastructure established a framework to further analyze, develop, and design holistic landscape performance concepts that address the issues of arid water resources, urban heat island, erosion, accessibility, and economic feasibility. Each student was responsible for re-envisioning traditional stormwater infrastructures along the wash to accommodate multifunctional aspects, performative benefits, social equity, and contextual response within each of their own unique sub-watersheds and wash channel (Exercise 5.0).

Goals & Objectives

From the workflow process stated prior, specific goals and objectives were established as part of the landscape performance curriculum standards at UNLV. Each exercise had separate goals and objectives, while maintaining the primary goal of utilizing new modeling methods to quantify performative metrics specific to desert ecologies. As a result of this workflow process, students were be able to:

- Envision innovative and sensible responsive ecological design practices for arid environments (Ex. 1.0)
- Communicate environmental, social, and economic benefits through infographic annotation and visualization respective to conceptual and existing projects (Ex. 1.0 & 2.0)
- Analyze quantifiable metrics from research methods and documentation for critic and evaluation of precedent studies (Ex. 2.0)
- Correlate the symbiotic relationship between environmental systems as they create unique ecological conditions and services through shared factors (Ex. 3.1)
- Understand the significance and impact of environmental systems at the Southwest region, Las Vegas valley and local sub-watershed scale that surround the Mojave Desert (Ex. 3.2)
- Demonstrate the ability to use performance metrics and calculators with parametric and GIS modeling methods for analytically extracting environmental conditions, constraints, and opportunities (Ex. 3.2)
- Apply the outcomes from their analytical model typologies to generate responsive design opportunities as evidence-based design strategies (Ex. 4.0)
- Measure the performative benefits derived from their design proposal that revolve around environmental, social, and/or economic opportunities (Ex. 5.1)
- Communicate and represent comprehensive evidence-based design through the use of dynamic visualization and parametric modeling methods (Ex. 5.2)

Deliverables & Methods

Each module contained a series of exercises with the goal to fulfill specific learning objectives, stated in the previous section. The exercises within each module contain a brief description of the exercise, the identified deliverable, and the tools, methods and resources in accomplishing the learning objectives.

Module 1 – *Envision (Ex. 1.0) & Study (Ex. 2.0)*

Based on readings and discussions, students created a vision board that depicts a perspective rendering of what landscape performance means in the Mojave Desert and Las Vegas valley. This project is intended to stem inspiration and creativity with limited constraints and parameters to their conceptual vision. Students utilized perspective rendering techniques in Photoshop in conjunction with established graphic styles to convert an existing photograph into their performative landscape representation (Ex. 1.0).

The phase of creativity and visionary ideas in relation to landscape performance from the previous exercise was grounded by investigating successful precedent studies of functioning landscape architecture projects from the Landscape Performance

Series Website (landscapeperformance.org). The precedent study was constructed into a narrative of project goals, social, environmental, and economic benefits, and sustainable features. These values were graphically shown through infographics, diagrams, and annotations over project photographs as hybrid visualizations. With each student constructing one unique precedent narrative, a collection of examples for performative metrics and inspiration was cataloged for future use in the semester (Ex. 2.0).

Module 2 – *Connect (Ex. 3.1) & Measure (Ex. 3.2)*

Through the investigation and assessment of environmental systems for productive ecological services, the studio aimed to understand natural symbiotic relationships between hydrological, vegetative, and geologic conditions with the assistance of readings from Travis Beck's "Principles of Ecological Landscape Design". As a group, the students conceived a physical environmental system web showing the connection of variables and conditions between systems using color coordinated post-it notes and yarn (Ex. 3.1). This learning objective assisted students in understanding the complexity behind the network of environmental systems through the process of scale as they evaluate the conditions of hydrology, vegetation, and soil at the regional, valley, and site-specific context (Ex. 3.2). Collecting numeric and GIS data from USGS and other reputable sources, groups analyzed their respective system using performance calculators, parametric modeling formulas, and digital representation to generate data-scapes. The outcome from this process was a series of site-specific ecological performance typologies that would serve as a framework to an evidence-based and responsive design methodology along the fragile wash system of Las Vegas, Nevada (Ex. 4.0 & 5.0).

Module 3 – *Strategize (Ex. 4.0)*, *Analyze (Ex. 5.1)*, *& Respond (Ex. 5.2)*

After establishing ecological performance typologies from a series of unique sub-watershed locations scattered throughout the Las Vegas valley, the data and formulas were applied to a series of connected sub-watersheds that were adjacent to a segment of the valley wash network. Students inventoried, calculated, and evaluated the stormwater runoff potential from a series of common rain intensities for that location to set a benchmark for runoff reduction using green infrastructure strategies (Ex. 4.0). These strategies were developed through the use of the NRCS and National Stormwater Runoff Calculator, parametric modeling formulas in Rhinoceros 3D's plugin Grasshopper, iTree, and green infrastructure guidelines from "The Sustainable Sites Handbook". This framework established a green infrastructure master plan strategy for the student's designated sub-watershed. These goals from their master plan were tested and investigated through a quantified digital model using vegetative, hydraulic, and climatic performance metrics in a parametric environment (Ex. 5.1). After a comprehensive analysis of their site's performative conditions, students developed design concepts for desert ecological design within existing traditional stormwater infrastructure as a response to the evidence outputted from their performance metrics and parametric formulas (Ex. 5.2).

Student Outcomes

Student work frome each exercise was assessed and evaluated for their ability to fulfill the intended learning objective from the assignment. They had varying results, however the primary goal of understanding, applying, and creating sustainable landscapes in the desert environment of Las Vegas using performative metrics was achieved.

In Exercise 1.0, every student had a clear vision of environmental and social benefits they wished to transform existing conditions into. The majority of students were committed to the preservation of water resources and wildlife habitat, while providing adequate comfortable outdoor spaces providing by mature tree canopies due to the harsh temperatures year-round. Although it was difficult to identify the specifics, there was an underlying understanding from all the students a significant cost savings from performative landscapes. Construction costs and cost savings were further investigated in Exercise 4.0 and 5.0.

The precedent study in Exercise 2.0 demonstrated high potential in effectively communicating performative benefits that contributed to the compounding success of the project study. The student's research and collection of data from these precedent studies were adequately showcased in their graphic narrative of the unique performance benefits using charts, data comparisons, and photographic evidence to create photo overlays of significant project information. With the deliverable of this exercise being a series of page descriptions of the precedent study, the intended goal of producing one comprehensive narrative of the project was a challenge. Most deliverables resulted in singular, yet still provocative, descriptors but not a holistic conclusion of the project's performative aspects.

Students were most successful in understanding the integral and complex relationship that exists between environmental systems in Exercise 3.1. They produced a comprehensive layering of information of their designated system that scaled from the region down to their sub-watershed. The result from this exercise was a series of thorough system analyses with strong data evidence showcased in graphical maps, timelines, diagrams, and data-scapes. The challenge that existed for each group was understanding the significance of the information presented from their analysis in Exercise 3.2. It was clear that the information was extensive and complex, yet the struggle for the students was in identifying the use of that information in moving forward.

The green infrastructure master plan strategy in Exercise 4.0 was the student's first experience of developing a design solution in response to analytical evidence, specifically runoff volume. The primary goal was for the students was to determine the runoff reduction values from green infrastructure practices integrated into the existing fabric of their sub-watershed. They compared existing runoff values with their green infrastructure values for a comparison and evaluation in the feasibility of their proposal. Within the master plan drawing of their green infrastructure applications, they provided detail drawings of their design strategies that included permeable pavers, bioretention, native landscapes, and other best management practices. The biggest challenge of this exercise was understanding the relative difference their strategies achieved. It was difficult to discern the overall impact and benefit their proposal achieved beyond runoff volume difference, such as a percentage in reduction and how that proposed reduction value may influence other design decisions.

The final assignment in Exercise 5.0 granted students the opportunity to go beyond schematic and strategic planning for landscape performance and begin detailing the experience of space and desert ecological design. The compounding effect of introducing factors of materials, strict site conditions, demographics, and stormwater management directed each student into different conceptualizations. Each student proposed thorough environmental benefits in respect to water resources while also integrating social and economic benefits in several student designs. The more successful student outcomes were able to communicate the comprehensive relationship between the three performance benefits by illustrating cost savings versus construction cost, fluctuating runoff volumes, and dynamic programing of space in response to water conditions along the wash.

Instructor Assessment & Reflections

The overall outcome of the studio course was well received by both students and peers, as the subject of landscape performance was a new topic introduced to the curriculum and included a challenging site for the students. Among the many successful components to the course, there came many challenges in both the comprehension and output regarding the subject matter.

Successful Outcomes

- Visualizing and communicating the compounding benefit landscape performance has in positively impacting a site was clearly understood by the students. There was a clear correlation made by students in the intricacy of how environmental, social, and economic aspects of design compliment and work together.
- Utilizing the Landscape Performance Series online resources were beneficial to the student's comprehension of performance values and benefits. The ease of access and extensive resources of the website served as a primary toolkit to the introduction of landscape performance metrics.
- Although it was a struggle at first, students began to grasp the complexity of ecological conditions and services. Students continued to further develop and investigate the different environmental systems beyond the assignment deadline, which proved effective in their design development.
- Students dissecting the complexity of environmental system functions and ecological services at different scales (regional, valley, and site) was successfully achieved. The workflow and research shifted at each scale and the student's aptitude for this was apparent. The regional scale was the most successful of the analysis process for the students.
- Working in groups at the environmental system analysis (Exercise 3.2) was beneficial and necessary for the required scope of work and resulted in consistent graphics and information from all the members in the group.

- Developing a catalog of ecological typologies, benefits, and outputs along the wash between all group members was useful as a design framework for the latter part of the semester in Exercise 5.0.
- Applying stormwater performance calculators at both a master plan scope of work and focus area was well grasped and explored thoroughly throughout that phase of the semester. The resulting outputs from the calculators was legible and well-conceived in drawings.
- The relationship between the analysis of performance metrics and design decisions was apparent due to the incorporation of a parametric modeling workflow, resulting in a responsive solution to evidence-based information.
- Integrating performance calculators and parametric modeling to the design phase of the final project provided measurable outputs for students to revise and adjust the concept in order to achieve their desired outcome through iterations was instrumental to their design development.

Challenges

- Understanding the significance of measureable outcomes was a challenge for students because the information was all relative unless a measureable baseline was determined. The information was often comprehensive and extensive, yet lacked a substantial conclusion.
- Although the design outcomes were responsive to the analytical outputs, the extent of response and change was rigid and lacked innovation in some occasions.
- Design conceptualization is often best done through sketching, so the translation of ideas in the design was sometimes difficult to integrate into the digital parametric model.
- Using parametric modeling as only a tool for investigating landscape performance was also a challenge, as some students overcommitted to the modeling process, which stated earlier can result in rigid design solutions, and impaired more obvious and holistic design opportunities.
- It was a continual struggle to have students express their design as a dynamic design opportunity by addressing changing climate conditions, plant succession, water levels, rather than a snapshot idealistic scenario. When addressing water resources in a desert environment, the majority of the time conditions will be dry yet the design should not be impaired due to the lack of available water.

Future Improvements

The overall structure of the course was beneficial to the students progressive understanding of the many facets involved in landscape performance, however, refining specific goals and outcomes for each exercise as a point of reference would aid in stronger conclusions from the students. Dedicating more time to the design process of developing performative scenarios through changing site constraints and parameters for outcomes to achieve specific goals would help in the succession of responsive and performative design solutions. Many new and advanced tools were used in the course of the semester, and sometimes the tools took over the process rather than the teaching of the subject matter. Establishing a better balance between the learning objectives and tools may result in a more thorough design outcome. It is more instrumental to provide resources on researching subject matters related to landscape performance, rather than only the tools to achieve measurable outputs, and that will be the goal for the next course objectives. As performance metrics and measurable outcomes become more mainstream to the design process, more time and effort can be dedicated for innovative solutions that address ecological services, social equity, and economic feasibility.