The Role of Research in Landscape Architecture Practice

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ABSTRACT

The profession of landscape architecture has not managed to sufficiently build a body of solid knowledge through research, which weakens the profession in terms of justifying its practice. In order to investigate why the profession has not built its knowledge-base sufficiently, this dissertation collected first-hand empirical data on the use and need of research in current landscape architecture practice, as well as the perceptions about research among landscape architects. Four questions were asked in this study: 1) What are the concerns of landscape architecture practice? 2) What is the significance of research in landscape architecture? 3) How do landscape architects perceive the need of research? 4) How are research findings disseminated in landscape architecture? To answer the questions, an online survey was given to randomly sampled ASLA members (adjusted response rate = 31%, n=239). The data was then analyzed through descriptive statistics, comparative statistics, and dimension analysis.

Modern professions are expected not only to successfully perform professional actions, but also to justify these actions with rational explanations. To meet this expectation, the scope of landscape architecture knowledge has expanded from design knowledge into systems knowledge. While design knowledge concerns how to do design, systems knowledge concerns why certain design actions should be taken. Meanwhile, with expanding systems knowledge, research becomes more and more important to landscape architecture practice. Sixty-seven percent of landscape architects are using research findings often in making design decisions.

However, results indicates that landscape architects expect research to generate rational solutions based on solid understanding of the phenomena and problems involved in design. Based on a review of literature, this expectation is unrealistic. The profession, if it expects to build a research-oriented practice, needs to change its perceptions about research, and advance its knowledge through studies and evaluations of built design work.

Despite the increasing use of research, this study also found that landscape architects today still make their design decisions largely based on a body of tacit knowledge, such as professional experience and intuition. This body of tacit knowledge is often learned in an apprentice manner between practitioners in their workplace, and is rarely shared in the whole profession. While practitioners do not share much beyond their workplace, educators primarily share within academia, which limits the profession from improving its work in a fast changing world. The profession should encourage practitioners to do research by promoting the examples of practicing researchers, and offer places to share knowledge. The profession should also encourage educators to share knowledge beyond academia and to be more aware of the potential implications of their research findings.

Preface

This dissertation studies the role of research in landscape architecture practice. The ultimate goal is to understand how landscape architecture can enhance its authority through research. I chose this dissertation topic largely because of my personal experience of being a landscape architect in China. In China, landscape architects often have low prestige in practice. They are paid less than architects and urban planners. It is not unusual when a landscape architect is told that his or her service is no longer needed, since an architect or an urban planner did his or her work when they designed the buildings. When I was in my second year, a professor asked us two questions: "Why does society need landscape architects anyway? What core knowledge does landscape architecture have that is unique to the profession and makes it irreplaceable?"

These two questions have haunted me ever since and I have never had a satisfactory answer. Since modern landscape architecture is relatively young in China, I was expecting to find an answer in countries outside China, where the profession is more matured. A German practitioner told me that I probably should look for the answers in landscape architecture in America, since she thought that the status of landscape architects in Germany, in her eyes, is only a little better than that in China, and to the best of her knowledge American landscape architects seem to have higher prestige, in general.

The eagerness to find an answer to the two questions drove me to pursue a Ph.D. in the United States. However, I found that American landscape architects are still struggling with problems concerning professional authority, too. For example, a survey participant commented that: "In many states a landscape architect's license stamp can be substituted by an architect or an engineer's stamp. This truly undervalues the existence of the profession." I still found a problem instead of an answer in landscape architecture practice in America. My efforts in exploring an answer to the authority of the profession of landscape architecture led to this dissertation.

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Table of Contents

List of Tables

List of Figures

Chapter I Introduction

1.1. Background

Landscape architecture was founded on a broad spectrum of knowledge. The early practitioners in this profession were generalists with practical skills and a breath of interests in dealing with creating and preserving natural beauty, as well as offering urban populations access to nature (Eliot, 1910). The scope of knowledge of early American pioneers in landscape architecture, such as Frederick Law Olmsted and Charles W. Eliot, ranged from biology, to the physical environment, to aesthetics, and to socioeconomics (Forman, 2002). The scope of their practice ranged from garden design, to park design, to park system planning, to residential suburb planning, to scenic preservation. In its early stage, the profession did not share a generally recognized specialty (Simo, 1999). Since then, the knowledge scope of landscape architects is general and broad.

With the development in communication techniques in the 20th century, significant changes took place in how knowledge was disseminated. In the internet age, human knowledge is becoming more accessible (Don A. Dillman, Smyth, & Christian, 2009; Friedman, 2005). Human knowledge is being advanced in both scope and depth, which provides new opportunities and challenges to landscape architects. Managing a broad range of specialized knowledge niches became very difficult, and the old identity of landscape architects as an omni-know-all generalists was challenged.

Landscape educators today are sharing information primarily through books, refereed journals, conferences and professional magazines (Chen, Clements, Miller, & Powers, 2011). The most often read refereed journals as reported by CELA educators include *Landscape Journal, Landscape and Urban Planning, Journal of the American Planning Association, Journal of Landscape Architecture,* and *Landscape Research* (Chen et al., 2011).

1.2. Problem Statement

There is a growing concern about the knowledge foundation of the profession, and some landscape architects have perceived a need that professional practice should be grounded in a body of more reliable knowledge, currently vaguely defined as “research:"

> *Albert Fein: "Artistic ability, or design creativity, is one factor by which individual practitioners differentiate their efforts. Hence, it is unlikely that any two solutions to a problem will be identical; however, all solutions to be valid must satisfy certain scientific needs and criteria." (Fein, 1972, p. 5-11)*
>
> *Ervin Zube: “The professional emphasis has been on practice and, in contrast to other professions such as engineering, medicine, and education, the practitioner cannot readily turn to a systematic body of information, derived from research and find answers to or information about pressing questions.”(Zube, 1981, p. 8)*
>
> *James F. Palmer and Richard C. Smardon: “It is our opinion that landscape architecture, as a profession, is not structured in a way to identify research needs, to support and encourage a response to those needs, and to integrate the response into the practice of landscape architecture. There is a need for a scientific and scholarly discipline that seeks to improve the performance in professional practice. (Riley & Brown, 1992, p. 178)*
>
> *Fellows of ASLA: “… Landscape architects need ‘better knowledge’ in order to be effective. It is a broad concern and was defined in three ways: as a need for better theoretical and/or technical expertise; as a need for research and as a need for greater academic rigor.” (Miller, 1997, p. 68)*
>
> *Elizabeth Meyer: “Our clients’ calls for data, for postconstruction evaluation, and for numbers are loud. But there’s a lot less academic research in this area than one would assume or hope for. ” (Jost & Lamba, 2010, p. 58)*

The above quotes indicate a concern that the profession seems unable to advance its knowledge sufficiently through research. To address this issue, there are several empirical studies examining the problems in academic research (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn, Brown, Mulley, & Hilts, 2003; Milburn, Brown, & Paine, 2001). There are also a few publications on research methods to address the lack of research skills among landscape architecture educators (Francis, 2001; March & Smith, 1995). Not only academicians, but also practitioners and organizations are taking actions to connect the profession with research. Innovative research projects as well as knowledge-compiling work has been done by practitioners (Jost & Lamba, 2010). Projects such as Sustainable Sites Initiative

(http://www.sustainablesites.org), Landscape Architecture Foundation's Case Studies Investigation (http://www.lafoundation.org/research/case-study-investigation/) and Performance Landscape Series (http://www.lafoundation.org/research/landscape-performance-series/) were initiated to bridge landscape practice with research.

1.3. Research Questions and Objectives

If the perceptions listed above are true, that landscape architecture is unable to advance its knowledge sufficiently through research, that may jeopardize the authority of the profession. This dissertation studies the role of research in landscape architecture. Knowing what role research is playing in landscape architecture and what problems the profession may have in advancing its knowledge, the profession can better understand how it may enhance its authority through research. This study examines the phenomena of research use in practice, as well as the production and dissemination of research findings in this profession. Therefore, the following research questions are asked in this study:

1. What are the concerns of landscape architecture practice?
    a. How has the profession of landscape architecture changed over time?
    b. What is the perceived knowledge-base of the current practice of landscape architecture? What are the changes in the perceived knowledge-base?
    c. What are the knowledge areas and domains of landscape architecture research?
2. What is the significance of research in landscape architecture?
    a. What is the definition of research in landscape architecture practice?
    b. What are landscape architects' attitudes toward research?
    c. What are the types of thinking and sources of knowledge that support decision-making in landscape architecture?
    d. For what purposes do landscape architects use research in practice?
3. How do landscape architects perceive the need for research?
    a. In what design stage(s) do landscape architects perceive a need for research?
    b. In what knowledge areas do landscape architects perceive a need for additional research?
4. How are research findings disseminated in landscape architecture?
    a. Where do landscape architects obtain new knowledge in this profession?

b. Who is producing knowledge through research? What knowledge is produced?

c. Where do researchers disseminate their research findings?

With the knowledge about the concerns of landscape architecture practice and the knowledge that the current practice is based on, one would be able to find whether the profession lacks certain knowledge to maintain its prestige as a modern profession. With the knowledge about the significance of research in the profession and the perception and the dissemination of research, one would be able to tell how knowledge is advanced through research in landscape architecture practice, and what its problems, if any, may be. If a lack of certain knowledge or a problem in the advancement of knowledge can be identified in landscape architecture, some actions may be taken to improve the current situation.

As this study concerns the phenomena of the advancement of knowledge in landscape architecture, research will be defined as the activities that are done in a rigorous or systematic manner and can lead to the discovery of new information, new understandings, or new applications in the field of landscape architecture.

1.4. Study Significance

This dissertation fills a lack of knowledge about the current use of research in practice, as well as the dissemination and perceptions of research. Though there are several empirical studies examining what may encumber educators from doing more research (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn et al., 2003; Milburn et al., 2001) and research that is more applicable to practice, there are very few empirical studies on how research findings are actually used in practice. The limited studies are either too old to inform current practice (i.e, Fein, 1972; Palmer, Smardon, & Arany, 1984), or used knowledge categories combined in ways that are difficult to tie to specific research studies (i.e., ASLA, CSLA, CELA, CLARB, & LAAB, 2004) .

This study collected first-hand empirical data on research use and research need in current landscape architecture practice, as well as the perceptions about research among landscape architects, in which data either are out of date or do not exist. A survey on research use and research perceptions was conducted among ASLA members, which was based partially on prior surveys on research engagement and dissemination among CELA members (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn et al., 2003). With this information, this study is able to identify reasons why the landscape architecture

profession cannot advance its knowledge through research sufficiently, from research production to research dissemination, and to the use of research in practice. The findings can directly guide current actions in connecting the profession with research.

1.5. Study Organization

The dissertation is organized in five chapters: introduction, literature review, methodology, results and discussion, and conclusion and implications. The introduction outlines the background, the problem statement, the research questions and the significance of this study. All the other chapters are organized and presented according to the four research questions addressed in the introduction chapter.

Chapter II Literature Review

In order to address the problem that the profession may be unable to advance its knowledge sufficiently through research, this dissertation began with examining the existing literature in terms of the research questions listed in Chapter I. It is organized in five sections, based on the research questions. Section 2.1 discusses professionalization and knowledge. Section 2.2 discusses the perception of knowledge in landscape architecture practice. Section 2.3 discusses the need of research as perceived by landscape architects. Section 2.4 discusses dissemination of research findings within the profession of landscape architecture. A summary is provided in section 2.5.

2.1. The Concerns of Landscape Architecture Practice

This section addresses the first research question "What are the concerns of landscape architecture practice?" Subsection 2.1.1 discusses the role of knowledge in modern professionalization in general. Subsection 2.1.2 provides a brief history of the professionalization of landscape architecture and the changing scope of knowledge within it. Subsection 2.1.3 discusses the existing scope of knowledge in landscape architecture. Finally, a summary of the section is provided in subsection 2.1.4.

2.1.1. Professionalization and Knowledge in Modern Professions

Professionalization

Professionalization is a type of occupation control which maintains the expertise of a certain practice (Abbott, 1988). Since the nineteenth century saw the first development of modern professions, sociologists have studied professionalization (Turner, 1989). An earlier theory saw professionalization as an independent system of institutional structures, such as professional registration, to control an asymmetric expert-client relation (i.e., Parsons, 1938), in which clients trust professionals as experts in a certain practice. A newer theory, cultural theory, viewed professionalization as a result of interactions between professions and larger social processes (i.e., Larson, 1977). A few current leading sociologists in

professionalization (i.e., Abbott, 1988; Freidson, 2001) believe that professionalization is centered in the control of special knowledge to support professional practice in professions, in general.

Abbott (1988) argued that modern professions are a type of occupation control through legitimization of expertise, as well as structural guarantees. In order to legitimize its expertise in a certain practice, a modern profession needs to specify its jurisdiction to the public and to legitimize its expertise in this jurisdiction by "[demonstrating] the rigor, the clarity, and the scientifically logical character of professional work" (p.54). These demonstrations usually involve academic knowledge and research, and are often different from practical knowledge about how to perform professional actions.

Cognition-based knowledge and Action-based Knowledge

Professions involve two types of knowledge that will be referred to as action-based knowledge, and cognition-based knowledge, in this dissertation. Action-based knowledge, also known as "knowledge how," is “knowing how to do things” (Ryle, 1945), or “knowing how to perform skills” (Roland, 1958), such as the discovery of ways and methods of doing things. Cognition-based knowledge, also known as "knowledge that," is descriptive knowledge “knowing that something is the case” (Ryle, 1945), or “knowing propositions of a factual nature” (Roland, 1958), such as the discovery of truth and facts.

These two types of knowledge play different roles in modern professions. Action-based knowledge directly guides professional actions, while cognition-based knowledge offers explanations and justifications for these actions. The explanations generated from cognition-based knowledge often define the prestige of a modern profession in professional competitions. For example, with years of observations of successful and unsuccessful medical cases in a specific area, an experienced nurse may have as much practical knowledge in diagnosis and prescription as doctors (Abbott, 1988). Abbott argued that the public placed more trust in doctors than nurses as a profession in the 1980s, since doctors were able to demonstrate the rationale of their diagnoses and prescriptions using a body of cognition-based knowledge.

2.1.2. Professionalization of Landscape Architecture and Its Knowledge

Landscape architecture was founded in the beginning of the 20th century, and was centered in action-based knowledge in aesthetics and professional skills (Simo, 1999; Zube, 1998). This profession, at its early stage, had an aesthetic focus and worked with the beauty of nature (Eliot, 1910).

With increased members and professional work in the Progressive Era and New Deal construction programs, there was a growing concern about the identity of the profession of landscape architecture in the mid 20th century, calling for more public relations for a clear image and a defensible justification of the profession. As revealed in the comments to a survey that Barton (1961) conducted, many landscape architects had concerns that the profession was losing its territory to architects and other aligned professions due to poor professional public relations. Better professional public relations were needed to inform the public of the scope of landscape architecture practice, and to justify "why [landscape architects] can do it better than any other professional person" (p.25).

In the late 1960s and early 1970s, the concerns in landscape architecture were observed to expand from aesthetics to ecological needs (Fein, 1972; see Table 1), and the knowledge bases began to expand from specialized knowledge and skills developed by its practitioners into science (Fein, 1972; see Table 2). As a result, Fein's study recommended that the profession develop scientific bases to support design creativity.

Table 1. The Concerns in Landscape Architecture Practice (Fein, 1972, p.1-26)

To what extent is each of the following central to your understanding of what the practice of landscape architecture should be concerned with?

Concerns	Undesignated or not at all or not too much	Fair degree	Great extent	Very great extent
Aesthetics	1%	4%	28%	67%
Ecological needs	1%	5%	25%	70%
Public welfare and enjoyment	11%	38%	37%	14%
Comfort and pleasure for the individual	8%	29%	41%	22%

Table 2. perceived Knowledge Bases for Landscape Architecture Practice (Fein, 1972, p.1-70)

To what extent do you believe the practice of landscape architecture today is based on the following knowledge?

Knowledge Bases	Undesignated or not at all	Not too much	Fair degree	Great extent or Very great extent
Specialized knowledge and skills developed by its practitioners	1%	2%	15%	82%
Scientific knowledge from the biological sciences	4%	27%	48%	22%
Scientific knowledge from the social sciences	5%	32%	39%	24%

Approximately in the same time frame of or slightly earlier than Fein's study, the three decades from the 1950s to the 1970s were the heyday of scientific research in landscape architecture. There was an increasing research involvement using the science of ecology and scientific method, led by landscape architects and planners such as McHarg (1969) and Fabos (1979). Seeking solutions for regional problems, they explored the relationship between natural systems and potential land uses. Rational methods as well as modeling or quantitative approaches were often adopted. There was also a group of pioneering environmental psychologists, funded by US Forestry Service, using statistical tools to describe human preferences in visual landscapes in the 1960s and 70s, such as Litton (1968, 1973, 1974) and Leopold (1969).

With the changing social and cultural context in the new economic policy during the Reagan Administration, there was a significant reduction in the federal budget to support these studies (Bryant, 2001). There was a noticeably decreasing number of scientific studies in ecological planning (Bryant, 2001; Cohen, 2003), urban modeling (Lee, 1973) and environmental psychology (Stokols, 1995). Meanwhile, the profession also began to realize that scientific knowledge alone did not necessarily lead to practical design knowledge. The assumption that the understanding of the world (cognition-based knowledge) would automatically turn into useful information for practice (action-based knowledge) was questioned. Subsequent theories, such as postmodernism, offered a new way to rethink more intuitive knowing -- the humanistic knowing (Barnes, 1998; Groth, 1997; Groth & Bressi, 1997). In the 1980s and 1990s, this profession developed a more humanistic culture, appreciating the intuitive, mystical and evocative aspects of design (Motloch, 2001, p. 42) with an increasing interest in topics such as history and culture (Jost & Lamba, 2010; Lamba & Graffam, 2011; Powers & Walker, 2009).

However, even though knowledge in landscape architecture expanded a lot in the past few decades, the profession was consistently perceived to be unable to support its practice with a body of solid knowledge, as revealed by empirical surveys in this profession (i.e., Fein, 1972; Miller, 1997). The reason for this, as Miller suggested, was probably due to the nature of landscape phenomena. Unlike engineers who usually deal with quantifiable and optimizable phenomena, landscape architects usually deal with complex phenomena which are difficult to predict or quantify. Miller's conclusion was consistent with that found by Glazer (1974). Glazer found that major professions, such as engineering and medicine, can develop solid knowledge, while minor professions, such as architecture, cannot, because the former deals with clearly defined objectives, while the latter deals with unclear ones. Therefore, landscape architecture practice may never be based on a body of knowledge as solid as that of engineering, since the nature of practice and knowledge are different between the two.

2.1.3. The Existing Scope of Knowledge in Landscape Architecture

In order to understand the existing scope of knowledge in landscape architecture, this study refers to two knowledge classification systems. One is the Landscape Architecture Body Of Knowledge (LABOK) knowledge areas (ASLA et al., 2004), which is probably the most comprehensive study on the scope of knowledge in landscape architecture, including both professional knowledge and academic knowledge. LABOK researchers found 32 knowledge areas in five categories of knowledge: core knowledge in the first professional degree, context knowledge for professional practice, specialized knowledge gained through post-professional education, through professional practice, and knowledge for acquisition at later stages (see Table 3). However, some LABOK knowledge areas are too comprehensive and should be divided into several areas, e.g., "human factors, such as behavior, perception, psychological and sensory responses." Another classification system includes the research topics in Council of Educators of Landscape Architecture (CELA) conferences, summarized by Powers and Walker (2009). This classification system contains 12 academic research topics (see Table 4).

Based on the two knowledge classification systems, this study developed a classification system of 19 knowledge areas organized in four knowledge domains (see Table 5): the judgmental design knowledge domain (design theory and design process, aesthetics, representation and communication,

professional ethics and the profession of landscape architecture), the construction design knowledge domain (grading and circulation, construction techniques, plants and materials, site engineering), the environmental systems knowledge domain (ecology, environmental psychology, water resource management, geospatial tools, health and landscape, and sustainable design), and the human systems knowledge domain (history and culture, community planning and design, garden history, and public policy).

Table 3. LABOK Knowledge Areas (ASLA et al., 2004)

Time of Acquisition and Relevance to Practice	Knowledge Areas
Core of first professional degree Practitioners are expected by >40% respondents 1) to be able to apply or have mastery of the knowledge in these areas at time of degree and, 2) to have mastery of the knowledge at time of professional responsibility.	Land information Natural site conditions and ecosystems Design creativity and process Influence of context on design Vehicular and pedestrian circulation Grading, drainage and stormwater Visual communication Graphic Presentation
Context for professional practice Practitioners are expected by >40% respondents 1) to comprehend or be able to apply or have mastery of the knowledge in these areas at time of degree and, 2) to be able to apply or have mastery of the knowledge at time of professional responsibility.	History Patterns of land-use and built form Social and cultural influences on design Visual resource management Conservation of natural resources Ecological planning principles Roadway design principles Landscape maintenance Ethics and social responsibility
More specialized knowledge - gained through post-professional education Practitioners are expected by >40% respondents 1) to be exposed to or comprehend or be able to apply the knowledge in these areas at time of degree, 2) to be able to apply the knowledge at time of professional responsibility and, 3) to be gained through post-professional degree in university programs	Historic preservation principles Research methods Therapeutic design Photogrammetry and remote sensing Rural analysis Water resource management Wetland and floodplain management
More specialized knowledge - gained through professional practice Practitioners are expected by >40% respondents 1) to be exposed to or comprehend or be able to apply the knowledge in these areas at time of degree, 2) to be able to apply the knowledge at time of professional responsibility and, 3) to be gained through practice	Land development policy and law Sustainable construction Construction Technologies Utility system; irrigation; lighting Construction administration, law, contracts Organizational management Resolving moral dilemmas
Knowledge for acquisition at later stages Practitioners are expected by <40% respondents 1) to be able to apply the knowledge in these areas at time of degree, Practitioners are expected by >40% respondents 2) to be able to apply the knowledge at time of professional responsibility and, 3) to be gained through continuing education programs	Land and water reclamation Regulatory approval processes Land and development economics Construction quality control Life-cycle cost analysis Conducting meetings Public relations

Table 4. CELA Research Areas Identified by Powers and Walker (2009, p. 100)

Subject Categories	Subject Descriptions	Range of Topics Identified and Attributed to Subject Category
History and Culture	Articles addressing land use and design in terms of human culture from prehistory to the present	Historic preservation; Cultural landscape studies; Biographies; Landscape archeology; Religion
Landscape Planning and Ecology	Articles addressing land use, design, and management of different landscape features, forms functions and systems.	Landscape assessment; Resource management; Open space; Byways; Shorelines; Land use planning and policy; Wildlife; Mining
Human and Environment Relationships	Articles exploring the human dimensions of design including their influence on the appearance, and use of natural and built landscapes.	Aesthetics; Place; Picturesque; Gender; Class; Race; Diversity; Behavioral, social and psychological factors
Design Theory	Articles addressing theories of design including processes, techniques, and criticism of existing theories.	Design theory; Design methods; Design processes; Hermeneutics; Phenomenology
Urban Design	Articles addressing urban space and form including alternative transportation, active living, policy, and city planning.	Community planning; Neighborhood design; Streetscapes; Parking; Urban plazas
Landscape Design and Implementation	Articles discussing garden design and general design issues including plants, gardening, innovative construction technologies, materials, and practices.	Garden design; Plants; Horticulture; Water use; Climatic factors; Design and build
Communication and Visualization	Articles exploring existing or new approaches and applications for communicating and facilitating design.	Photography; Music; Storytelling; Poetry; Visual simulations; Drawing; Film
Methods of Inquiry	Articles presenting existing or new quantitative, qualitative, and mixed methods for landscape design and planning.	Computer programs; GIS applications; Analysis of computers; Post occupancy evaluations; Long- term monitoring
Sustainability	Articles addressing the relationship between humans and the environment in terms of longevity and productivity of various systems.	Ecological design; Bioregionalism; Waste; Garbage; Health
Landscape Architecture as a Profession	Articles addressing the profession including the practice, training, and future of landscape architecture.	Discipline discussion; State of the profession; Demographics of the profession; Future growth issues
Design Education and Pedagogy	Articles addressing various issues related to design education, curriculum, and pedagogy.	Pedagogy; Creativity; Gaming; Role play; Studio projects

Table 5. The Scope of Knowledge in Landscape Architecture

Knowledge Areas	Area Descriptions	LABOK Classification*	LABOK Domains **	Specification of classification bases
The Judgmental design knowledge domain				
Design theory and design process	Research addressing theories of design including processes, creative thinking, aesthetics, and criticism of existing theories	BLA Core	Theory	Based on LABOK knowledge "design creativity and process" and CELA topic "design theory"
Aesthetics	Research addressing theories about aesthetics.	BLA Core	Theory	Based on LABOK knowledge "design creativity and process" "visual communication" and "graphic presentation" and CELA topic "human and environmental relationships"
Representation and communication	Research exploring communication or representation skills, especially graphic ones.	BLA Core	Communication	Based on LABOK knowledge "visual communication" and "graphic presentation" and CELA topic "communication and visualization"
Professional ethics	Knowledge discussing moral standards and ethic codes	Context	Value	Based on LABOK knowledge "environmental ethics" and "social responsibility in design" and CELA topic "landscape architecture as a profession"
The profession of landscape architecture	Knowledge discussing the issues related to the well-being and future of LA profession, such as practice and knowledge	Context	LA	Based on LABOK knowledge "history of landscape architecture and allied professions" and CELA topic "landscape architecture as a profession"
The Construction design knowledge domain				
Grading and circulation	Research addressing grading design and circulation design.	BLA Core	Site	Based on LABOK knowledge "grading, drainage and storm-water treatment" and "vehicular and pedestrian circulation"
Construction techniques	Knowledge discussing the construction techniques used in landscape design.	Practice	Site	Based on LABOK knowledge "construction equipment and technologies" and CELA topic "landscape design and implementation"
Plants and materials	Knowledge addressing the characters of plants and materials as well as their usage in landscape design.	Practice	Site	Based on LABOK knowledge "construction equipment and technologies" and CELA topic "landscape design and implementation"
Site engineering (lighting, irrigation etc.)	Knowledge discussing design elements such as water, materials and plants, as well as general design issues such as construction technologies	Practice	Site	Based on LABOK knowledge "utility systems" "irrigation systems" "lighting systems" and CELA topic "landscape design and implementation"
The Environmental systems knowledge domain				
Ecology	Research exploring the managemental, planning and design solutions to modify built environment and human activities to work better with nature systems.	BLA Core + Context	Systems + DPM	Based on LABOK knowledge "natural site condition and ecosystems" and "ecological planning principles" and CELA topic "landscape planning and ecology"
Environmental psychology	Research explaining how landscapes are perceived by human beings, how this information is processed psychologically and responded to externally via behavior.	Context	DPM	Based on knowledge "visual resource management" and CELA topic "human and environmental relationships"
Water resource management	Research addressing drainage and storm-water management as well as water quality control.	MLA specialty	DPM	Based on LABOK knowledge "water resource management" and CELA topic "landscape design and implementation"
Geospatial tools	Research addressing geospatial tools	Practice	Construction	Based on LABOK knowledge "geographic coordination system and layout techniques and conventions" and CELA topic "methods of

				inquiry"
Health and landscape	Research addressing the relationship between designed landscape and human health and well-being	MLA specialty	Theory	Based on LABOK knowledge "therapeutic aspects of design" and CELA topic "sustainability"
Sustainable design	Knowledge addressing sustainable design and its techniques such as green roof and green wall.	Practice	Site	Based on LABOK knowledge "sustainable construction practice" and CELA topic "sustainability"
The Human systems knowledge domain				
History and culture	Research addressing the landscapes, mostly man-made, which have a strong cultural significance developed over time.	Context	LA	Based on LABOK knowledge "history of landscape architecture and allied professions" and "social and cultural influence on design" and CELA topic "history and culture"
Community planning and design	Knowledge addressing community planning and design as well as public participation	Context	Systems	Based on LABOK knowledge "social and cultural influences on design" and CELA topic "urban design"
Garden history	Research addressing the evolution of built landscapes over time, usually about a specific landscape or in a specific time frame	Context	LA	Based on LABOK knowledge "history of landscape architecture and allied professions" and "social and cultural influence on design" and CELA topic "history and culture"
Public policy	Knowledge discussing policy making and policy analysis.	Practice	Policy	Based on LABOK "knowledge government policies and laws that affect the use and development of land" and CELA topic "landscape planning and ecology"

Note:
* Abbreviation for LABOK classification: BLA Core = Core Knowledge of the First Professional Degree, context = Context Knowledge for Professional Practice, MLA specialty = Specialized Knowledge Gained through Post-professional Education, Practice = Specialized Knowledge Gained through Professional Practice.
** Abbreviation for LABOK knowledge domains: Theory = Design and Planning Theories and Methodology, Value = Values and Ethics in Practice, LA = Landscape Architecture History and Criticism, Site = Site Design and Engineering: Materials, Methods, Technologies and Applications, Systems = Natural and Cultural Systems, DPM = Design, Planning and Management at Various Scales and Applications, Construction = Construction Documentation and Administration, Policy = Public Policy and Regulations

Judgmental design knowledge and construction design knowledge are largely action-based knowledge, since the two knowledge domains are primarily how-to knowledge concerning design methods and actions. Environmental systems knowledge and human systems knowledge are largely cognition-based knowledge, since the two domains are primarily descriptive knowledge concerning how environmental and human systems work and how certain designs influence these systems.

The judgmental design knowledge domain is general principles abstracted from design experience through rational critiques on the intuitive judgment and thinking process. This is the most natural way to refine intuitive judgment and professional thinking. However, building knowledge through this approach is limited considering that the design thinking process is often tacit and very difficult to put into words. Note that three out of five areas in the judgmental design knowledge domain are classified in LABOK as core knowledge of the first professional degree. As discussed earlier, Fein (1972) found that the knowledge-bases of landscape architecture practice is specialized knowledge and skills developed by

practitioners (see Table 2). Therefore, it is reasonable to assume that judgmental design knowledge is primarily developed by practitioners.

The construction design knowledge domain is an important complement to judgmental design knowledge. In construction design knowledge, details or procedures of design work are carefully documented, while explanations or abstract principles are not necessary. This would increase the efficiency of professional work. It is reasonable to assume that construction design knowledge is primarily developed by practitioners, since three out of four areas in the construction design knowledge domain are specialized knowledge gained through professional practice.

The other two domains tie practical design knowledge to a deeper and more rigorous understanding of natural and human systems usually associated with academic knowledge. The environmental systems knowledge domain is more concerned with natural systems, while the human systems knowledge domain deals more with the human systems. As discussed earlier in this chapter, these knowledge domains are relatively young compared to the other two domains in landscape architecture. It is reasonable to believe that both the environmental systems knowledge domain and the human systems knowledge domain are primarily developed by landscape architecture educators, since the former is largely specialized knowledge gained through post-professional graduate education, while the latter is largely contextual knowledge for professional practice.

2.1.4. Summary of the Section

Knowledge is central to modern professions because it not only facilitates practice but also justifies it. The knowledge that facilitates practice is action-based knowledge, and the knowledge that justifies practice is cognition-based knowledge. These are two different type of knowledge. Landscape architecture evolved from a profession centered in action-based knowledge in aesthetics and professional skills in the beginning of the 20th century, and expanded to cognition-based knowledge in ecology in the middle 20th century. The expanding practice scope pushed the profession to expand its knowledge to more cognition-based areas such as ecology in the 1950-60s, and history and culture in the 1980-90s.

Based on two knowledge classification systems, LABOK knowledge areas, and CELA research topics, this study summarized the current scope of knowledge in landscape architecture into 19

knowledge areas in four domains: the judgmental design knowledge domain (design theory and design process, aesthetics, representation and communication, professional ethics, and the profession of landscape architecture), the construction design knowledge domain (grading and circulation, construction techniques, plants and materials, and site engineering), the environmental systems knowledge domain (ecology, environmental psychology, water resource management, geospatial tools, health and landscape, and sustainable design), and the human systems knowledge domain (history and culture, community planning and design, garden history, and public policy). The judgmental design knowledge domain and the construction design knowledge domain are largely action-based knowledge, while the environmental systems knowledge domain and the human systems knowledge domain are largely cognition-based knowledge.

2.2. The Significance of Research in Landscape Architecture Practice

This section addresses the third research question, "What is the significance of research in landscape architecture practice?" This section is organized in four subsections. The first two subsections discuss how research is defined (subsection 2.2.1) in landscape architecture, as well as the attitude toward it (subsection 2.2.2). Subsection 2.2.3 discusses the use of research in landscape architecture practice, while subsection 2.2.4 provides a summary of the section.

2.2.1. Definition of Research

Chenoweth and Chidister (1983) observed a lack of consensus among landscape architecture educators in what research was and how it should be conducted. There was a bimodal distribution in the attitude toward statements such as "combining information gathered from written sources, experts and on-site investigation to guide design is research," or "a study must be guided by stated hypotheses in order to be considered as research." Chenoweth and Chidister did not find a consistent explanation as to how and why educators differed in their definitions of research.

Research is a term widely used in landscape architecture. It has been narrowly used to mean "experimental or laboratory sciences," while broadly used to refer to "library research" (Riley, 1990). Some landscape architects suggested including design as a type of research to encourage direct

knowledge support to practice (e.g. Benson, 1998; Selman, 1998; Thwaites, 1998). However, some landscape architects were concerned that the simple inclusion of design as research would jeopardize academic rigor, which would eventually weaken the knowledge foundation of the profession (e.g. LaGro, 1999; Milburn & Brown, 2003; Milburn et al., 2003; Riley, 1990).

2.2.2. Attitude toward Research

Empirical surveys given to landscape architecture educators found a positive attitude toward research among educators over time (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn et al., 2001). A few landscape architects insisted on including design as research, too. It was unclear how popular the wider definition of research is among the whole profession. In spite of a favorable attitude toward research, educators perceived a lack of support from their peers in doing research (Chenoweth & Chidister, 1983; Milburn et al., 2001). Besides, educators' positive attitude toward research was overwhelmed by their teaching load, which had higher priority (Chenoweth & Chidister, 1983). However, as discussed in Chapter I, some educators who participated in these surveys commented about the lack of practicality in academic research (Chen et al., 2011; Milburn et al., 2001). These concerns seem to be consistent with statistical analysis on articles published in *Landscape Journal* (Powers & Walker, 2009) and *Journal of Landscape Architecture* (Jost & Lamba, 2010).

2.2.3. Use of Research in Landscape Architecture Practice

Practitioners use research findings in their practices, but maybe not particularly often. In a survey conducted in 1983 (Palmer et al., 1984), over 80% of ASLA members and USFS members, reported using research findings in their work occasionally or more often, while over half of CELA members, instead, used research regularly (see Table 6).

Table 6. Frequency of Using Research in Practice (Palmer et al., 1984, p. 388)

In your work, how frequently do you rely on research findings?

	Frequency of Using Research in Practice			
	Never	Infrequently	Occasionally	Regularly
CELA (n=172)	1%	12%	36%	51%
ASLA (n=325)	2%	26%	51%	21%
USFS (n=176)	0%	21%	60%	19%

Actually, the use of research in practice was probably underestimated. Respondents reported moderate difficulty in finding research. Nine out of ten ASLA members and eight out of ten CELA educators and USFS members reported that research was only infrequently or occasionally available (see Table 7). These difficulties are understandable, since at that time even educators were poorly prepared with research training, which included how to use library sources and familiarity with publications (Chenoweth & Chidister, 1983).

Table 7. Level of Research Availability (Palmer et al., 1984, p. 389)

How difficult has it been for you to locate research reports when you have sought them?

	Level of Research Availability			
	Never Available	Infrequently Available	Occasionally Available	Regularly Available
CELA (n=172)	1%	28%	52%	20%
ASLA (n=325)	0%	41%	49%	10%
USFS (n=176)	1%	26%	53%	21%

2.2.4. Summary of the Section

The definition of research in landscape architecture is not fully revealed by existing literature. Research is a term broadly used in landscape architecture. Some landscape architects use it to refer to certain design thinking, however, it has been unclear how popular this usage is in the whole profession. The attitude toward research is not fully revealed by existing literature, either. Empirical surveys suggest that there has been a positive attitude toward research among landscape architecture educators since the 1980s, in spite of the fact that some landscape architects expressed concern about the lack of practicality in academic research. Practitioners reported using research in their practice more than occasionally in the 1980s, however, they also reported difficulties in locating research findings which may encumber them from applying more research findings to practice.

2.3. The Need of Research in Landscape Architecture Practice

This section addresses the third research question, "How do landscape architects perceive the need of research?" In order to understand the significance of research, one first needs to understand how knowledge is advanced in landscape architecture. However, there are very limited empirical studies on the advancement of knowledge in landscape architecture. Therefore this study first examined the possible knowledge advancement approaches in design professions (subsection 2.2.1), and then it discussed the significance of research in landscape architecture (subsection 2.2.2) as well as how research findings are used in practice (subsection 2.2.3). A summary (subsection 2.2.4) is provided at the end of the section.

2.3.1 Advancing Knowledge in Design Professions

Peirce (1878) described three types of logic reasoning in advancing knowledge: abduction, deduction and induction. In abduction, one builds exploratory knowledge by looking for a pattern in a phenomenon and hypothesizing. In deduction, one builds knowledge by reasoning with verified knowledge. In induction, one builds knowledge by generalizing from particular instances. According to Pierce, there was an increasing validity from abduction or hypothesizing, to deduction or evaluating hypotheses, and to induction or justifying hypotheses with empirical data (Staat, 1993; Yu, 1994). Responding to the three ways of logic reasoning, there are three approaches of advancing knowledge: the reflective approach, rational approach, and empirical approach. This subsection explains these three approaches from the most familiar (rational) to the least (reflective). Research is used to increase the validity of knowledge and therefore increase the justification potential power. The research methods used to increase the validity of empirical knowing is known as quantitative methods, while those used to increase the validity of reflective knowing is known as qualitative methods (Littlejohn, 1983; Littlejohn & Foss, 2008).

The Rational Approach

The most well-known means to knowledge in modern society is the rational approach. Rational knowing generates new knowledge from existing knowledge using logic reasoning. Rational knowing is widely used in expanding knowledge. However, rational knowing generates very limited knowledge when one tries to infer between action-based knowledge and cognition-based knowledge. It is a common belief

that correct action-based knowledge relies on correct cognition-based knowledge (Ryle, 1945). This belief is also known as "technical rationality" (Schön, 1983) or positivism (Corner, 1991). According to this belief, professionals first obtain cognition-based knowledge about the nature of the designed systems, which is the system of a design object and its context (Alexander, 1964). This is usually done through fundamental research, which is undirected research that advances knowledge but does not readily lead to applications (Sherwin & Isenson, 1967). Based on the findings from fundamental research, the profession then needs to conduct applied research to generate design implications (Schön, 1983). After that, professionals transfer general design implications to project-specific design solutions. Finally, professionals integrate the solutions into a holistic design proposal and build it (Alexander, 1964). The rational knowledge advancement process is illustrated in Figure 1.

However, two empirical studies suggest that the knowledge transfer from cognition-based knowledge to action-based knowledge is very low. The Hindsight Project, the first study, is a cost-benefit analysis of Department of Defense research investment in military weapon design (Abelson, 1966; H. L. Hayes, 1966; Layton, 1971; Leiserson, 1967; Sherwin & Isenson, 1966, 1967), where only a very small portion of technological knowledge derived directly from scientific research. This Hindsight analysis traced the 13 most influential military technological systems after WWII, and was able to locate the scientific discoveries and technological inventions -- the Hindsight events that they named-- that actually led to the improvement of these systems by verifying with the original researchers (Sherwin & Isenson, 1966, 1967). Surprisingly, the Hindsight project found that the immediate, direct influence of science on technology was very small. Among all the events that influenced technological development, only 8% were scientific findings, including 6% applied research, and 2% fundamental research (Sherwin & Isenson, 1967).

The second study is a historical case-study on the research projects in the Bureau of Public Roads (BPR) in the 19th century (Seely, 1984). Road damages encumbered military transportation in WWI. Shortly after the war, BPR researchers believed that their old methods of analyzing road carrying capacity, such as empirical charts, were not accurate enough and therefore more research needed to be done to predict road damage. Researchers spent five years on the project and published the Arlington report, in which they could quantify when roads would be damaged by vehicles with specific weights and tires on specific types of pavements, at specific thicknesses. However, Arlington study only examined one type of

soil foundation. Therefore the results could generate much less practical implications than did older, empirical charts. In the following decade after the Arlington study, BPR researchers expanded their study to soil and introduced more sophisticated devices and full-size field studies into their research. However, the results of these studies still did not generate much in the way of practical implications.

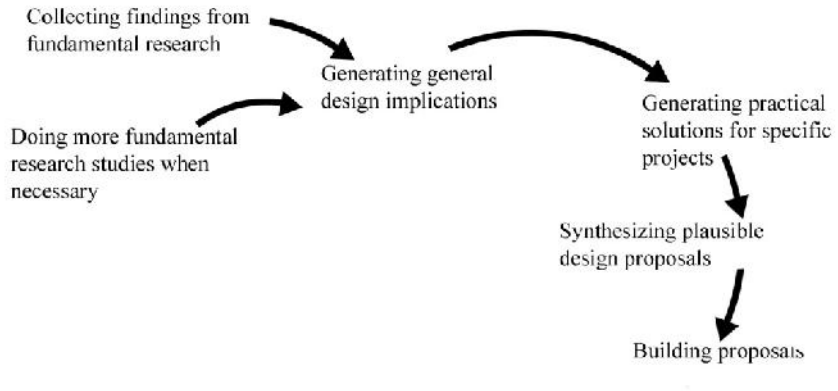

Figure 1. The Rational Approach to Advancing Knowledge

The Empirical Approach

The second approach to the advancement of knowledge is the empirical approach, which is also known as trial-and-error (Crewe & Forsyth, 2003), or the performance-based approach (Windhager, Steiner, Simmons, & Heymann, 2010) or evidence-based approach (Windhager et al., 2010). Researchers learn what works and what does not work from experiments or from analysis of built designs (see Figure 2).

While many people may think that the empirical approach is similar to the rational approach, the two approaches are actually quite different. Rational researchers believe that action-based knowledge comes from cognition-based knowledge, which means that one has to know what something is, and why it is the way it is, in order to solve the problem. However, this is not always the case. Harford (2011) shared a story about the design of a nozzle when engineers found a technical solution, but without scientific explanations. Unilever wanted to design a special nozzle which was very important for producing a type of detergent with certain qualities. Unilever first hired scientists to study the desired nozzle-shape based on fluid dynamics. The problem, although it seems simple and well-defined for landscape architects, was actually too complicated for the scientists. However, Unilever did find the desired nozzle. The Unilever engineers first designed 10 random variations and kept the best performer.

Then, they designed another 10 variations based on this best performer and kept the best again. After 45 generations, they got the desired nozzle, but they did not generate information as why their nozzle worked.

Rational researchers (e.g., scientists) aim to *know*, while empirical researchers (e.g., engineers) aim to *do* (Layton, 1971). With different goals, the two types of researchers might reach different interpretations of the same result. For example, as Layton (1971) documented, two electronic engineers -- Henry Rowland and Francis Hopkinson -- both made the same discovery of the "characteristic curve" of the direct-current dynamo. Hopkinson used this discovery to improve the Edison dynamo. Rowland, however, missed the significance of his discovery since he was only looking for what caused the "characteristic curve." Rowland was looking for a law of nature as a rational researcher, while Hopkinson was looking for a design principle as an empirical researcher.

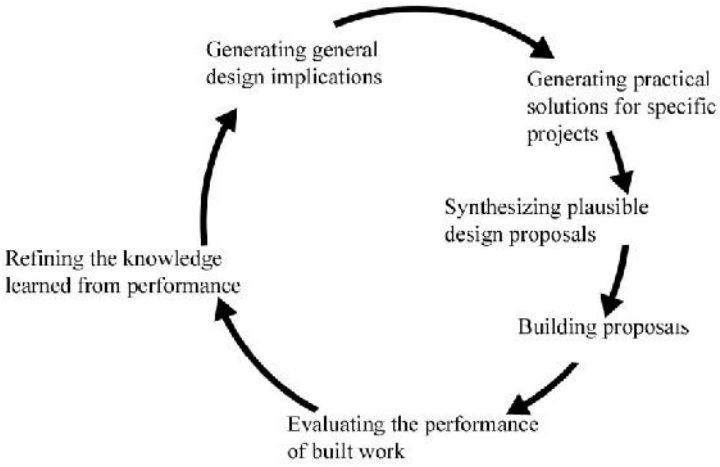

Figure 2. The Empirical Approach to Advancing Knowledge

The Reflective Approach

The third approach to the advancement of knowledge is called the reflective approach or "reflection in action" (Schön, 1983) or the hermeneutic approach (Corner, 1991). The knowledge generated from the reflective approach does not require much prior knowledge or verifications through systematic research and therefore it is most affordable among the three approaches. In practice, practitioners rely on tentative knowledge generated from the reflective approach and test tentative knowledge in practice (see Figure 3). In the design professions, designers often use a reflective approach,

which allows designers to go back and forth between problem-setting and problem-solving. Designers first frame problem(s) based on the information they collect and then do an initial move toward solutions. With the feedback they get from initial problem-solving, they may go back to collect more information and reframe the problem. The rationale of the process of going between problem-solving and problem-setting is simulated by J. R. Hayes and Simon (1974) in their UNDERSTAND software program. Unlike computers, which can only operate on explicit rules, human brains can reflect on various sources, rational and irrational, explicit and tacit. For example, designers can reflect on the *feeling* of a situation that has led them to certain actions or they can reflect on artistic judgment, or emotional memories (Schön, 1983).

Figure 3. The Reflective Approach to Advancing Knowledge

2.3.2. The Significance of Research

Palmer and his colleagues' (1984) survey found that the profession perceived a moderate to high significance of research (see Table 8). Among all the four research areas, the highest significance of research was found in stewardship (see Table 8). Though the profession was primarily concerned with aesthetics as well as ecological needs (see Table 1), the significance of research in new-age design was substantially lower than stewardship. The knowledge need may change between Fein's survey in 1972 and Palmer's survey in 1984, but it is more likely that intuitive design knowledge such as aesthetics is advanced through research, while stewardship is probably advanced through an empirical and a rational approach.

Table 8. Significance of Research in Different Research Areas (Palmer et al., 1984, p. 386)

	Mean Value of Rating*			
	Stewardship	Social meaning	New-age design	Professional development
CELA (n=172)	6.8	6.4	6.4	6.2
ASLA (n=325)	6.8	6.3	6.4	6.1
USFS (n=176)	6.5	6.1	6.1	5.5

Note:
* Significance of Research Areas were rated from a ten-degree scale, with 1 as lowest and 10 as highest.

2.3.3. Summary of the Section

According to Pierce, there are three types of logic reasoning in advancing knowledge: abduction, deduction, and induction. Correspondingly, there are three approaches to advancing knowledge: 1) a reflective approach in which knowledge is generated through reflections before, during, and after design (abduction), 2) a rational approach in which cognition-based knowledge is generated through fundamental research, while action-based knowledge is generated through applied research based on fundamental research findings (deduction), and 3) an empirical approach in which knowledge is generated through empirical experiments or post-project evaluation (induction). Research is a systematic way of generating knowledge to increase the validity of knowledge. The methods used to increase the validity of empirical knowing is known as quantitative methods, while those used to increase the validity of reflective knowing is known as qualitative methods. A rational approach can be used to expand knowledge, but it is limited when generating knowledge from cognition-based knowledge to action-based knowledge.

Over 80% of practitioners in the 1980s reported using research findings more than occasionally in their practice. They also found difficulties in locating research results, which encumbered them from using research;

2.4. The Dissemination of Research Findings by Landscape Architecture Educators

This section addresses the third research question, "How are research findings disseminated in landscape architecture?" However, the existing literature was exclusively on research dissemination by educators. Little research, especially empirical research, has been done in regard to knowledge produced and disseminated by practitioners. Actually, it seems that there was uncertainty about what practitioners think research is, or how many of them were doing research. While Meyer and her colleagues at the

University of Virginia thought that "the most significant research" now is done by practitioners (Jost & Lamba, 2010), Lamba believed that most research is done by educators and consumed by practitioners (Lamba & Graffam, 2011). Therefore, this section only discusses the research produced (subsection 2.3.1) and disseminated (subsection 2.3.2) by educators in landscape architecture.

2.4.1. Research Conducted by Educators in Landscape Architecture

Research time-investment by educators in landscape architecture was examined by three surveys over time (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn et al., 2001). The time spent on research and scholarship increased significantly from 1981 to 2010 (Chen et al., 2011; Chenoweth & Chidister, 1983). An average faculty member used to spend 1~15 hours weekly on research and scholarship in the 1980s, but is now spending 6~15 hours (see Table 9).

Table 9. Time Spent in Research and Other Tasks by CELA Members (Chen et al., 2011; Chenoweth & Chidister, 1983)

Time Spent By Task	**1981 CELA Survey** (Chenoweth & Chidister, 1983)		**2010 CELA Survey** (Chen et al., 2011)	
	Mean*	Hours per week	Mean*	Hours per week
Administrating	1.62	1~10hrs	2.38	6~15hrs
Teaching	4.52	16~25hrs	3.86	11~20hrs
Research and scholarship	1.56	1~10hrs	2.31	6~15hrs
Service	0.76	0~5hrs	1.78	1~10hrs
Other activities	1.19	1~10hrs	1.65	1~10hrs

Note: * Mean is coded as 0=0 hour, 1= 1~5 hours, 2= 5~10 hours, 3 = 11~15 hours, 4 = 16~20 hours, 5 = 21~25 hours, 6 = 26~30 hours, 7 = 31~35 hours, 8 = 35 hours or more.

Educators' research interests seem unevenly distributed in the 19 knowledge areas (see Table 5 for classification of knowledge areas). Most educators' interests were found in environmental systems knowledge and human systems knowledge, while few educators reported doing any research in construction design knowledge (see Table 10). As discussed earlier in this chapter, based on LABOK results, environmental systems knowledge and human systems knowledge are primarily advanced through research by educators, while judgmental design knowledge and construction design knowledge are primarily advanced in practice by practitioners.

Table 10. Research Engagement Reported by CELA Educators by Knowledge Areas

Knowledge Areas	LABOK classification	Educators who are interested in	
		Count	Valid percent*
Judgmental design knowledge domain			
Design theory and design process	BLA Core	25	16%
Aesthetics	BLA Core	4	3%
Representation and communication	BLA Core	13	9%
Professional ethics	Context	1	1%
The profession of landscape architecture	Context	1	1%
Construction design knowledge domain			
Grading and circulation	BLA Core	1	1%
Construction techniques	Practice	2	1%
Plants and materials	Practice	6	4%
Site engineering (lighting, irrigation etc.)	Practice	0	0%
Environmental systems knowledge domain			
Ecology	BLA Core	33	22%
Environmental psychology	Context	12	8%
Water resource management	MLA Specialty	9	6%
Geospatial tools	MLA Specialty	8	5%
Health and landscape	MLA Specialty	6	4%
Sustainable design	Practice	21	14%
Human systems knowledge domain			
History and culture	Context	43	28%
Community planning and design	Context	25	16%
Garden history	Context	2	1%
Public policy	Practice	1	1%

Note: *Valid percents were calculated based on only the participants who provided descriptions specific enough to be coded with 153 participants as 100%. Among the 230 participants, 153 participants (66.5%) provided descriptions specific enough to be coded and 49 (21.3%) were engaged in more than one topic.

It is interesting to note that although 72% of them agree or strongly agree that landscape architects are involved primarily in applied research, educators still seem to do as much fundamental research as applied. For example, among the 33 educators who claimed to be doing research in ecology, only slightly more than half of their research topics are applied research (see Table 11). Forty-five percent of all the papers published in *Landscape Journal* between 1981 to 2006 provided only general conclusions, while only 6% provided recommendations for design and planning, and another 2% offered guidelines (Powers & Walker, 2009).

Table 11. Fundamental and Applied Research in Ecology Research in Landscape Architecture (Chen et al., 2011)

Research Types	Range of Topics and Specification
Fundamental (n=19*)	landscape ecology (7), forestry (2), urban biodiversity (2), plant (community) ecology (2), field ecology (1), ecological flow (1), settlement ecology (1), urban forestry (1), natural history of woody plants (1), Ecology (1)
Applied (n=23*)	ecological design (6), ecological planning (3), landscape planning (2), natural resource management (1),], urban ecology (3), green infrastructure (3), green roof (2), green wall (1), bioregional design and bio-mimicry (1), ecological performative landscape (1), ecological restoration (1),

Note: * Some educators are engaged in both fundamental research and applied research, and therefore the educators who are doing fundamental research and those who are doing applied research added together (19+23=42) are larger than the total number of educators engaged in ecology (n=33).

2.4.2. Research Disseminated by Landscape Architecture Educators

Results suggested that educators today are much better in research production and received better training in how to conduct research than they were in the 1980s. Today an average educator in landscape architecture publishes about one refereed journal article and a professional magazine article and gives three conference presentations with paper, and another three presentations without paper, every two years. Additionally, an average educator also publishes one book chapter every four years and one book every six years (see Table 12).

Table 12. Research Publications Reported by CELA Members (Chen et al., 2011; Milburn et al., 2001)

Types of Publications	1999 CELA survey (Milburn et al., 2001)		2010 CELA survey (Chen et al., 2011)		
	Publication per person per year (1997-1999)		Percent reporting some publications	Publication per person per year (2008-2010)	
	Mean	Std. D		Mean	Std. D
Refereed journal articles	0.48	NA	63%	0.51	0.56
Professional magazine articles	NA	NA	51%	0.43	0.56
Conference presentations w/ paper	0.87	NA	69%	0.67	0.63
Conference presentations w/o paper			70%	0.70	0.66
Books and monographs	NA	NA	27%	0.16	0.36
Book chapters	NA	NA	46%	0.27	0.40

Educators with research interests in different knowledge areas seem to share their findings via different media. Educators studying history and culture and community planning and design, for example, tend to share most often in conferences, but less in professional magazines (see Table 13). Educators studying design theory and design process and sustainable design, however, tend to share their research most often in both conferences and professional magazines.

Table 13. Educators' Research Dissemination in Major Areas

Disseminating method	Judgmental Design Knowledge				Environmental Systems Knowledge						Human Systems Knowledge			
	Design theory and design process n=16		Representation and communication n=11		Ecology n=25		Environmental psychology n=10		Sustainable design n=19		History and culture n=28		Community planning and design n=20	
	Mean	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
Articles published in refereed journals	**2.00**	1.86	**1.73**	2.00	**2.04**	1.84	**1.90**	1.85	**1.42**	1.17	**2.07**	1.74	**1.90**	1.71
Articles in professional journals and magazines	**2.25**	2.11	**1.55**	1.63	**1.12**	1.74	**1.90**	1.91	**2.26**	2.18	**1.04**	1.17	**0.75**	1.12
Presentations at refereed conferences with papers	**2.81**	2.07	**1.64**	1.50	**2.20**	1.96	**2.40**	2.76	**1.89**	1.85	**2.21**	1.93	**2.25**	1.65
Presentations at refereed conferences without papers	**2.63**	2.13	**1.91**	1.70	**2.60**	2.14	**1.30**	1.42	**2.68**	2.24	**1.82**	1.79	**2.15**	2.21
Books and monographs	**0.44**	0.63	**0.45**	1.21	**0.44**	0.92	**0.40**	0.52	**0.26**	0.56	**0.61**	1.34	**0.30**	0.66
Book chapters	**1.13**	1.31	**0.82**	1.78	**0.68**	1.41	**0.60**	1.07	**0.68**	1.06	**1.11**	1.42	**0.75**	1.12

Note:
*Results are based on a self-reported research interest collected in a CELA survey (Chen et al., 2011).
* Only areas with more than ten educators reporting research interest are represented in this table.
*The number indicates the amount of publications per person per year.

2.4.3. Summary of the Section

In general, educators spent more time in conducting research than they used to 30 years ago, and they disseminated their findings via publications more often than they used to 10 years ago. Although most of them believe that research in landscape architecture should primarily be applied research, evidence suggested that about half of educators' research is undirected fundamental research studies. Most educators' research is in the environmental systems knowledge domain and the human systems knowledge domain. Some educators are doing research in the judgmental design knowledge domain, too. Only a fraction of educators claimed to be doing research in the construction design knowledge domain. Educators with research interests in different knowledge areas differ slightly in the media used to disseminate their findings.

2.5. Summary of the Chapter

Research is becoming more and more important to the practice of modern professions, including landscape architecture. The reason that research is important, as found in sociological studies on professionalization, is that the public expects modern professions not only to successfully perform certain professional tasks, but also to provide rational explanations for their professional actions.

The two activities, performing tasks and providing explanations, involve two different types of knowledge -- design knowledge, and systems knowledge. Design knowledge, also known as action-based knowledge or tacit knowledge, is knowledge about how to do certain things, and therefore facilitates practice. Systems knowledge, or cognition-based knowledge, is knowledge about what the systems are and how the systems work, and therefore justifies practice. Sociological studies suggest that the justifications that systems knowledge provides are important in the public perception of modern professions and their capabilities. Since systems knowledge is often advanced through academic research in modern professions, research is playing a more and more important role in defining the prestige of modern professions.

Studies have suggested that the knowledge of landscape architecture has expanded in systems knowledge. Landscape architecture evolved from a profession centered in design knowledge in aesthetics and professional skills in the beginning of the 20th century, and expanded to systems knowledge in ecology in the mid-20th century. Landscape architecture educators today are spending more time doing research and are disseminating their findings more through publications than they were a couple of decades ago. A content analysis of educators' research interests suggests that landscape research studies done by architecture educators are mostly in systems knowledge, which is supposed to justify design practice. However, it is not clear according to existing studies why landscape architecture cannot enhance its prestige through research.

The existing literature generates contradictory results on what research is, or what attitudes the profession may believe or feel about research. Although landscape architects think that research is important to landscape architecture, current research seems not satisfactory. Some landscape architects, including both educators and practitioners, suggested recognizing design as a type of research, while other educators and practitioners were concerned that recognizing design as research would jeopardize academic rigor, and therefore weaken the knowledge foundation of landscape architecture.

The reason why landscape architecture cannot enhance its prestige through research, as suggested by the literature, probably lies in how knowledge is and should be advanced in this profession. There are three ways of advancing knowledge: a rational approach, empirical approach and reflective approach. It is commonly believed that design knowledge comes from certain systems knowledge (rational approach). In other words, one is able to perform certain task because he/she is able to generate a rational move towards a problem based on his/her cognition of the problem itself. However, empirical studies have suggested this approach to knowledge advancement only generates very limited design knowledge. Instead, more design knowledge is generated through the reflective approach, or empirical approach in which practitioners learn how to perform certain tasks based on previous, similar experiences when explicit cognition of the problem is not necessarily involved. Though some literature (e.g., Corner, 1991) pointed out that the rational approach probably does not work for landscape architecture, a review of existing literature revealed a gap in terms of how knowledge is advanced in landscape architecture and whether there are impediments to the advancement of knowledge in this profession

Therefore, in order to understand why landscape architecture cannot enhance its practice through research, a study is needed to know what knowledge landscape architecture practice is currently built on, and the composition of design knowledge and systems knowledge within it. The study also needs to know how knowledge is advanced through the profession, and what difficulties it may have in advancement.

Chapter III Methodology

This chapter explains the research methods used in this study, in two sections. The first section explains how data was collected in order to answer the research questions addressed in the introduction chapter. The second section explains how the data were analyzed and interpreted.

3.1. Survey Method

This section first discusses the rationale for selecting the American Society of Landscape Architecture (ASLA) members as the population, and for using an internet-based survey method (Subsection 3.1.1) for data collection. Then, it explains briefly the data that were collected in order to answer each research question (Subsection 3.1.2). After that, this section explains the sampling method and the dissemination of questionnaires (Subsection 3.1.3) and the composition of the respondents and their representivity of the population (Subsection 3.1.4).

3.1.1. The Rationale for Selecting the Population and Using an Internet-based Survey Method

As this study primarily concerns the role of research in the practice of landscape architecture, landscape architecture practitioners were the best information source. Therefore the members of the largest professional association in landscape architecture in North America -- the American Society of Landscape Architecture (ASLA) -- were chosen as the population for this study.

A quantitative method was used in this study. Cognitive sciences have found that human memories and intuition are usually unreliable in describing phenomena that involves probability and statistics (Daniel Kahneman, 2011). Since the study is intended to analyze the use of research in the profession as a whole, a survey method was used that collected perceptions of the use of research and related perceptions from each respondent.

An internet-based survey was used because of its advantages in collecting and organizing a large amount of data at a relatively low cost (Witt, 1998), and considering the easy access to internet and email today (Don A. Dillman et al., 2009; D. A. Dillman, Tortora, & Bowker, 1998). With the fast-paced culture and technological changes since the 1990s, less time-intensive and more participant-controlled survey methods, such as internet surveys, have become more effective than traditional mail-in surveys (Don A. Dillman et al., 2009; D. A. Dillman et al., 1998). SurveyMonkey® (https://www.surveymonkey.com), an online survey tool, was used to manage the questionnaire design, distribution, and maintenance.

3.1.2. Research Questions and Questionnaire Design

The questionnaire consisted of 24 questions and 107 sub-questions. The questionnaire was organized in four sections: the definition of research, knowledge and practice, research that matters, and background information. The first three sections, including 13 questions and 97 sub-questions, addressed the research questions and sub-questions listed below:

1. What are the concerns of landscape architecture practice?
    a. How has the profession of landscape architecture changed over time?

One question on the concerns of the landscape architecture practice (Q3) was asked in this survey, which could be compared with Fein's (1972, refer to Chapter II) results 40 years ago, to see the changes in landscape architecture practice over time.

    b. What is the perceived knowledge-base of the current practice of landscape architecture? What are the changes in the perceived knowledge-base?

One question on the knowledge-bases (Q7) was asked in this survey, which could be compared with Fein's (1972, refer to Chapter II) results 40 years ago. to see the changes in the knowledge of landscape architecture over time.

    c. What are the knowledge areas and domains of landscape architecture research?

One question on the use of knowledge (Q12) was asked in this survey. Survey participants were asked to share their frequencies of knowledge using in 19 knowledge areas. The 19 knowledge areas were generated based on LABOK classification (ASLA et al., 2004) and CELA research topics (Powers & Walker, 2009) discussed in Chapter III.

Together with the professionalization theories discussed in Chapter II, the survey results revealed what knowledge landscape architecture practice is founded on and why this is the case from a large social and cultural context of landscape architecture practice.

2. What is the significance of research in landscape architecture?

    a. What is the definition of research in landscape architecture practice?

Respondents were asked to share their attitudes toward eight statements on whether certain activities are research or not(Q1_2~Q1_9).

    b. What are landscape architects' attitudes toward research?

Four questions concerning the attitudes of practitioners toward research (Q1_1, Q1_10, Q1_11, Q1_12 and Q1_13) were asked.

    c. What are the types of thinking and sources of knowledge that support decision-making in landscape architecture?

One question about the use of research in supporting design decisions was asked, as well as questions about the use of other knowledge sources and types of thinking (Q4). The frequency of research use in practice can be compared with Palmers and his colleagues' (1984) findings of 30 years ago.

    d. For what purposes do landscape architects use research in practice?

One question concerning the purposes of using research in practice (Q11) was asked.

Existing literature yields conflicting results on how the profession perceives what research is, and what attitude the profession in general holds toward research. Survey results on the questions above revealed the perceptions of ASLA members about research in landscape architecture, as well as their frequency of research use in everyday practice.

3. How do landscape architects perceive the need for research?

    a. In what design stage(s) do landscape architects perceive a need for research?

One question concerning research use during different design stages (Q10) was asked.

    b. In what knowledge areas do landscape architects perceive a need for additional research?

One question on perceived additional research need (Q13) was asked. Survey participants were asked to share their perceptions about whether they need additional research in 19 knowledge areas.

Survey answers to the above questions revealed what knowledge in landscape architecture, as perceived by ASLA members, needs to be advanced through research. Explanations of these perceptions

were provided based on the survey results, as well as the professionalization theories and the advancement of knowledge approaches discussed in Chapter II.

4. How are research findings disseminated in landscape architecture?

    a. Where do landscape architects obtain new knowledge in this profession?

One question was asked on how ASLA members obtain new information in this profession (Q5). Two questions were asked on their frequencies of consulting other professions (Q8 and Q9).

    b. Who is producing knowledge through research? What knowledge is produced?

One question was asked on research responsibility in advancing knowledge (Q2). One question was asked on participants' responsibility for doing research in their job descriptions (Q24).

    c. Where do researchers disseminate their research findings?

One question was asked on where ASLA members disseminate their research findings (Q6).

Chapter II discussed the research produced and disseminated by educators. Survey answers to the above questions revealed how ASLA members may access these research findings produced by educators. The results also revealed how the knowledge-need perceived by more practice-oriented ASLA members may differ from that perceived by more academic-oriented CELA members.

3.1.3. Sampling Method and Questionnaire Distribution

Sampling Method

This study generated data on the role of research in the practice of landscape architecture. Thus the members of a professional society -- the American Society of Landscape Architects (ASLA) -- were chosen as the sampling pool of this study. Fifteen thousand one hundred fifty-five individual members from North America (United States and Canada) were listed in the on-line ASLA member directory. In order to keep the survey more manageable, this study only randomly sampled a small portion, about 5%, of the selected population.

Since this study is focused on research-use in landscape architecture practice, all student members (those who are still in educational programs), associate members (those who graduated from educational programs and have been practicing for less than 3 years), and affiliated members (those who practice in a related profession, but do not hold a degree or a license in landscape architecture) were excluded. Only

full members and honorary members were surveyed. Because it was limited by the online survey method, this survey also excluded members who did not provide email addresses, which approximately comprised less than 5%.

The ASLA member online directory was used for random sampling. The directory was arranged by states, and the members of each state were organized in alphabetical order. The first full or honory member with an email address was selected and subsequently, every twentieth member, and from then on every 20 members listed on the ASLA member directory were sampled. The survey targeted an initial sample size of 791, which made up of 5.22% of ASLA members from North America.

Questionnaire Distribution and Response Rate

A web-link to the questionnaire was delivered via email. On February 14, 2012, an invitation email was sent to all the 791 selected participants in the sample, with a link to the questionnaire website. Among them, 17 emails were unable to be delivered successfully. Another five people contacted the researcher asking to be removed from the survey. Thus, the actual sample size was 769. A second email was sent out one week later (on February 23, 2012) to the 618 participants who did not fill out the questionnaire. A last email was sent out another week later (on March 1, 2012) to the 568 participants who did not fill out or only partially completed the questionnaire. The survey was closed on March 6, 2012, when there was fewer than 1 participant submitting a questionnaire every other day. Until the closing day, 239 complete responses were collected (adjusted response rate=31%).

This is a moderate response rate. However, studies have shown that response rates have decreased significantly in web-based surveys in recent years, probably due to overwhelming spam (Sheehan, 2001). This response rate is around the average of other web-based surveys in recent years (Cook, Heath, & Thompson, 2000).

3.1.4. Description of Respondents

The distribution of age, gender, educational degree, serving organization and job function suggested that the sample was not heavily skewed on any of the background variables (Table 14). Actually, the sample background distribution of this survey was comparable to that of the Landscape Architecture Body Of Knowledge (LABOK) survey (ASLA et al., 2004).

Table 14. Comparison of Participants' Background Information of ASLA Survey 2012 with LABOK Survey 2003

Demographic	ASLA Survey 2012 n=239		LABOK Survey 2003 ASLA member n=207	
	Count	Percent	Count	Percent
Gender				
Male	145	61%	162	78%
Female	58	24%	44	21%
Undesignated	36	15%	1	1%
Age				
Under 25	0	0%	1	1%
25 to 34	25	11%	36	17%
35 to 44	40	17%	27	13%
45 to 54	62	26%	56	27%
55 to 65	61	26%	68	33%
over 65	22	9%	19	9%
Undesignated	29	12%	0	0%
Highest Degree				
No degree	7	3%	3	1%
Certificate program	4	2%	2	1%
Bachelor degree (4-5 yrs)	124	52%	111	54%
Masters degree	87	36%	78	38%
Doctoral degree	4	2%	7	3%
Others/ undesignated	13	5%	6	3%
Types of Organization Currently Working in				
Exclusively landscape architecture firm	75	31%	55	27%
Multi-disciplinary firm	78	33%	62	30%
Government	30	13%	54	26%
Education	19	8%	1	1%
Others/ undesignated	37	16%	35	17%
Job Function				
Sole owner	55	23%	38	18%
Partner or stockholder	44	18%	38	18%
Manager/director/department head	33	14%	30	15%
Associate	24	10%	15	7%
Employee	35	15%	34	16%
Faculty member	15	6%	33	16%
Others/ undesignated	33	14%	19	9%

However, educators may be slightly overrepresented in the sample. For example, there are 15,155 ASLA members (based on online directory access on February 2, 2012) and 875 CELA educators

registered (based on online directory access on February 17, 2010). This suggests that educators should comprise 6%, if all CELA educators are ASLA members. Since 9% of respondents were educators in this sample, they may be slightly overrepresented in the survey, which is probably because educators may be more interested in the use of research in practice.

Though the sample is well-distributed in the professional related demographics, such as serving organizations and job functions, it is unclear how well these participants represent the population without comparable information for all ASLA members. Unfortunately, the factors that may influence participants' perceptions and behavior about research, such as educational information, are not available in the ASLA member directory.

3.2. Analysis Method

Three analysis techniques were used in this study: descriptive statistics, comparative analysis and dimension analysis. Descriptive statistics were used to describe the general research use and perceptions of research by survey participants. Dimension analysis was used to help classify items into meaningful groups that are easier to understand. Comparative analysis was used to test whether the differences were statistically significant between different groups (i.e., practitioners and educators) or between findings in this survey and those in an earlier survey.

3.2.1. Descriptive Statistics

Most data were from multiple-choice questions measured on a four or five point Likert scale, which are treated as quantitative data for most statistical analyses (Babbie, 2004). In multiple choice questions, options were coded as numbers.

All quantitative data were tabulated and are represented in bar charts by the percentages of responses in each category for each item (see Appendix D). Unexpected patterns in the descriptive statistics were highlighted. Nominal data (Babbie, 2004; Stevens, 1946) were reported by frequencies. Ordinal or interval data, measured on a four or five point Likert scale, were reported by means and standard deviations, as well as frequencies. Along with numerical measurements (frequencies, means and

standard deviations), a frequency histogram was provided for every multiple choice question (see Appendix E).

3.2.2. Comparative Analysis

Both Kruskal-Wallis test and T-test are statistical methods to compare means. T-test is a parametric method, which is more powerful in identifying difference; however, it requires a minimal sample size (usually more than 30). Kruskal-Wallis test is a nonparametric method which is less powerful, but relies on fewer assumptions. Therefore, T-test was used to compare the differences between findings in this survey and those in an earlier survey (Q3 and Q7 with Fein's study). T-test was also used to compare the difference between participants with different perceptions about definitions of research in their use of research (Q4 and Q10). To test the differences of extremely unbalanced groups (i.e., 19 educators and 183 practitioners), Kruskal-Wallis test was used.

3.2.3. Dimension Analysis

Principal Component Analysis (PCA) was used to identify the dimensions in the responses with multiple sub-questions (Q1, 4, 5, 6, 8 and 12). PCA reduces the numerous observed variables (i.e., site engineering, construction techniques, plants and materials, and grading and circulation) to a smaller number of factors (construction design knowledge domain), while maintaining as much information as possible. This reduction not only makes the measurement simper, but more importantly, the factors can reveal the patterns that reflect attitudes and perceptions behind the statements (Härdle & Simar, 2007; Meyers, Gamst, & Guarino, 2006), which are hidden in the mental constructs that influence answers to the questionnaire.

One of the problems with PCA is that it extracts components one by one and then one can extract components from the remaining variance. For example, after the first component extracts 20% of the variance in the data set, the second component will try to extract as much variance as possible from the remaining 80%. The later components get heavily influenced by the earlier ones. Therefore the earlier factors are more reliable than the later ones. A tradeoff has to be made between two conflicting goals: to

maintain as much information as possible, and to reduce the data to as few factors as possible. Making this tradeoff is subjective; however, it was based on two empirical criteria. First, factors should have an eigenvalue larger than one. Eigenvalue is the statistical measurement indicating the total variations of dataset extracted by this particular factor. In simple words, eigenvalue can be viewed as the number of original variables whose information is captured by the factor. An eigenvalue larger than one is a very low requirement. Many researchers usually rely on the second criterion to limit components to those that stand out from others in a scree plot. They are the components with an eigenvalue significantly higher than that of others. In this study, both criteria were used in deciding components.

3.3. Summary

This dissertation analyzes the role of research in landscape architecture practice and the advancement of knowledge. To answer the four research questions listed in the introduction chapter, 23 questions and 107 sub-questions were asked. The data were collected via an anonymous online survey from randomly sampled ASLA members in March, 2012, with an adjusted response rate of 31% (n=239) and a sample showing no significant bias on any background variables.

Three analysis techniques were used in this study: descriptive statistics, comparative analysis, and dimension analysis. The data were first tabulated and plotted in bar charts for abnormal distributions. The differences between different groups or between the findings of a current survey and those from earlier surveys were tested using T-test. PCA was also used to reduce the dimensions in responses with multiple sub-questions.

Chapter IV. Results and Discussion

As discussed in the literature review, research creates a body of knowledge that provides defensible explanations for professional actions, which is important for the modern profession of landscape architecture. Meanwhile, a review of the literature also revealed that the knowledge that professional actions are built on is more often generated from practice, which does not necessarily come with explanations. In order to enhance its practice, landscape architecture needs both knowledge that facilitates practice (design knowledge or action-based knowledge) and knowledge that justifies practice (systems knowledge or cognition-based knowledge). As discussed in the literature review, the former often comes from practice experience, while the later often comes from academic research.

Is the profession of landscape architecture balanced between the two types of knowledge? How are the two types of knowledge advanced in this profession? What role does research play in the advancement of knowledge in order to support landscape architecture practice? How does the profession perceive the role of research? Answers to these questions are important to understand why the profession may not be able to enhance its practice through research. However, there is a knowledge gap in existing literature which does not provide sufficient information to answer the questions above. Therefore a survey was conducted among randomly sampled ASLA members to collect information regarding the questions above, and the results of the survey are presented in this chapter.

This chapter is organized into four sections. Section 4.1 gives findings about the current concerns of the landscape architecture profession, the knowledge-base of the current practice, the changes in the knowledge-base over time, and areas of knowledge and domains. Section 4.2 gives findings about the significance of research in the practice of landscape architecture, including definitions of research, dimensions of research, and the types of thinking and knowledge that support decision-making in landscape architecture. In 4.3, findings are presented about how research in landscape architecture is disseminated, and the media used to disseminate research, and finally, section 4.4 involves findings about the importance of research in different design stages, and the perceived need for additional research for the practice of landscape architecture.

4.1. The Concerns of Landscape Architecture Practice

In order to understand the role of research in landscape architecture, one first needs know about the concerns of (section 4.1.1) and the perceived knowledge-bases of (sections 4.1.2 & 4.1.3) landscape architecture practice. Based on the concerns of practice, one then can better understand the use of certain knowledge in practice (section 4.1.4)

4.1.1. A Changing Profession

The concerns of landscape architecture practice have expanded since the 1970s. As indicated in Table 15, the practice primarily concerned aesthetics (67%) to a very great extent and ecological needs (70%) in 1972 (Fein). However, 40 years later, the concern in aesthetics decreased (from 67% to 46%, $p<.01$), while concerns increased in public welfare and enjoyment (from 14% to 69%, $p<.01$) and comfort and pleasure for the individual (from 22% to 42%, $p<.01$).

Table 15. Concerns in Landscape Architecture Practice (1972， 2012)

Q3. To what extent is each of the following central to your understanding of what the practice of landscape architecture should be concerned with?

No.	Concerns		Undesignated or not at all or not too much*	Fair degree	Great extent	Very great extent	Mean	SD	T-Test	
									T**	P
Q3_1	Aesthetics	2012	2%	6%	45%	46%	3.38	0.66	-4.24	<0.01
		1972	1%	4%	28%	67%	3.62	0.56		
Q3_2	Ecological needs	2012	<1%	5%	33%	62%	3.57	0.58	-0.85	not sig
		1972	1%	5%	25%	70%	3.62	0.65		
Q3_3	Public welfare and enjoyment	2012	1%	3%	27%	69%	3.66	0.54	16.47	<0.01
		1972	11%	38%	37%	14%	2.56	0.86		
Q3_4	Comfort and pleasure for the individual	2012	<1%	9%	49%	42%	3.33	0.63	7.71	<0.01
		1972	8%	29%	41%	22%	2.79	0.87		

Note:

* The numerical means and standard deviations were calculated on the following coding: *undesignated* = system missing, *not at all* =0, *not too much* =1, *fair degree*=2, great extent=3, *very great extent*=4. In Fein's survey, <1% is calculated as 0.5%.

** Fein's survey was collected from 1521 ASLA members, while this survey was collected from 239 sampled ASLA members.

With the changing scope of practice, there are also changes in the knowledge-bases of its practice. In 1972, the profession relied almost exclusively on the knowledge and skills developed by practitioners (see Table 17). Forty years later, the profession is better equipped with scientific knowledge from natural sciences. Fifty-two percent of ASLA members now believe the profession was based on natural sciences to a great or very great extent, while only 22% thought so in 1972.

4.1.2. The Perceived Knowledge-Bases of the Current Practice

Current landscape architecture practice is still perceived to be largely based on specialized knowledge and skills developed by its practitioners. Eighty-five percent of ASLA members believe that landscape architecture practice is based on specialized knowledge and skills, which is largely action-based knowledge to a great or very great extent (Table 16). Many fewer ASLA members believe the practice is based on natural sciences (52%) or humanistic knowledge (35%), or social sciences (29%), which are usually cognition-based knowledge.

While specialized knowledge and skills developed by practitioners are action-based knowledge, the other three knowledge bases in Table 16 are cognition-based knowledge. Hence the results actually indicate that landscape architecture practice is based largely on action-based knowledge. As discussed in Chapter II, professional actions are directly guided by action-based knowledge, while they are justified and explained by cognition-based knowledge. Therefore the results may imply that the current practice focuses more on providing design solutions than on justifying them.

Table 16. Perceived Knowledge-Bases for Current Landscape Architecture Practice
Q7: To what extent do you believe practice of landscape architecture today is based on the following knowledge?

No	Knowledge-Bases	Not too much	Fair degree	Great or very great extent	Mean *	SD*
Q7_1	Specialized knowledge and skills developed by its practitioners	<1%	13%	85%	3.21	0.71
Q7_2	Scientific knowledge from natural sciences (e.g. forestry and biology)	10%	37%	52%	2.49	0.82
Q7_4	Abstract knowledge from humanistic disciplines (e.g. history and art)	16%	46%	35%	2.23	0.84
Q7_3	Scientific knowledge from social sciences (e.g. psychology)	26%	44%	29%	2.06	0.84

Note:
* The numerical means and standard deviations were calculated on the following coding: *not sure* = system missing, *not at all* = 0, *not too much* = 1, *fair degree* = 2, *great extent* = 3, *very great extent* = 4.

4.1.3. The Changing Perception of Knowledge-Bases

With the changing scope of practice, there are also changes in the knowledge-bases of practice (see Table 17). In 1972, the profession relied almost exclusively on the knowledge and skills developed by practitioners. Forty years later, the profession is better equipped with scientific knowledge from natural sciences. Fifty-two percent of ASLA members now believe the profession is based on natural sciences to a great or very great extent, while only 22% thought so in 1972.

Table 17. Perceived Knowledge-bases for Landscape Architecture Practice (1972, 2012)
Q7. To what extent do you believe the practice of landscape architecture today is based on the following knowledge?

No.	Knowledge-base		Undesignated or not sure or not at all*	Not too much	Fair degree	Great or very great extent	Mean	SD	T-Test** T	P
Q7_1	Specialized knowledge and skills developed by its practitioners	2012	1%	0%	13%	85%	3.21	0.71	0.68	not sig
		1972	1%	2%	15%	82%	3.16	0.75		
Q7_2	Scientific knowledge from natural sciences (e.g. forestry and biology)	2012	1%	10%	37%	52%	2.49	0.82	7.80	<0.01
		1972	4%	27%	48%	22%	1.90	0.81		
Q7_3	Scientific knowledge from social sciences (e.g. psychology)	2012	1%	26%	44%	29%	2.06	0.84	2.21	<0.05
		1972	5%	32%	39%	24%	1.88	0.91		
Q7_4	Abstract knowledge from humanistic disciplines (e.g. history and art)	2012	3%	16%	46%	35%	2.23	0.84	NA	NA
		1972	NA	NA	NA	NA				

Note:
* The numerical means and standard deviations were calculated on the following coding: *undesignated* = system missing, *not sure* = system missing, *not at all* = 0, *not too much* = 1, *fair degree* = 2, great extent = 3, *very great extent* = 4. In Fein's survey, <1% is calculated as 0.5%.
** Fein's survey was collected from 1274 landscape architecture students, while this survey was collected from 239 sampled ASLA members.

The perceived knowledge-base for landscape architecture has changed over time. However, one may notice in Table 17 the need for social sciences did not increase as much as natural sciences did. Compared with natural sciences, the knowledge from social sciences and that from humanistic disciplines account for a much smaller portion of the body of knowledge in landscape architecture. This difference is interesting, considering ecological needs and public welfare are equally important to landscape architecture practice today (see Table 15).

4.1.4. Knowledge Areas and Domains

Principal Component Analysis [1] (PCA) found a similar pattern of knowledge use within knowledge domains (see Table 18), which confirmed the four knowledge domains identified in Chapter II generated based on existing literature. In general, PCA results are consistent with the literature-based classification except that they identified two dimensions within human systems knowledge, [2] while

[1] PCA is a statistical method to reduce the dimensions of data while maintaining as much information as possible. It identifies similar patterns of variations among variables and collapses them into a new variable (refer to Chapter III). The similar patterns of variations among variables sometimes imply a co-founding hidden variable or certain mental constructs or general categories based on which people make their decisions.
[2] There may be two reasons that PCA identifies human systems knowledge in two dimensions. First, PCA is usually good in identifying the first one or two dimensions but not the latter ones, since the latter are based on the earlier ones. Second, human systems knowledge, by its nature, is complex. While the planning dimension contextualizes landscape in a larger spatial frame, the culture and history dimension contextualizes landscape in a larger time frame.

assigning "Geospatial tools (e.g. GIS)" knowledge in the human systems knowledge domain instead of the environmental systems knowledge domain[3].

Among the four domains, construction design knowledge was most often used in practice (mean of means=3.06), with a small range of means from 2.92 (grading and circulation) to 3.32 (plants and materials). Judgmental design knowledge (mean of means=2.48) and environmental systems knowledge (mean of means=2.45) were also used quite often. However, there were larger differences between mean uses of research topics in judgmental design knowledge (ranging from 2.15 to 2.90) and even larger in environmental systems knowledge (ranging from 1.65 to 2.79). Human systems knowledge, both planning knowledge (mean of means=2.27) and history and culture knowledge (mean of means=2.07), were least used in landscape architecture practice, which was consistent with the knowledge-base as perceived in Table 16. However, the moderate to high percentage of using knowledge in environmental and human systems knowledge may imply that the knowledge-bases in sciences and humanistic disciplines may be underestimated.

[3] Geospatial tools are usually associated with large-scale projects which need information management tools. Therefore they can be used in environmental systems knowledge such as ecological planning and water resource management, but they can also be used in human systems knowledge such as public policy and community planning. It is possible that the planning component is abstracted in the environmental systems knowledge dimension, but not in the planning knowledge dimension, and therefore PCA assigned geospatial tools to the latter.

Table 18. Four Knowledge Domains and Knowledge Areas -- PCA Test

Q12. If you engage in the following as part of your practice, please indicate how often you use research on that topic.

No.	Knowledge Areas	Domains*					Often or very often	Mean **	SD**
		1	2	3	4	5			
Domain 1: Judgmental design knowledge (Cronbach's Alpha=.832)									
Q12_16	Professional ethics	**.736**	.230	.188	.228	.008	35%	2.15	1.18
Q12_13	The profession of landscape architecture	**.731**	.271	.085	.198	-.046	46%	2.42	1.18
Q12_5	Aesthetics	**.720**	.211	.159	.108	.160	63%	2.90	1.02
Q12_4	Design theory and design process	**.601**	.156	.282	-.059	.369	47%	2.45	1.06
Q12_6	Representation and communication	**.581**	.149	.123	.378	.240	52%	2.48	1.12
Domain 2: Construction design knowledge (Cronbach's Alpha=.841)									
Q12_18	Site engineering (lighting, irrigation etc.)	.218	**.807**	.013	.090	.074	70%	3.02	1.01
Q12_9	Construction techniques	.043	**.787**	.329	.086	.057	69%	2.99	1.03
Q12_10	Plants and materials	.204	**.754**	.136	.006	.096	83 %	3.32	0.82
Q12_19	Grading and circulation	.356	**.737**	-.028	.161	.023	64%	2.92	1.07
Domain 3: Environmental systems knowledge (Cronbach's Alpha=.767)									
Q12_8	Water resource management	.006	.350	**.707**	.273	.157	57%	2.60	1.23
Q12_14	Environmental psychology	.293	-.102	**.651**	.330	.170	21%	1.65	1.12
Q12_15	Health and landscape	.428	-.042	**.626**	.114	.097	33%	2.05	1.11
Q12_12	Sustainable design	.294	.302	**.588**	.128	-.043	79%	3.17	0.84
Q12_3	Ecology	-.016	.227	**.563**	.081	.493	64%	2.79	1.05
Q12_11	Geospatial tools (e.g. GIS)	.049	.172	.143	**.758**	.021	34%	1.96	1.22
Domain 4: Human Systems Knowledge (Crobach's Apha = .668)									
Q12_7	Community planning and design	.245	.047	.136	**.748**	.077	57%	2.56	1.22
Q12_17	Public policy	.255	.049	.278	**.610**	.213	42%	2.28	1.25
Q12_2	Garden history	.169	.157	.057	-.004	**.826**	26%	1.84	1.17
Q12_1	History and culture	.104	-.060	.166	.303	**.780**	44%	2.29	1.27

Domain 1: Eigenvalue = 6.66, Variance explained = 35%
Domain 2: Eigenvalue = 2.05, Variance explained = 11%
Domain 3: Eigenvalue = 1.43, Variance explained = 8%
Domain 4: Eigenvalue = 1.23, Variance explained = 7 %
Domain 5: Eigenvalue = 1.00, Variance explained = 5%
Total variance explained = 65%

Note:
*Rotated via Varimax with Kaiser Normalization.
** The numerical means and standard deviations were calculated on the following coding: *not part of my practice*= 0, *rarely* =1, *occasionally*=2, *often*=3, *very often*=4.

4.1.5. Summary of the Section

The scope of landscape architecture practice has expanded from aesthetics to ecological need in the 1970s, and has expanded to public welfare in 2012 and is still expanding in the category of individual comfort. Due to the expanding scope of practice, the scope of landscape architecture knowledge has increased from knowledge developed by practitioners -- largely judgmental design knowledge and

construction design knowledge -- to a broad range of knowledge domains. The scope of landscape architecture knowledge today includes four domains: largely judgmental design knowledge, construction knowledge, environmental systems knowledge, and human systems knowledge. At least one knowledge area from each domain was used by over half of the profession in their practice often or very often.

4.2. The Significance of Research in Landscape Architecture Practice

This section discusses the role of research in advancing the expanding knowledge discussed in section 4.1, as well as its role in supporting landscape architecture practice. In order to understand the role of research better, one needs first to understand what landscape architects mean by the term research (subsection 4.2.1), as well as how landscape architects think about research (subsection 4.2.2). One also needs to know how research facilitates decision-making in landscape architecture practice (subsection 4.2.3), and why research is used in practice (subsection 4.2.4).

4.2.1. Definitions of Research

Since this study is intended to facilitate the enhancement of landscape architecture practice through research, the knowledge-generating activities are limited to those that are done in a rigorous or systematic manner and can lead to the discovery of new information, new understandings or new applications in the field of landscape architecture, which was defined as research in this study, and in the beginning of the ASLA survey that generated the findings. While advancing knowledge through academic research is probably well defined to most people, the advancement of knowledge in practice is less clear. To clarify this, survey respondents were asked to share their attitudes towards eight statements about research in design practice (see Table 19).

Results indicate that knowledge from design analysis (i.e., Q1_6 and Q1_5 in Table 19) and case studies (i.e., Q1_7) are widely recognized as research among ASLA members. However, many fewer, though still over half, agreed that design generation (i.e., Q1_3 and Q1_8) or design related activities (i.e., Q1_9) were research. Divided opinions were also found in some statements concerning research products

and methodology (i.e., Q1_2 and Q1_4). Principle Component Analysis (PCA)[4] results indicated that these divided opinions were probably on the first dimension, while the agreed opinions were on the second (see Table 20).

Table 19. Definition of Research Perceived by ASLA members

Q1. Please indicate the extent to which each of the following statements you agree and disagree with your definition of research

No.	Statements	Disagree or strongly disagree	Neutral or not sure	Agree or strongly agree
Q1_2	Scholarship and research are the same thing	66%	25%	10%
Q1_3	Design is a form of research	19%	13%	67%
Q1_4	The design process and research methodology are two distinctively different approaches for solving problems	40%	16%	42%
Q1_5	Research is a part of a landscape architect's everyday information gathering and fact processing	8%	10%	82%
Q1_6	Combining information gathered from written sources, experts, and on-site investigations to guide design decisions is a type of research	5%	3%	93%
Q1_7	Case studies for a design project are a type of research	4%	4%	92%
Q1_8	Generating alternative design concepts is a type of research	32%	16%	52%
Q1_9	The use of drawing to explain new designs is a type of research	46%	21%	32%

Table 20. PCA Dimensions of Definition of Research Perceived by ASLA Members

Q1. Please indicate the extent to which each of the following statements you agree and disagree with your definition of research

No.	Statements	PCA Dimension*		Disagree or strongly disagree	Neutral or not sure	Agree or strongly agree
		1	2			
Q1_8	Generating alternative design concepts is a type of research	**.796**	.279	32%	16%	52%
Q1_3	Design is a form of research	**.758**	.173	19%	13%	67%
Q1_9	The use of drawing to explain new designs is a type of research	**.732**	.246	46%	21%	32%
Q1_4	The design process and research methodology are two distinctively different approaches for solving problems	**-.627**	-.009	40%	16%	42%
Q1_2	Scholarship and research are the same thing	**.388**	-.017	66%	25%	10%
Q1_6	Combining information gathered from written sources, experts, and on-site investigations to guide design decisions is a type of research	.131	**.898**	5%	3%	93%
Q1_7	Case studies for a design project are a type of research	.047	**.822**	4%	4%	92%
Q1_5	Research is a part of a landscape architect's everyday information gathering and fact processing	.189	**.772**	8%	10%	82%
		Component 1: Eigenvalue = 2.34,Total variance explained = 29 %				
		Component 2: Eigenvalue = 2.25, Total variance explained = 28%				
		Total variance explained = 57%				

Note: Rotated via Varimax with Kaiser Normalization.

ASLA members reached a general conclusion that gathering information and reflecting on it is a type of research (see Q1_5, Q1,6 and Q1_7 in Table 20). Two types of information were found:

contextual information about on-going design projects (Q1_5 and Q1_6), and information about the design and performance of built projects (Q1_7). However, the opinions of ASLA members were divided in five other statements concerning whether design and design related activities should be considered as types of research (see Q1_2, Q1_3, Q1_4, Q1_8 and Q1_9 in Table 20). There are even bimodal distributions in the responses to some statements (i.e., Q1_4, Q1_8 and Q1_9).

In order to have a better understanding of why ASLA members differ in their opinions in these statements, their attitudes toward whether "generating alternative design concepts is a type of research" (Q1_8) was cross-tabulated with their educational degree in landscape architecture (Q18), their positions (Q23), and their involvement with research (Q24_12) in their jobs. One would assume that the more exposure to research and an academic environment would lead to a more specific definition of research. Although that participants with a higher degree are more likely not to refer generating design alternatives as research (see Table 21), being a faculty member (see Table 22), or having a self-identified involvement with research (see Table 22) did not make a statistically significant difference in how one would define research.

Table 21. Crosstab between Educational Background and Definition of Research

Q18. Which of the following best describes your highest educational degree in landscape architecture?

Highest Educational Degree in Landscape Architecture	Generating alternative design concepts is a type of research			
	Disagree	Not sure	Agree	Total
Bachelor (n=123)	25%	17%	58%	100%
Master or Doctoral degree (n=86)[5]	43%	9%	48%	100%
Significance: Chi-sq = 8.10, p= .02				

Table 22. Crosstab between Job Position and Definition of Research

Q23. What is your position within your organization?

Job Positions	Generating alternative design concepts is a type of research			
	Disagree	Not sure	Agree	*Total*
Sole owner (n=54)	33%	17%	50%	100%
Partner or stockholder (n=44)	30%	14%	57%	100%
Manager/director/department head (n=33)	30%	15%	55%	100%
Associate (n=24)	29%	17%	54%	100%
Employee (n=33)	33%	3%	64%	100%
Faculty member (n=13)	31%	23%	46%	100%
Significance Test: Chi-sq = 5.17, p=.88				

[5] There are too few participants with doctoral degrees (n=4), and therefore the two categories are combined to yield meaningful results for chi-sq test. The chi-sq test actually examined the difference between bachelors and masters.

Table 23. Crosstab between Involvement in Research and Definition of Research

Q23. Are your primary job functions involved with research in the firm at the present time?

Current Job Functions	Generating alternative design concepts is a type of research: Disagree	Not sure	Agree	*Total*
Primarily Involved with Research (n=151)	36%	14%	50%	100%
Primarily Not Involved with Research (n=54)	24%	17%	59%	100%
Significance Test: Chi-sq = 2.47, p= .29				

What activities may those who agreed refer to as research? To understand this, ASLA members' attitudes toward whether "generating alternative design concepts is a type of research" (Q1_8) was again cross-tabulated with their research use in practice (Q4, Q11 and Q12), as well as their purposes of using research (Q10). Results indicate that those who agreed with the statement may refer to reflective thinking during design as a type of research. They seem to, at least as they reported, have an additional thinking process that uses intuition and the knowledge that they considered to be research (see Q4_1 and Q4_4 in Table 24). This is consistent with what Schön (1983) called "reflection in action" discussed in Chapter II, in which practitioners reflect, usually using intuition, on their behaviors, feelings, or situations when they make certain decisions, and refine a body of tacit understandings about what action to take.

Table 24. Types of Thinking and Sources of Knowledge Used in Practice Divided by Research Definition Groups

Q4. How often do you use each of the following types of thinking or sources of knowledge in making decisions in your practice?

		Group means of thinking and knowledge divided by research definition groups *		**T-test**		
No.	**Types of thinking or sources of knowledge**	Generating design solution is not research (n=76)	Generating design solution is research (n=125)	Equal variances assumed	T	P
Q4_1	Intuition	3.14	3.39	yes	-2.16	.03
Q4_2	Common sense	3.61	3.73	no	-1.51	not sig
Q4_3	Logic and reasoning	3.76	3.74	yes	0.28	not sig
Q4_4	Research findings	2.64	3.04	yes	-3.26	<.01
Q4_5	Professional experience	3.84	3.85	yes	-0.09	not sig
Q4_6	Professional education	3.32	3.38	yes	-0.65	not sig
Q4_7	The work of other landscape architects	2.76	2.83	yes	-0.57	not sig
Q4_8	Technical standards	3.36	3.36	yes	-0.05	not sig
Q4_9	Historical information	2.71	2.93	yes	-1.86	not sig
Q4_10	Client expressed desires	3.65	3.61	yes	0.55	not sig
Q4_11	Other specialists	3.03	3.00	yes	0.24	not sig

Note:

* The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely* =1, *occasionally*=2, *often*=3, *very often*=4.

4.2.2. Attitude toward Research

Probably due to the expanding scope of practice and scope of knowledge, the profession in general agreed that research is important to practice (94% agree or strongly agree, see Q1_1 in Table 25). However, the current situation of research is not perceived to be satisfactory. Fifty two percent of ASLA members have a concern that there is not enough research being done in landscape architecture, while another 41% are either neutral or not sure. In other words, only 8% believe that there is enough research (see Q1_11). Additionally, about a fifth of ASLA members have concerns that most research is too theoretical or too general to help practice, while another fifth are either neutral or not sure (see Q1_12 and Q1_13).

Table 25. The Attitudes of ASLA Members about Research In Landscape Architecture
Q1. Please indicate the extent to which each of the following statements you agree and disagree with your definition of research

No.	Statement	Not sure	Disagree or strongly disagree	Neutral	Agree or strongly agree
Q1_1	Research is important to landscape architecture practice	0%	3%	3%	94%
Q1_11	There is not enough research being done in landscape architecture	7%	8%	34%	52%
Q1_12	Most research is too theoretical to help practice	4%	46%	29%	21%
Q1_13	Most research is too general to help a specific project	2%	55%	23%	20%

Results indicate that practitioners are more aware of the application of research, while educators are more aware of the knowledge generated from research (see Table 26). Practitioners were more likely to find that most research is too theoretical (mean difference = 0.72, $p < .01$) or too general (mean difference = 0.56, $p = .02$) to contribute to practice. Educators in landscape architecture were more likely to find that there is not enough research being done (mean difference = 0.71, $p < .01$).

Table 26. Difference between Practitioners and Educators in Attitude towards Research

Q1. Please indicate the extent to which each of the following statements you agree and disagree with your definition of research

Statements		Practitioners (n=183)		Educators (n=19)		Mean difference	Kruskal-Wallis	
		Mean	SD	Mean	SD		Chi-sq	Asymp. Sig.
Q1_11	There is not enough research being done in landscape architecture	3.66	0.90	4.37	0.76	-0.71	11.61	<.01
Q1_10	It is important to be able to repeat a research study and obtain the same results	3.69	1.02	3.84	1.07	-0.16	0.47	Not sig
Q1_1	Research is important to landscape architecture practice	4.47	0.69	4.26	1.37	0.21	0.37	Not sig
Q1_13	Most research is too general to help a specific project	2.66	1.01	2.11	1.20	0.56	5.27	.02
Q1_12	Most research is too theoretical to help practice	2.82	1.05	2.11	1.24	0.72	7.98	<.01

4.2.3. Types of Thinking and Sources of Knowledge that Support Decision-Making

Landscape architects use many sources of knowledge to support their decision-making in practice (see Table 27). Two thirds of the ASLA members reported using research often or very often in their practice (see Q4_4 in Table 27). This is much higher than what Palmer et al. (1984) observed 30 years ago, if research means the same thing now and 30 years ago, when only 21% of ASLA members used research regularly, as discussed in Chapter II.

Despite the increasing use of research to support decision-making, research is not a substitute for creative design thinking or professional experience. It should be noted that research findings, as well as many other knowledge sources, are less often used than rational and intuitive thinking, professional experience, common sense, and clients' desires. This is consistent with how survey responses perceived the knowledge-bases of the profession (see Table 17).

Table 27 Types of Thinking or Knowledge Sources that Support Decision-Making in Practice

Q4. How often do you use each of the following types of thinking or sources of knowledge in making decisions in your practice?

No.	Sources of knowledge or types of thinking	Occasionally	Often or very often	Mean*	SD*
	Types of thinking				
Q4_3	Logic and reasoning	2%	98%	3.76	0.47
Q4_1	Intuition	15%	82%	3.27	0.81
	Sources of knowledge				
Q4_2	Common sense	2%	98%	3.69	0.52
Q4_5	Professional experience	1%	98%	3.84	0.42
Q4_10	Client expressed desires	4%	95%	3.60	0.56
Q4_8	Technical standards	10%	89%	3.35	0.69
Q4_6	Professional education	13%	86%	3.31	0.73
Q4_11	Other specialists	22%	70%	2.97	0.79
Q4_4	Research findings	28%	67%	2.89	0.86
Q4_9	Historical information	31%	65%	2.83	0.81
Q4_7	The work of other landscape architects	34%	62%	2.82	0.81

Note:

* The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely* =1, *occasionally*=2, *often*=3, *very often*=4.

4.2.4. The Purposes of Using Research

Practitioners use research for various purposes. They not only use research to generate design solutions (56% use it for this purpose often or very often, see Q11_2 in Table 28) or confirm design solutions (47%, see Q11_3); they also use research to generate new understanding (46%, see Q11_1) and explain designs to clients (50%, see Q11_5) and colleagues (42%, see Q11_4). Research can also create a competitive advantage over other design firms (24%, see Q11_6) or other professions (31%, see Q11_7).

ASLA members tend to view all those purposes as being closely linked. There is a moderate to high association among all seven purposes (correlation coefficients = .36 ~ .79, all $p<0.01$, Cronbach's alpha[6] = .87). The logic behind this association, as confirmed via Structure Equation Modeling (RMSEA =.07, Chi-square=25.22, NFI = .97, CFI=.98[7]) illustrated in Figure 4, may be that landscape architects believe that having a general understanding of natural and human systems can lead to certain design rationales from which a designer may generate solutions or confirm them. The design rationales will lead to a body of knowledge that can be explained to clients or colleagues or potential competitors, which will eventually lead to a competitive advantage over other design firms or other professions. However, only a

[6] Cronbach's Alpha test was used to confirm whether items tested are measuring the same thing. Its value ranges from zero to one. A high Cronbach Alpha value indicates that tested items belong to the same general category when ASLA members use them in practice.

[7] Statistical tests indicate a good fit of the model. However, the chi-square test indicated that there is a statistically significant difference between the observed and predicted values. A moderate RMSEA value suggests this difference is small and is not practically meaningful.

small portion (24%~31%) of ASLA members use research often or very often to create that competitive advantage.

Table 28. Purpose of Using Research in Practice

Q11: How often do you use research findings for the following purposes in your practice?

No.	Purposes of using research	Rarely	Occasionally	Often or very often	Mean*	SD*
Q11_2	To generate design solutions	11%	29%	56%	2.69	0.94
Q11_5	To explain design to clients	14%	29%	51%	2.63	1.01
Q11_1	To understand natural /human systems	16%	34%	46%	2.54	1.00
Q11_3	To confirm design decisions	15%	33%	47%	2.52	0.96
Q11_4	To explain design to colleagues	18%	35%	42%	2.41	0.96
Q11_7	To distinguish landscape architecture from other professions	29%	30%	31%	2.13	0.97
Q11_6	To compete with other design firms	39%	27%	24%	1.92	0.97

Note: * The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely* =1, *occasionally*=2, *often*=3, *very often*=4.

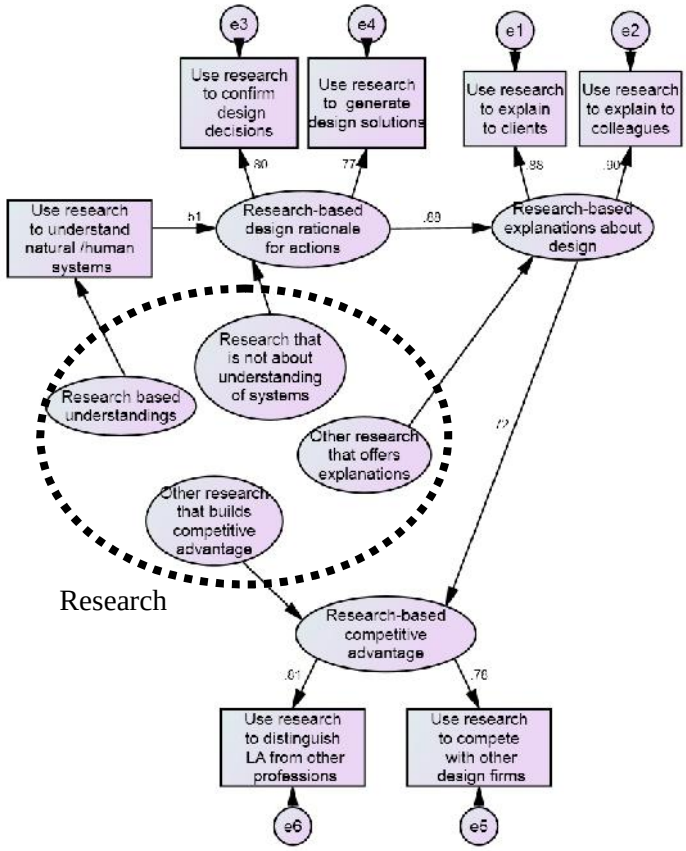

Figure 4. The Rationale behind Using Research Confirmed through Structure Equation Modeling

Q11: How often do you use research findings for the following purposes in your practice?

4.2.5. Summary of the Section

Research is perceived as being important to practice. However, the current research supply is not satisfactory. About half of landscape architects believe there is not enough research being done in landscape architecture, and a fifth of them believe that most research is too theoretical or too general to help practice. These unsatisfactory attitudes toward research are probably related to a broad definition of research. To many landscape architects, research is not limited to rational and empirical research, but also includes reflective knowing during design. This broad definition of research, as discussed in Chapter II, may jeopardize academic rigor which would eventually weaken the knowledge foundation of the profession. Another problem associated with the definition of research is that the profession lacks a consensus as to whether certain design activities (i.e., generating design alternatives and using drawings) are research or not.

Two thirds of landscape architects today use research findings to support decision-making in their practice. However, as this study shows, landscape architects rely more on common sense, professional experience, and client expressed desires to make decisions. Supporting decision-making is only one of the purposes of the use of research. Landscape architects also use research to generate explanations, sometimes to create competitive advantages.

4.3. The Need for Research in Landscape Architecture Practice

Since research is perceived to be important and many ASLA members perceived that research in their profession is not enough, it is necessary to know the current need for knowledge and how well it is being satisfied. Subsection 4.3.1 discusses the importance of research in different design stages, and subsection 4.3.2 examines one of the stages -- post-occupancy evaluation -- more closely. Subsection 4.3.3 discusses the need for additional research by knowledge areas, as perceived by landscape architects. A summary of the section is provided in subsection 4.3.4.

4.3.1.The Importance of Research in Different Design Stages

Research was perceived to be important throughout the design process, with small differences between stages (see Table 29). While the call for evidence-based design grows in this profession (Deming

& Swaffield, 2011; Jost & Lamba, 2010), it is surprising to notice that research was perceived as comparatively less important in evaluating post-occupancy performance (67%). Actually, the involvement of research slightly decreases as design develops. Results suggested that landscape architects believe that more knowledge should be generated through research before, rather than after, design actions. In other words, this profession expects research to generate design actions from the cognition of design systems and design problems. However, this rational approach of advancing knowledge in professions, as discussed in the literature review, is often unrealistic.

Table 29. The Importance of Research in Different Design Stages
Q10. In which of the following design stages do you believe research is an important source of knowledge?

No.	Design Stages	Somewhat important	Important or very important	Mean *	SD*
Q10_1	Identifying and framing problems	13%	80%	2.27	0.79
Q10_2	Gathering and analyzing information	5%	89%	2.53	0.67
Q10_3	Generating design solutions	15%	79%	2.26	0.78
Q10_4	Design construction and implementation	17%	77%	2.21	0.79
Q10_5	Evaluating post-occupancy performance	21%	67%	2.04	0.90

Note:
* The numerical means and standard deviations were calculated on the following coding: *not sure*= system missing, *not important*=0, *somewhat important*=1, *important*=2, *very important*=3.

4.3.2. Research in Post-Occupancy Evaluation

It is important to do post-occupancy evaluation to advance knowledge to an empirical level, and to provide research with practical value. Inferring from ASLA members' comments, not many landscape architects would be surprised if only a fraction of built projects had been evaluated in this profession:

> *It would be very helpful if there was more post construction evaluation of public projects that was done in a rigorous way. In private practice this is simply not possible--i.e., there is no remuneration for this. At least that is my understanding.*
>
> *SITES is a perfect example-as I am leading a pilot project for submission. If time were not an issue-what a great concept-but time is money. How in the world can one justify to a paying client the hours associated with such documentation?*

ASLA members' perception about post-occupancy evaluation may also reveal a lack of knowledge in evaluation work among practitioners. There are fewer ASLA members who believe that research is important, or very important, in evaluating post-occupancy performance, than in other stages. However, performance measuring, especially that involved with human perceptions and behaviors, requires a lot of research (Zimmerman & Martin, 2001). Generalized principles, which are based on multiple cases and comparative studies, require a lot of research (Francis, 2001), too.

4.3.3. Additional Need by Knowledge Areas

Three things should be noted about the profession, when one aligns the current use (see Table 18 and Figure 5) and additional need for research (see Figure 6). First, the body of knowledge that current landscape architecture practice is based on, seems to be balanced between design knowledge (judgmental design knowledge and construction design knowledge) and systems knowledge (environmental systems knowledge and human systems knowledge), and between analytical/empirical knowledge (construction design knowledge and environmental systems knowledge) and intuitive/holistic knowledge (judgmental design knowledge and human systems knowledge). Among the four knowledge domains, design knowledge is most often used in current practice ($\bar{x}$ = 3.06, see Figure 5), with a small range of means from 2.92 (grading and circulation) to 3.32 (plants and materials, see Figure 5).

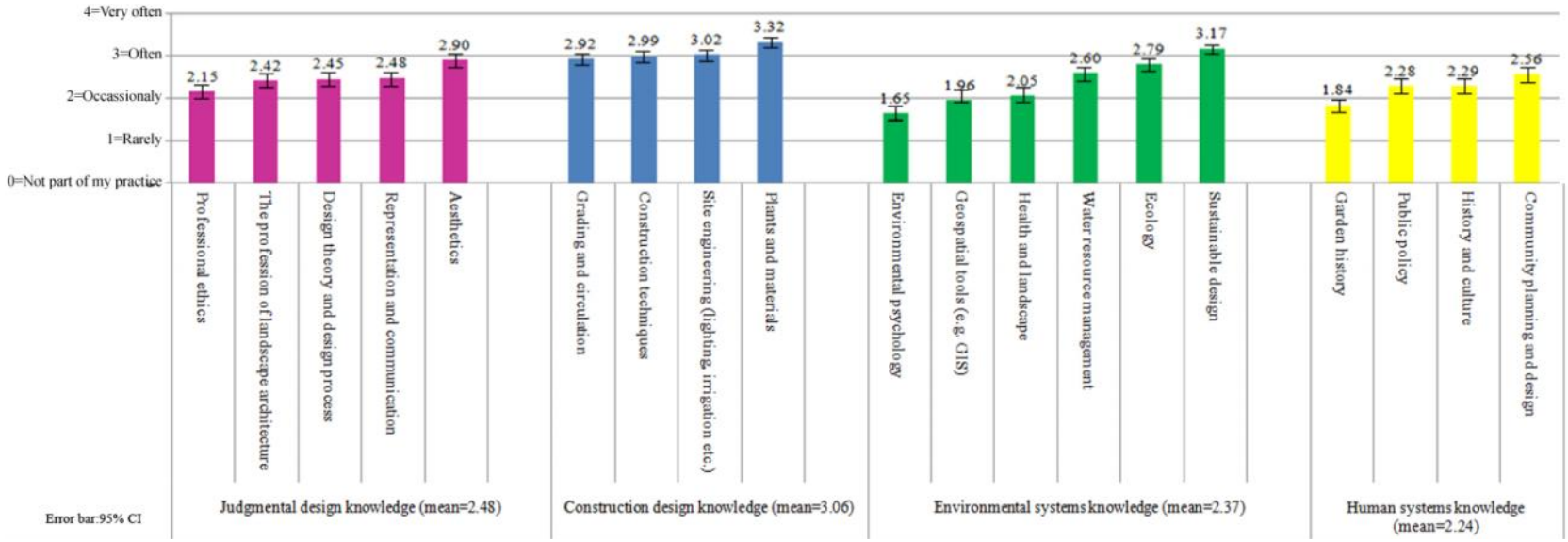

Figure 5. The Use of Research Findings in Practice

Q12. If you engage in the following as part of your practice, please indicate how often you use research on that topic.
Note: * The numerical means and standard deviations were calculated on the following coding: *not part of my practice*= 0, *rarely* =1, *occasionally*=2, *often*=3, *very often*=4.

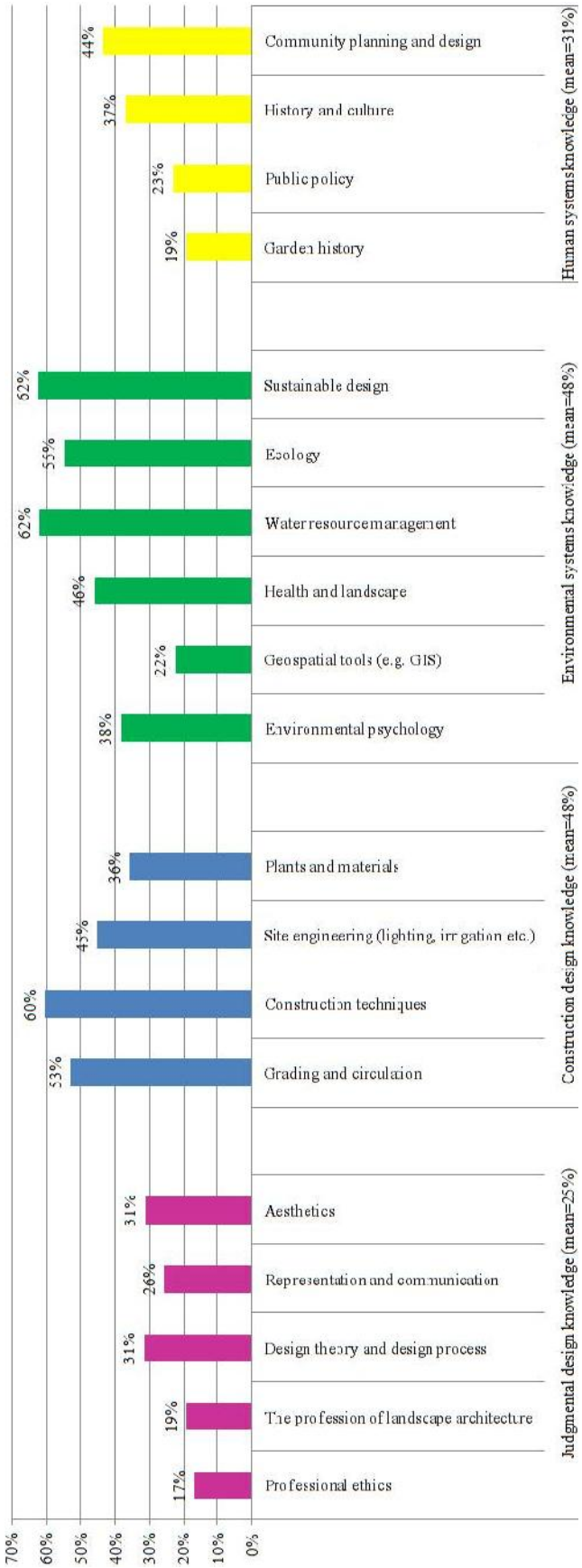

Figure 6. Need for Additional Research Perceived by Practitioners

Q13. In what areas do you believe additional research would help you practice? (Check all that apply)

Second, there is a decreasing need for judgmental design knowledge and an increasing need for environmental systems knowledge. While judgmental design knowledge ($\bar{x}$ = 3.06, see Figure 5) is used more often than environmental systems knowledge ($\bar{x}$ = 2.37, see Figure 5) in current practice, the need for additional judgmental design knowledge ($\bar{x}$ = 25%, see Figure 6) is perceived much less than the need for additional environmental systems knowledge ($\bar{x}$ = 58%, see Figure 6). While it is difficult to advance judgmental design knowledge through a performance-based empirical approach, it is not that difficult to advance environmental systems knowledge through this approach. Therefore the expectation of additional research is consistent with the expectation for more research in post-occupancy evaluation.

Third, the human systems knowledge domain is less often used ($\bar{x}$ = 2.24, see Figure 5) in practice and is perceived as being less needed for additional research ($\bar{x}$ = 31%, see Figure 6). This does not seem appropriate for a profession that is perceived to be concerned with public welfare (69% found to a great or very great extent, see Q3_3 in Table 15) and individual comfort and pleasure (42% found to a great or very great extent, see Q3_4 in Table 15). As discussed in Chapter II, performance, including post-occupancy evaluation, associated with human systems knowledge is usually difficult to measure or evaluate. Therefore the low use and perceived need for human systems knowledge is probably due to its limitation in advancing a body of performance-based empirical knowledge.

4.3.4. Summary of the Section

Most research need is found in construction design knowledge and environmental systems knowledge, which may possibly indicate a preference for empirical research, as commented on by three of the survey respondents. Due to their difficulties in justifying empirically, judgmental design knowledge and human systems knowledge are perceived as less needed. Therefore, practitioners may be less motivated to seek out and learn from those types of research studies.

4.4. Dissemination of Research Findings in Landscape Architecture

Based on the knowledge need from practice discussed in section 4.3, as well as the knowledge production by educators discussed in Chapter II, this section investigates how well the knowledge generated is circulated in this profession. To understand dissemination, one first needs to know how landscape architects get new knowledge (subsection 4.3.1). One also needs to know what knowledge is generated through research (subsection 4.3.2), and how research findings are circulated (subsection 4.3.3). A summary is provided in the end of the section (subsection 4.3.4).

4.4.1. Media Used to Obtain New Knowledge in Landscape Architecture

Educators and practitioners are engaged in very different jobs. As shown in Figure 7, educators are primarily involved in research and teaching. They do much less design than private and public practitioners. They produce even less construction documents and are rarely engaged in on-site construction activities. In contrast, practitioners, both private and public, gain significant on-site experience from a lot of design and planning work, and from a fair amount of on-site construction activities (see Figure 7).

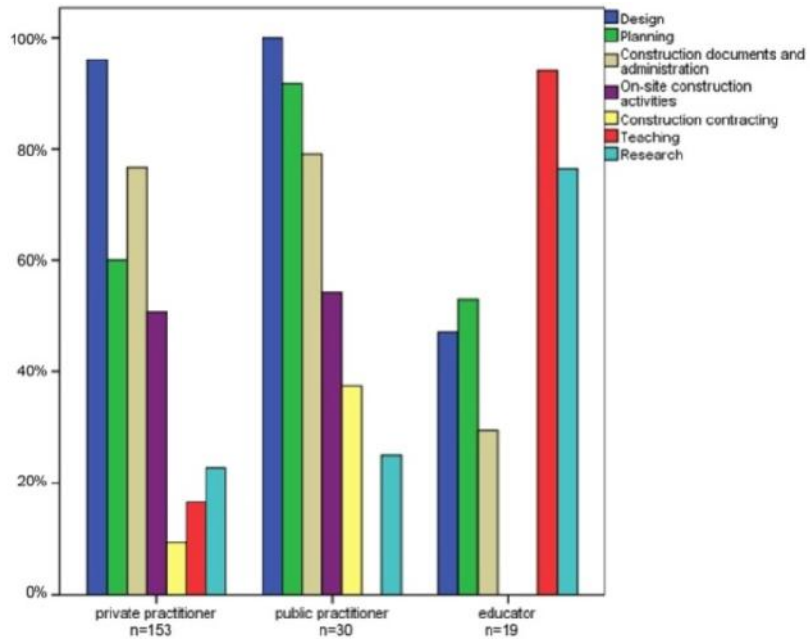

Figure 7. Primary Job Functions of Private Practitioners, Public Practitioners and Educators
Q24. What are your primary job functions in the firms at present time? (Check as many as apply)

Educators also obtain knowledge from many various sources significantly more often than practitioners, including refereed journals (see Table 30), design competitions, travelling, professional documents and reports, historic precedents, and books (see Table 12). While practitioners often get new information only from the internet ($\bar{x}$ = 3.48), professional magazines ($\bar{x}$= 3.19) and everyday life ($\bar{x}$ = 3.14), educators often get new information from the internet ($\bar{x}$ = 3.47), books ($\bar{x}$ = 3.42), travelling ($\bar{x}$ = 3.26), everyday life ($\bar{x}$ = 3.26), professional documents and reports ($\bar{x}$ = 3.26), and historic precedents ($\bar{x}$ = 3.21).

Table 30. Difference between Practitioners and Educators in Using Information Sources
Q5. How often do you use the following for keeping up with new knowledge in the practice?

No.	Statements	Practitioners (n=183)		Educators (n=19)		Kruskal-Wallis	
		Mean*	SD	Mean*	SD	Chi-sq	Asymp. Sig.
Q5_1	Professional documents and reports	2.64	0.88	3.26	0.73	8.43	<.01
Q5_2	Design competitions	1.68	0.80	2.32	1.00	8.21	<.01
Q5_3	Refereed journals	1.87	0.88	2.84	0.96	16.14	<.01
Q5_4	Professional magazines	3.19	0.77	2.89	0.81	2.25	not sig.
Q5_5	Books	2.87	0.83	3.42	0.61	7.93	<.01
Q5_6	Internet	3.48	0.64	3.47	0.61	0.01	not sig.
Q5_7	Design- historic precedents	2.66	0.83	3.21	0.71	7.50	<.01
Q5_8	Short courses and workshops	2.40	0.80	2.21	0.98	0.89	not sig.
Q5_9	Professional conferences	2.40	0.89	2.37	0.90	0.09	not sig.
Q5_10	Professional newsletters	2.30	0.81	2.42	0.84	0.56	not sig.
Q5_11	Professional databases	1.96	0.86	1.83	0.92	0.49	not sig.
Q5_12	Other landscape architects	2.60	0.83	2.63	0.90	0.06	not sig.
Q5_13	Related professionals	2.80	0.77	2.95	0.71	0.47	not sig.
Q5_14	Clients	2.34	1.01	2.11	1.02	0.92	not sig.
Q5_15	Travelling	2.64	0.93	3.26	0.81	8.39	<.01
Q5_16	Everyday life	3.14	0.78	3.26	0.56	0.23	not sig.

Note:
* The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely*=1, *occasionally*=2, *often*=3, *very often*=4.

4.4.2. Knowledge Produced through Research

Expected Responsibility in Advancing Knowledge

Giving their job functions and their access to various knowledge sources, it is reasonable to expect educators to take a primary responsibility in advancing knowledge in landscape architecture (see Figure 8). However, it should be noted that there is also a high expected responsibility for private practitioners to advance knowledge, since the knowledge-base of landscape architecture practice is still largely specialized knowledge and skills developed by practitioners (see Table 17).

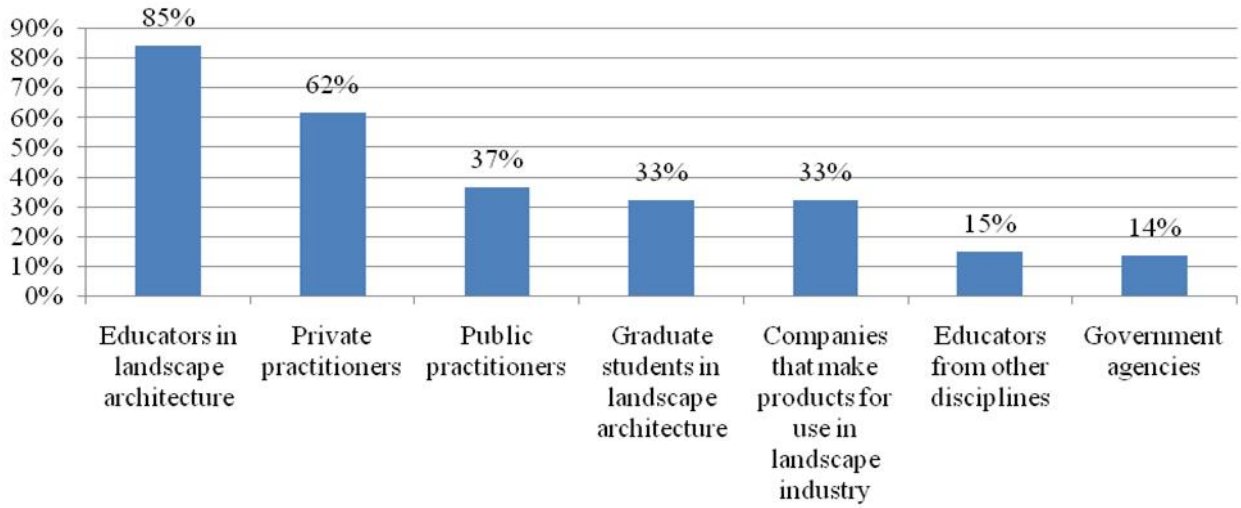

Figure 8. Perceived Responsibility for Advancing Knowledge
Q2. Who do you believe should be PRIMARILY responsible for advancing knowledge in landscape architecture? (Check up to three)

The Knowledge Produced by Educators through Research

Educators in landscape architecture conduct most research in environmental systems knowledge ($\bar{x}$ = 10%, see Figure 9) and human systems knowledge ($\bar{x}$ = 12%, see Figure 9). They also conduct some research in judgmental design knowledge ($\bar{x}$ = 6%, see Figure 9). However, they do very little research in construction design knowledge ($\bar{x}$=1%, see Figure 9), even though this type of knowledge is most often used in practice ($\bar{x}$=3.06, see Figure 5) and is highly demanded by practitioners ($\bar{x}$=48%, see Figure 6).

Instead, educators do much more research in human systems knowledge ($\bar{x}$= 12%, see Figure 9), which is the least often used in practice ($\bar{x}$=2.24, see Figure 5).

Knowledge Produced by Practitioners through Research

This study did not measure what knowledge practitioners may produce through research. However, it did discover that landscape architects do recognize combining information from various sources (93% agreed or strongly agreed, see Q1_6 in Table 19) and case studies (92% agreed or strongly agreed, see Q1_7 in Table 19) as research. Therefore, it is reasonable to believe that the knowledge produced by practitioners through research is largely action-based knowledge such as judgmental design knowledge and construction design knowledge. In other words, it is reasonable to assume that environmental systems knowledge and human systems knowledge are primarily advanced by educators, while construction design knowledge and judgmental design knowledge are primarily advanced by practitioners.

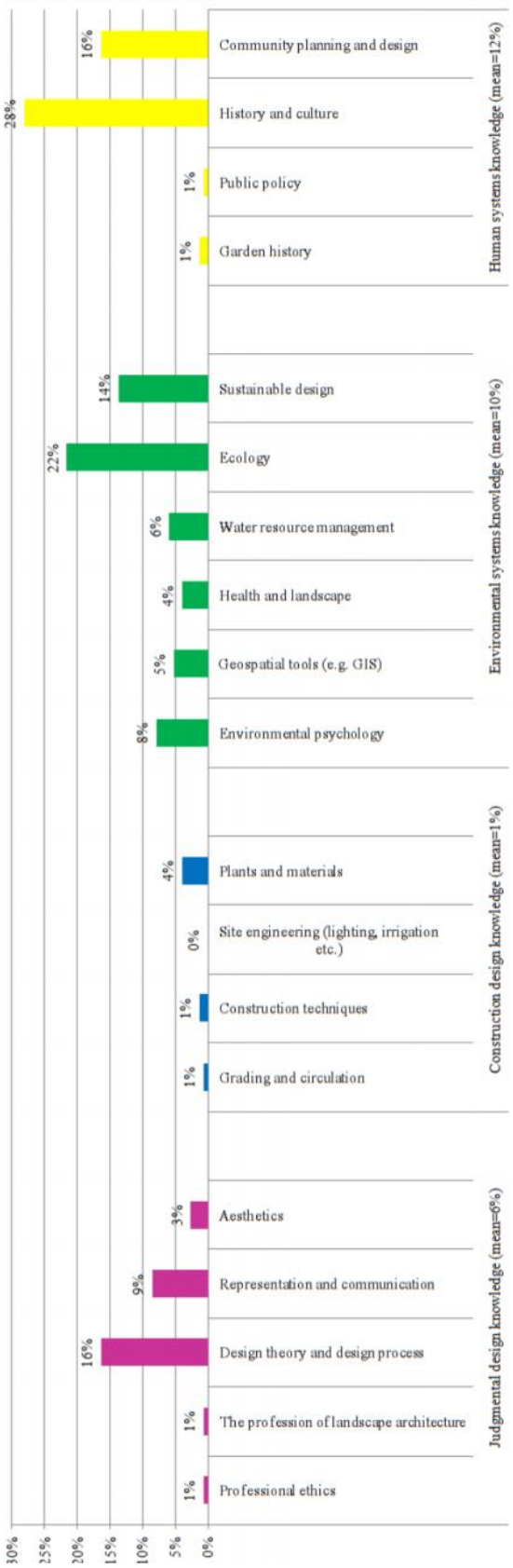

Figure 9. Educators' Current Research Engagement

4.4.3. Media for Disseminating Research Findings

Although practitioners think that some of the activities they do in practice are research (see Subsection 4.1.1), they do not often share their findings with a community larger than their co-workers. ASLA members often only disseminate their research findings in working environments via co-workers (59% used it often or very often, see Table 31), which is usually circulated within a very small circle. Many fewer ASLA members (3~18%) disseminated research findings to a larger audience via other sources. Some shared via oral presentations (conference 13%, non-conference 18%) or university teaching (12%). Only a small portion of ASLA members disseminated their knowledge via publications, such as websites (7%), professional magazine articles (6%), refereed journal articles (3%), and books (3%).

Table 31. Media Used to Disseminate Research Findings
How often do you use the following media to disseminate your research findings?

No.	Sources used to disseminate research findings	Rarely	Occasionally	Often or very often	Mean*	SD*
Q6_8	Teaching co-workers	16%	21%	59%	2.70	1.03
Q6_3	Presentations and lectures other than conferences	43%	35%	18%	1.80	0.88
Q6_2	Presentations and lectures at professional conferences	49%	34%	13%	1.68	0.82
Q6_7	Teaching in universities	65%	18%	12%	1.51	0.88
Q6_6	Publishing on web sites	72%	18%	7%	1.34	0.66
Q6_1	Writing articles for professional magazines	72%	18%	6%	1.32	0.61
Q6_5	Writing articles for refereed journals	81%	11%	3%	1.19	0.54
Q6_4	Writing books	86%	5%	3%	1.12	0.46

Note:
* The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely*=1, *occasionally*=2, *often*=3, *very often*=4.

Educators, however, share their research findings in many ways. They often disseminate their research findings through teaching in universities ($\bar{x}$ = 3.63, see Table 32), conference presentations ($\bar{x}$ = 2.74), and teaching co-workers ($\bar{x}$ = 2.47). They also publish their findings in various media, including refereed journals ($\bar{x}$ = 2.06), professional magazines ($\bar{x}$ =1.89), websites ($\bar{x}$ = 1.79) and books ($\bar{x}$ = 1.61).

Table 32. Differences between Practitioners and Educators in Media Used to Disseminate Research Findings

No.	Media used to disseminate research findings	Practitioners (n=183) Mean*	Practitioners (n=183) SD*	Educators (n=19) Mean*	Educators (n=19) SD*	Kruskal-Wallis Test Chi-sq	Kruskal-Wallis Test Asymp. Sig.
Q6_1	Writing articles for professional magazines	1.28	0.57	1.89	0.88	15.89	<.01
Q6_2	Presentations and lectures at professional conferences	1.56	0.73	2.74	0.93	26.7	<.01
Q6_3	Presentations and lectures other than conferences	1.71	0.84	2.74	1.05	16.93	<.01
Q6_4	Writing books	1.07	0.33	1.61	1.04	18.23	<.01
Q6_5	Writing articles for refereed journals	1.09	0.29	2.06	1.11	39.95	<.01
Q6_6	Publishing on web sites	1.29	0.6	1.79	0.92	8.76	<.01
Q6_7	Teaching in universities	1.31	0.59	3.63	0.6	68.86	<.01
Q6_8	Teaching co-workers	2.78	1.03	2.47	0.9	1.95	Not sig

Note:
* The numerical means and standard deviations were calculated on the following coding: *not sure*=system missing, *rarely*=1, *occasionally*=2, *often*=3, *very often*=4.

It should be noted that the media that both educators and practitioners use may largely limit knowledge-sharing within each community. Practitioners rarely share beyond other practitioners. Educators mostly share to their students and to other educators, since practitioners rarely read refereed journals ($\bar{x}$ = 1.87, see Table 30), or discover much new information from professional conferences ($\bar{x}$ = 2.40, see Table 30).

It is understandable that practitioners are reluctant to share their findings, especially when findings are related to clients' privacy or to the competitive advantages of their firms. However, this no-sharing culture among practitioners handicaps the profession from advancing its knowledge. Without information shared by practitioners, it is difficult for educators to conduct genuine performance-based research. Therefore the profession is probably still advancing its knowledge through the reflective model, primarily.

When the profession is expanding its practice to more specialized areas, as discussed in the beginning of this chapter, this no-sharing culture not only handicaps advancing academic knowledge, but also handicaps advancing professional knowledge:

> *Landscape architecture being multifaceted generates a problem in that we cannot be all things at once. Were there more specialization within the profession much like the academies and fellowships that doctors obtain, it would help sort out the project responsibilities to the most qualified within an area and foster more collaboration. Far too often I observe an under qualified person struggling with a project that another is capable of - and the one who is struggling should be doing yet something else. We are still too much generalists.(A comment from a survey respondent)*

4.4.4. Summary of the Section

Practitioners often use the internet, professional magazines, and everyday life to get new information about landscape architecture. Educators, however, often use more types of sources including books, professional documents and reports, travelling, and historic precedents. Educators play an important role in advancing knowledge in the profession through integrating knowledge from these various sources through research,

Educators often disseminate their research findings through teaching in universities, conference presentations, and teaching co-workers. They also publish their findings in various media. Practitioners, however, usually only disseminate their research findings through teaching co-workers. The media that educators and practitioners use to disseminate research findings may limit knowledge-sharing between educators and practitioners, which can jeopardize the advancement of knowledge in the profession.

4.5. Summary of the Chapter

The scope of landscape architecture practice expanded from aesthetics to ecological need in the 1970s, and has expanded to public welfare in the present, and is still expanding in the area of individual comfort. Together with the expanding scope of practice, the scope of landscape architecture knowledge has expanded from the judgmental design knowledge domain and the construction design knowledge domain, to the environmental systems knowledge domain and the human systems knowledge domain. Today, the body of knowledge of landscape architecture seems to be balanced between systems knowledge and design knowledge, between intuitive/holistic knowledge and analytical/empirical knowledge.

With the expanding scope of knowledge, research is perceived as being important to practice. Landscape architects today often use research findings to support decision-making in their practice. Results suggest that landscape architects expect research findings to rationally generate design actions. However, the current research supply is not satisfactory. About half of landscape architects believe there is not enough research being done in landscape architecture, and a fifth of them believe that most research is too theoretical or to general to help practice. When current research does not generate sufficient design

actions, landscape architects still rely most on common sense, professional experience, and client-expressed desires to make their design decisions.

Not only does the profession have difficulties in generating practical design actions from research, evidence suggests that several impediments may also jeopardize the profession from using research findings to justify its practice. First, research is broadly defined by some landscape architects to include reflective thinking during design, which may jeopardize academic rigor and could eventually weaken the knowledge-foundation of the profession. Additionally, since a considerable portion of landscape architects disagree with this usage, the lack of consensus could cause problems in communication and collaboration. Second, the media that educators and practitioners use to disseminate research findings may limit knowledge-sharing between educators and practitioners, which could jeopardize the advancement of knowledge in the profession. Third, practitioners do not usually conduct post-occupancy evaluation, which is important in advancing knowledge in landscape architecture to a higher empirical level.

Landscape architecture also relies on knowledge and research findings from many other disciplines (e.g., ecology) and professions (e.g., civil engineering). On the one hand, it enables the small profession of landscape architecture to be able to build its practice on a larger body of knowledge. On the other hand, it also makes it more difficult for the profession to have a shared research paradigm, which therefore encumbers the profession to advance its knowledge in a more efficient way (Kuhn, 1970).

Chapter V Conclusion and Implications

This chapter discusses the important findings of this dissertation in a larger context of previous studies, and examines the implications of these findings. This chapter is organized in four sections. Section 5.1 summarizes the conclusion of this study in the order of the four research questions addressed in Chapter I. Based on the conclusion, section 5.2 discusses the potential implications and suggestions to enhance landscape architecture practice through research. Section 5.3 lists the limitations of this study and provides suggestions for future studies. A summary is provided in section 5.4.

5.1. Conclusion and Discussion of Major Findings

This study investigated the role of research in landscape architecture practice. The study is intended to provide researchers and practitioners information on what may encumber the profession from advancing its knowledge through research. Therefore, the profession may take actions to remove these encumbrances, in order to enhance its practice. This section discusses the major findings in this study in the order of the four research questions that were raised in Chapter I.

5.1.1. The Concerns of Landscape Architecture Practice

To answer the first research question "What are the concerns of landscape architecture practice?" respondents' answers to three questions (Q3, Q7, and Q12) were analyzed. Results reveal that the knowledge scope that current landscape architecture practice is built on consists of four domains. Two of them are action-based knowledge, which is knowing how to do things. Among them, one (judgmental design knowledge) is more intuitive, and one (construction design knowledge) is more concrete. The other two are related to cognition-based knowledge, which is knowing that something is the case. Among them, one (environmental systems knowledge) is more about natural phenomena and one (human systems knowledge) is more about human phenomena. As a profession that was largely centered in aesthetics in its early stage (Fein, 1972), the current landscape architecture practice is balanced between systems knowledge and design knowledge, and between analytical/empirical knowledge and intuitive/holistic

knowledge. On average, construction design knowledge ($\bar{x}$ = 3.06) is used more often than other three domains ($\bar{x}$ = 2.24~ 2.48).

Results suggest that the scope of knowledge in landscape architecture developed from the two types of design knowledge, action-based knowledge -- judgmental design knowledge (e.g., aesthetics), and construction design knowledge (e.g., professional skills in site engineering) -- in the early 20th century and expanded to environmental systems knowledge (e.g., ecology) in the mid 20th century (Fein, 1972). This study saw the scope of knowledge continuing to expand to human system knowledge in terms of the amount of knowledge use in practice and the amount of research produced by educators.

The expanding scope of knowledge, as discussed in Chapter II, reflects a new requirement for professions in modern society. Modern professions need not only to do good work, but also need to have a body of solid knowledge to back their work up. One respondent commented on this survey that:

> *Landscape Architects absolutely must back up their ideas with facts. As a profession, we have a tendency to assume others will iron out the finer points, but this is our responsibility. We can't just assume things will work (stormwater, safety, ecology); we must know they will work. Either we have to research this ourselves or engage the help of related professions.*

The ability to demonstrate expertise through solid knowledge and research is vital for the survival of landscape architecture as a profession, especially during tough economic times. Another respondent commented on this survey that:

> *It is important to research ways in which the profession can be made stronger. For instance, in many states Landscape Architect's license stamp/seal can be substituted by an Architect or an Engineer's stamp. This truly undervalues the existence of the profession and during tough economic times like this if a landscape architectural drawing can be stamped by anyone else the landscape architect gets laid off. This issue needs to be brought to the forefront otherwise this profession will die and will not be able to sustain these difficult economic times as big government agencies and the private sector really sees no need to keep a landscape architect on staff.*

Despite the expanding knowledge scope, however, landscape architecture practice is still largely based on tacit knowledge, which is probably more about design knowledge but not fully captured by the design knowledge listed in the survey. Eighty-five percent of landscape architects perceive that the practice is based on specialized knowledge and skills developed by practitioners. Design decisions are made more on professional experience and common sense than research findings or historical information. There is a paradox that the profession senses an increasing need for explicit knowledge generated from research, while the actual decisions making in its practice still rely largely on tacit knowledge.

This paradox, as discussed in Chapter II, is probably related to a mistaken public belief that professional decisions are made in a fully informed manner based on explicit and solid knowledge. This mistaken belief overestimates the role of research, while underestimates the role of tacit knowledge in practice. The knowledge that current landscape architecture practice is built on is still largely tacit knowledge, which is advanced through the reflective approach illustrated in Figure 3 on page 23.

5.1.2. The Significance of Research in Landscape Architecture Practice

With the knowledge of landscape architecture practice and its knowledge structure, a second question is asked in this dissertation: "What is the significance of research in landscape architecture?" This question is intended to understand how landscape architects perceive the role of research, an important knowledge advancing approach in landscape architecture practice, and how their perception fits into the actual role of knowledge in landscape architecture practice as discussed in the context of the first research question. To answer the second research question, respondents' answers to four questions (Q1, Q4, Q10 and Q11) were analyzed.

Results reveal that research is widely perceived to be important in landscape architecture. On the one hand, research is used often or very often by over half of landscape architects in making design decisions, which is much more often than it was used in the 1980s. On the other, educators are spending more time in doing research than they were two decades ago (Chen et al., 2011; Chenoweth & Chidister, 1983) and are publishing more, too, than they were a decade ago (Chen et al., 2011; Milburn et al., 2003). However, many landscape architects perceive a lack of research being done in this profession. It is reasonable to believe that the perceived lack of research in landscape architecture may be because of

landscape architects' problems in locating research findings, as reported in a prior study (Palmer et al., 1984). One survey participant commented on this survey that:

> *When I am confronted with a new design challenge, sometimes I find it difficult to actually find documented, researched articles, papers, reports to help me understand the story I am trying to tell. I find there is a disconnect between those researching and those looking for the research, it's just not on my day to day radar and unless I make a point to search something out chances are I am not going to find it.*

To prepare for the changing scope of practice and knowledge need, the profession of landscape architecture should prepare its practitioners with at least some research skills, such as locating resources in libraries and databases, interpreting research results, evaluating the validity of research and applying it to specific cases, and conducing some simple research.

Another reason, which is probably more important, for the unsatisfactory situation of research supply is that landscape architects may have an unrealistic expectation on research and the knowledge it may generate. As discussed in Chapter II, other than the reflective approach, modern professions can generate knowledge through a rational approach (see Figure 1 on page 21) and empirical approach (see Figure 2 on page 22). Evidence suggests that landscape architects expect research to generate knowledge to support design actions more through rational approach (informed design actions are rationally generated based on systematic studies on phenomena and problems), than through an empirical approach (design actions are generated based on systematic studies on previous actions and consequences). They expect a higher need for research before the generation of design solutions (rational approach), than after it (empirical approach). As discussed in Chapter II, a rational approach is not a productive way of generating knowledge about design solutions. It is no wonder that educators are doing more fundamental research than they believe they should do (Chen et al., 2011), and not many of them have extended their findings into practical implications (Powers & Walker, 2009). Therefore, it makes sense that about a fifth of practitioners think that research -- probably that done by educators -- is too theoretical and too general to be useful.

Though they generally agree that research is important to practice, results also suggest that landscape architects do not agree on what research is. The lack of consensus in the profession can cause problems in communication and collaboration. While one asks for empirical research, another may think

every practitioner is doing reflective research in their practice. Additionally, the lack of consensus in definition also makes it difficult for practitioners to specify the knowledge they need, and therefore it is difficult locate research findings.

5.1.3. The Need for Research in Landscape Architecture Practice

To answer the third research question "How do landscape architects perceive the need for research?" respondents' answers to two questions (Q11 and Q13) were analyzed. Results suggest that practitioners prefer the findings of analytical/empirical research (i.e., environmental systems knowledge and construction design knowledge) to findings in intuitive/holistic research (i.e., judgmental design knowledge and human systems knowledge). This preference over analytical/empirical knowledge reveals a possible bias in modern culture. Modern professions are competing with each other in a fast changing world. Practitioners expect research to demonstrate their expertise as a profession. Therefore it is no reasonable to assume that practitioners would expect research to generate immediate and practical results. It is understandable that they would be conservative about expanding the body of knowledge in landscape architecture into deep holistic understanding. In the 1970s, practitioners were found to be more conservative about practice and knowledge and were more likely to maintain the status quo of knowledge (Fein, 1972).

Practitioners' expectations of knowledge need probably reflect problems in both empirical and holistic research. On the one hand, the need for analytical/empirical research probably implies the lack of research in these areas. As discussed in Chapter II, though educators perceived that the profession should primarily be involved with applied research, educators are actually conducting quite a lot fundamental research. As revealed in the survey results, construction design knowledge, though it is used most often in current practice and highly expected as research by practitioners, is least studied by educators. Therefore, the profession should push their findings from describing what and why something is the case, to knowledge about how to make changes. On the other hand, low expectations in intuitive/holistic research probably implies the lack of awareness of the implications of these research studies. Therefore, researchers in intuitive/holistic research should make it more clear how their findings may tie back to practice.

5.1.4. Dissemination of Research Findings in Landscape Architecture

To answer the third research question "How are research findings disseminated in landscape architecture?" respondents' answers to three questions (Q2, Q5 and Q6) were analyzed. Research is perceived to be important to landscape architecture. Some scholars, such as Elizabeth Meyer, found many innovative research studies are happening in practice (Jost & Lamba, 2010). If they are doing any research, results suggest that practitioners tend to share the findings with their co-workers. This colleague knowledge-sharing model is often used in sharing tacit knowledge (Schön, 1983). However, this way of knowledge sharing is not efficient enough for modern professions in a fast changing society. Therefore, firms and organizations need to externalize tacit knowledge for more efficient knowledge sharing (Nonaka, Byosiere, Borucki, & Konno, 1994). Research is often involved in practice and industry when externalizing tacit knowledge. However, as a participant commented in this survey, practitioners in landscape architecture are not very motivated to conduct or share research:

> *In billable work, there is very limited time allotted for research. It's hard for clients to feel comfortable with multiple hours of research that may not lead to anything substantive. Research questions need to have an open ended quality to them so they can lead you to the best solution. This is not a comfortable place for clients when the researcher is billing out at $100+ an hour.*

Though it is probably true that practitioners lack economic incentives to do or share research, findings of motivation research suggest that sometimes non-economic incentives work as well as, or even better than, economic ones. Studies on psychology and motivation reveal that human beings do not always make decisions based on rational cost-benefit analysis (Daniel Kahneman, 2011; D. Kahneman & Tversky, 1974; Kaplan & Kaplan, 2009). People do not only do things when they get paid; they do things sometimes when they feel that they are fun, or valuable (Pink, 2009). The latter motivation is often underestimated in business. Pink (2009) explained the two types of motivation with two business models of creating an encyclopedia in the mid 1990s. The first model hired professionals to write, while the second model just provided a place and paid no one. In the second model, people were just writing for fun. What is surprising to all economists is that the first model, Microsoft's Encarta, failed, while the second model, Wikipedia, thrived.

Inspiring research motivated by non-financial incentives can be found in landscape architecture, too. Sustainable Design and Development, one of the ASLA Professional Practice Networks (PPN), had played an important role in promoting the research-oriented Sustainable Site Initiative program (ASLA, 2013). Another example is James R. Urban. Urban had done extensive research and publications on urban trees and soils (ASLA, 2007), which in return won him and his firm both reputation and business contracts[8].

Educators, though they do reach out and share some of their research findings with practitioners, still share most of their findings within academic circles such as teaching students and co-working educators, presenting in non-professional conferences and publishing in refereed journals and books. The current dissemination model probably limits educators from getting feedback from practitioners, and therefore makes educators less aware of the knowledge need in practice:

> *Anonymous CELA survey response: "Research in LA seems increasingly self serving to involved academics rushed on by the university system. The actual relevancy or value of works is not seemingly an important issue. CELA has become too oriented towards using academic research methods as a measure of validity."(Milburn et al., 2001, pp. 64-65)*
>
> *Anonymous CELA survey response:"Too much 'research' is only research for research's sake and for academic promotion within a hermetic world. " (Chen et al., 2011)*
>
> *Anonymous CELA survey response:"Part of my problem with research is that it is too tied up in refereed journals. Our work needs to get to decision-makers and in formats that are compelling and clear. Too much of the research realm of landscape architecture seems to be about research for its own sake." (Chen et al., 2011)*

5.2. Implications and Suggestions

This section extended the findings to suggestions for actions that can be taken in this profession. Some general suggestions for the profession are given, as well as more suggestions to educators, practitioners, and professional organizations.

[8] James Urban has been researching and testing ideas about urban trees and soils since 1982 and he was awarded with ASLA Medal of Excellence 2007 for his contribution to the knowledge and practice of landscape architecture. He exemplifies that conducting and sharing research is not mutually exclusive with the competitive advantages and financial interests of design firms.

5.2.1. Profession in General

Modern professions are expected not only to successfully perform professional actions, but also to be able to offer rational explanations of their actions. The later requires knowledge about the phenomena involved in design. This knowledge is usually gained through systematic research. To meet the new expectations for the modern profession, landscape architecture is expanding its knowledge from design knowledge to systems knowledge, and from tacit knowledge to research-oriented knowledge.

Considering the existing situation in this profession, research may not play as important a role in current landscape architecture practice as it may be perceived. Compared with other professions such as architecture and engineering, landscape architecture is a small profession. The profession does not seem to have enough academicians to support a strong academic tradition. There are not many Ph.D.s in this profession (see Q18 in Appendix D). In addition, there are many more practitioners than educators in this profession (see Q20 in Appendix D). The new knowledge created by practitioners, either through research or in other ways, is rarely shared with the whole profession.

The profession expects research to build a body of solid knowledge from which design actions can be rationally generated. However, this expectation, as found in a review of literature and confirmed by results of this study, is not realistic in landscape architecture. If landscape architects expect research to play an important role in their practice, the profession needs to advance its knowledge through research via the empirical approach instead of the rational approach.

5.2.2. Educators

There are several things that educators may do to enhance the role of research in landscape architecture practice. First, educators should be more aware of the possible implications of their findings in practice when they are doing research. They should address these implications in an appropriate manner that can be easily understood by practitioners. They should share the findings that have potential implications in practice through the media that can be accessed by practitioners, such as *Landscape Architecture Magazine* and ASLA conferences.

Second, educators should teach students, who are future practitioners, basic research skills. The basic research skills should include: 1) using libraries, databases and online searching tools to locate

important research findings, 2) interpreting research results and being able to judge how much one can trust research results (internal validity) and whether research results can be applied to specific cases (external validity) , and 3) being able to conduct simple research when necessary.

5.2.3. Practitioners

Practitioners hold a body of knowledge that is very important to landscape architecture practice. As one participant commented, that:

> *The practitioner is the greatest researcher existing for the practice of landscape architecture. Each of us builds on what predecessors have taught us through their design work, whether it be direct employment experience, or seeing great works by Dan Kiley, Garrett Eckbo, Oehme van Sweden, Kathryn Gustafson, etc. Finely-tuned research in specific areas of practice is important for design knowledge, but only as part of the greater whole.*

Though many ASLA members think practitioners are responsible for advancing knowledge, results suggest that practitioners rarely share their research findings beyond their co-workers. In order to meet the new knowledge need in the profession of landscape architecture, practitioners need to be more aware of their responsibility in knowledge-sharing. If competitive advantage is a concern, practitioners should consider the advantage only in the short term, but also in the long term. The latter requires practitioners' investment in knowledge and research.

5.2.4. Professional Organizations

Professional organizations such as ASLA and LAF should be more aware of their roles in guiding the directions of landscape architecture practice. They should balance their attention between projects with a high aesthetic value and those with a high knowledge value. The annual ASLA awards, especially, deliver important information about what should be valued in the profession. More awards should be given to individuals like James Urban, who advanced the knowledge of the profession. One survey participant commented that:

Thinking about it, I feel research is very important in all aspects of landscape architecture. The difficulty comes in making the time to conduct research or including it in our scope of services whether overt or not... From appearances, the glorious images presented by ASLA for awards or as featured by Landscape Architecture Magazine one would think differently. Many times presenting beautiful graphics which hide lack of real content that is applicable to real life by presenting a microcosm of the world.

Professional organizations can also enhance research culture in landscape architecture by providing research tools and training, as well as places for knowledge sharing (e.g., online forums and blogs). Since the profession lacks a consensus on what research is, professional organizations can achieve more agreement within the profession by refining the definition of research.

5.3. Limitations of the Study and Improvements

This study generated empirical data on the use and dissemination of research in practice, as well as the current perceptions of research in the landscape architecture profession. Based on these data, suggestions were provided in order to enhance knowledge advancement to meet the increasing knowledge need of the profession. However, since this is an area that is not well studied in landscape architecture, this study is limited and could be improved in the following aspects.

5.3.1. A Vague Definition of Research

The term research is used widely in this profession. Some may narrowly define research as scientific research, while some may refer to library research as research too (Riley, 1990). They may not maintain the same definition of research in different contexts, either. Therefore, though this study provides a definition in the beginning of survey to help articulate the definition, the definition of research is probably still vague, which may weaken the findings of the dissertation.

5.3.2. Not Being Able to Articulate the Data Once it is Collected

Although the use of online questionnaires can target a larger sample size, it does not allow verifications or articulations of the data once they are collected. For example, this study can be enhanced if the participants were asked about their research interests. However, in the beginning of the survey, it was not confirmed whether or not practitioners think what they do in everyday practice is research. The forced-choice questionnaire also limits the depth of inquiry. For example, it is difficult to capture how research is defined in landscape architecture with the force-choice questions on a five-degree Likert scale.

5.3.3. Differences in the Interpretations of Knowledge Areas

In order to keep the questionnaire concise, this study did not provide any descriptions specific to the 19 knowledge areas. As a result, respondents may have different interpretations of what should be included in these 19 knowledge areas.

5.3.4. Sample Representativity

This study generated a random sample from the online directory of ASLA members. It assumes that this sample represents the true composition of landscape architects in North American. Since there is no information about the members other than their membership types, states and email address, it is impossible to know whether the demographics of those who responded were the same as those who did not provide this information. In additional, although respondents' demographics showed no significant bias, it is still difficult to tell how representative the respondents are of the population this study targets at -- all the landscape architects in North America, since there are no statistics of the demographics of the population.

5.4. Future Research Considerations

This study offered a snapshot of the role of research and knowledge advancement in landscape architecture. It also provides some suggestions on how the profession can be improved through research.

However, many findings are still preliminary. More research is needed in the following areas in order to provide more specific instructions on how to improve the profession:

- *What research is being done by practitioners and what knowledge is being created through their research?*

  This study revealed that landscape architects generally believe that practitioners are doing some types of research in their everyday practice, such as design analysis and case studies. However, it is unclear what knowledge is created in these research studies. It is also unclear how practitioners share their findings and what encumbers them from sharing with a large professional community.

- *How many post-project evaluations are being done in landscape architecture projects?*

  Participants' comments to this survey suggest that probably only a small portion of projects are being evaluated after they are built. This study only investigated the importance of research during post-occupancy evaluation. However, a considerable portion of landscape architecture work is planning, which does not involve construction and occupancy. Therefore post-project evaluations of both design and planning projects should be done. In addition, there are few empirical studies on how many projects are actually being evaluated after the projects are finished, and what difficulties practitioners may have in conducting post-project evaluations.

- *How is construction design knowledge advanced in landscape architecture? Who is doing research in these areas, and how do they share their results?*

  This study revealed that construction design knowledge is used most often in landscape architecture practice, and is expected by many landscape architects to generate more research. However, there are very few studies on the research situation in construction, and only a very small portion of landscape architecture educators reported doing any research in these areas. In order to meet the knowledge need from landscape architecture practice, it is important to understand the existing research situation in construction design knowledge.

- *How does knowledge advancement in landscape architecture differ from that of related professions such as architecture and engineering?*

  This study generated data on the perceptions about research and research use in the practice of landscape architecture. However, it is difficult to diagnose the possible problems in knowledge advancement without a baseline. Therefore a comparison with knowledge advancement in related

professions such as architecture and engineering will help identify the problems in knowledge advancement in landscape architecture.

5.5. Summary of the Chapter

Modern professions are not only expected to offer good professional services, but are also expected to justify their services (Abbott, 1988), which involves systems knowledge, that describes what systems are and how systems work. As a result, the scope of knowledge in landscape architecture has expanded in systems knowledge since the profession was founded. The profession developed from design knowledge in its early stage, and expanded to systems knowledge in environmental systems since the 1970s (Fein, 1972), and is still expanding in human systems knowledge later.

Design knowledge, especially tacit knowledge, is often advanced through a reflective approach in which designers reflect on their previous practice experience. Some of the knowledge generated from a reflective approach is referred to as research in landscape architecture. The knowledge is often learned from co-workers in workplace in an apprentice manner. As found in this study, practitioners rarely share knowledge with the whole profession in forms of publications and lectures, a fact that may impede the advancement of knowledge in landscape architecture in a fast changing world. Meanwhile, the tacit nature of the knowledge itself cannot offer strong justifications for design actions.

To justify design actions, the profession needs to build a body of solid knowledge upon which to base justifications. Therefore, research is becoming more and more relevant to this profession. Landscape architects in general perceive research as important to practice and are using research in practice much more often than they were in the 1980s (Palmer et al., 1984). Conversely, educators are spending more time in doing research and are sharing their results more often (Chen et al., 2011; Chenoweth & Chidister, 1983; Milburn et al., 2003).

Results suggest that landscape architects expect justifications to be generated through research via a rational approach, in which one needs research to obtain an understanding of the problems and the systems involved in design in advance. Design actions and justifications are generated from the rational thinking process. However, historical studies suggest that a rational approach is not efficient in generating practical design actions (Sherwin & Isenson, 1967), and therefore justifies very few actions. Results suggest that educators in landscape architecture tend to advance knowledge in a rational approach. Since

this approach is not very efficient in generating practical design knowledge, many research studies end up with descriptions of the phenomena without useful implications for practice (Powers & Walker, 2009).

Instead, an empirical approach seems more productive in justifying design actions. In the empirical approach, designers first generate design solutions based on their best knowledge, usually through trial and error, which does not necessarily involve rational explanations as to why certain actions should be taken. Then, designers try these solutions in built work. Researchers may study the results of the built work in a systematic manner, called post-occupancy evaluation, to generate empirical knowledge about design actions and their context. Results suggest that many practitioners in landscape architecture probably are not engaged in these types of empirical studies.

Landscape architecture experiences impediments in all the three ways of advancing knowledge (the rational approach, reflective approach and empirical approaches). As a result, current research is not perceived to be satisfactory. Over half of landscape architects surveyed found there is not enough research. About a fifth found that most of the research they encountered is too theoretical or too general to be applied to practice.

The profession, if it expects to build a research-oriented practice, needs to change its perceptions about research, and advance its knowledge through the empirical approach instead of the rational approach. More post-project evaluations and studies should be done in a systematic manner, which requires effort from educators, practitioners and professional organizations.

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Appendix A. Questionnaire Design

Definition of Research

The purpose of this survey is to understand how research can help the practice of landscape architecture. Research is a word that can be used in many ways. For example, one might research airplane flights for an upcoming trip. However, for this survey we are interested in how "research" can enhance or expand the knowledge base of the profession. In this case research means activities that are done in a rigorous or systematic manner and can lead to the discovery of new information, new understandings or new applications in the field of landscape architecture.

1. Please indicate the extent to which each of the following statements you agree and disagree with your definition of research

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Sure
Research is important to landscape architecture practice	◯	◯	◯	◯	◯	◯
Scholarship and research are the same thing	◯	◯	◯	◯	◯	◯
Design is a form of research	◯	◯	◯	◯	◯	◯
The design process and research methodology are two distinctively different approaches for solving problems	◯	◯	◯	◯	◯	◯
Research is a part of a landscape architect's everyday information gathering and fact processing	◯	◯	◯	◯	◯	◯
Combining information gathered from written sources, experts, and on-site investigations to guide design decisions is a type of research	◯	◯	◯	◯	◯	◯
Case studies for a design project are a type of research	◯	◯	◯	◯	◯	◯
Generating alternative design concepts is a type of research	◯	◯	◯	◯	◯	◯
The use of drawing to explain new designs is a type of research	◯	◯	◯	◯	◯	◯
It is important to be able to repeat a research study and obtain the same results	◯	◯	◯	◯	◯	◯
There is not enough research being done in landscape architecture	◯	◯	◯	◯	◯	◯
Most research is too theoretical to help practice	◯	◯	◯	◯	◯	◯
Most research is too general to help a specific project	◯	◯	◯	◯	◯	◯

2. Who do you believe should be PRIMARILY responsible for advancing knowledge in landscape architecture? (Check up to three)

- ☐ Educators in landscape architecture
- ☐ Educators from other disciplines
- ☐ Graduate students in landscape architecture
- ☐ Public practitioners
- ☐ Private practitioners
- ☐ Government agencies
- ☐ Companies that make products for use in landscape industry

Other (please specify)

Knowledge and Practice

In order to understand how research may contribute to current practice, it is important to know how landscape architects acquire and apply knowledge.

3. To what extent is each of the following central to you understanding of what the practice of landscape architecture should be concerned with?

	Not at all	Not too much	Fair degree	Great extent	Very great extent	Not sure
Esthetics	◯	◯	◯	◯	◯	◯
Ecological needs	◯	◯	◯	◯	◯	◯
Public welfare and enjoyment	◯	◯	◯	◯	◯	◯
Comfort and pleasure for the individual	◯	◯	◯	◯	◯	◯

4. How often do you use each of the following types of thinking or sources of knowledge in making decisions in your practice?

	Rarely	Occasionally	Often	Very Often	Not Sure
Intuition	◯	◯	◯	◯	◯
Common sense	◯	◯	◯	◯	◯
Logic and reasoning	◯	◯	◯	◯	◯
Research findings	◯	◯	◯	◯	◯
Your professional experience	◯	◯	◯	◯	◯
Your professional education	◯	◯	◯	◯	◯
The work of other landscape architects	◯	◯	◯	◯	◯
Technical standards	◯	◯	◯	◯	◯
Historical information	◯	◯	◯	◯	◯
Client expressed desires	◯	◯	◯	◯	◯
Other specialists	◯	◯	◯	◯	◯

Others sources (please specify)

5. How often do you use the following for keeping up with new knowledge in the profession?

	Rarely	Occasionally	Often	Very Often	Not Sure
Professional documents and reports	◯	◯	◯	◯	◯
Design competitions	◯	◯	◯	◯	◯
Refereed journals	◯	◯	◯	◯	◯
Professional magazines	◯	◯	◯	◯	◯
Books	◯	◯	◯	◯	◯
Internet	◯	◯	◯	◯	◯
Design- historic precedents	◯	◯	◯	◯	◯
Short courses and workshops	◯	◯	◯	◯	◯
Professional conferences	◯	◯	◯	◯	◯
Professional newsletters	◯	◯	◯	◯	◯
Professional databases	◯	◯	◯	◯	◯
Other landscape architects	◯	◯	◯	◯	◯
Related professionals	◯	◯	◯	◯	◯
Clients	◯	◯	◯	◯	◯
Travelling	◯	◯	◯	◯	◯
Everyday life	◯	◯	◯	◯	◯

Other (please specify)

6. How often do you use the following media to disseminate your research findings?

	Rarely	Occasionally	Often	Very Often	Not Sure
Writing articles for professional magazines	◯	◯	◯	◯	◯
Presentations and lectures at professional conferences	◯	◯	◯	◯	◯
Presentations and lectures other than conference	◯	◯	◯	◯	◯
Writing books	◯	◯	◯	◯	◯
Writing articles for refereed journals	◯	◯	◯	◯	◯
Publishing on web site	◯	◯	◯	◯	◯
Teaching in universities	◯	◯	◯	◯	◯
Teaching co-workers	◯	◯	◯	◯	◯

Other (please specify)

7. To what extend do you believe practice of landscape architecture today is based on the following knowledge?

	Not at all	Not too much	Fair degree	Great extent	Very great extent	Not sure
Specialized knowledge and skills developed by its practitioners	◯	◯	◯	◯	◯	◯
Scientific knowledge from natural sciences (e.g. forestry and biology)	◯	◯	◯	◯	◯	◯
Scientific knowledge from social sciences (e.g. psychology)	◯	◯	◯	◯	◯	◯
Abstract knowledge from humanistic disciplines (e.g. history and art)	◯	◯	◯	◯	◯	◯

Other (please specify)

8. How often do you consult with the following professions?

	Not at all	Not too much	Fair degree	Great extent	Very great extent
Architects and planners	◯	◯	◯	◯	◯
Engineers	◯	◯	◯	◯	◯
Behavioral scientists	◯	◯	◯	◯	◯
Natural scientists	◯	◯	◯	◯	◯
Humanistic academicians	◯	◯	◯	◯	◯
Applied artists (e.g. industrial designers)	◯	◯	◯	◯	◯
Liberal artists (e.g. painters)	◯	◯	◯	◯	◯
Systems analysts and computer specialists	◯	◯	◯	◯	◯

9. If you do seek the knowledge and expertise of other professionals in your work, which of those professionals provides knowledge and expertise that you consider to be is most important to your practice? Why?

Research That Matters

In order to understand how research may contribute to current practice, It is important to know your beliefs about what type(s) of research matter most and why they matter.

10. In which of the following design stages do you believe research is an important source of knowledge?

	Not Important	Somewhat Important	Important	Very Important	Not Sure
Identifying and framing problems	◯	◯	◯	◯	◯
Gathering and analyzing information	◯	◯	◯	◯	◯
Generating design solutions	◯	◯	◯	◯	◯
Design construction and implementation	◯	◯	◯	◯	◯
Evaluating post-occupancy performance	◯	◯	◯	◯	◯

11. How often do you use research findings for the following purposes in your practice?

	Rarely	Occasionally	Often	Very Often	Not Sure
To understand natural /human systems	◯	◯	◯	◯	◯
To generate design solutions	◯	◯	◯	◯	◯
To confirm my design decisions	◯	◯	◯	◯	◯
To explain my design to my colleagues	◯	◯	◯	◯	◯
To explain my design to my clients	◯	◯	◯	◯	◯
To compete with other design firms	◯	◯	◯	◯	◯
To distinguish landscape architecture from other professions	◯	◯	◯	◯	◯

Other (please specify)

12. If you engage in the following as part of your practice, please indicate how often you use research on that topic

	Rarely	Occasionally	Often	Very Often	NOT PART OF MY PRACTICE
History and culture	◯	◯	◯	◯	◯
Garden history	◯	◯	◯	◯	◯
Ecology	◯	◯	◯	◯	◯
Design theory and design process	◯	◯	◯	◯	◯
Aesthetics	◯	◯	◯	◯	◯
Representation and communication	◯	◯	◯	◯	◯
Community planning and design	◯	◯	◯	◯	◯
Water resource management	◯	◯	◯	◯	◯
Construction techniques	◯	◯	◯	◯	◯
Plants and materials	◯	◯	◯	◯	◯
Geospatial tools (e.g. GIS)	◯	◯	◯	◯	◯
Sustainable design	◯	◯	◯	◯	◯
The profession of landscape architecture	◯	◯	◯	◯	◯
Environmental psychology	◯	◯	◯	◯	◯
Health and landscape	◯	◯	◯	◯	◯
Professional ethics	◯	◯	◯	◯	◯
Public policy	◯	◯	◯	◯	◯
Site engineering (lighting, irrigation etc.)	◯	◯	◯	◯	◯
Grading and circulation	◯	◯	◯	◯	◯

Other (please specify)

13. In what areas do you believe additional research would help your practice? (Check all that apply)

- [ ] History and culture
- [ ] Garden history
- [ ] Ecology
- [ ] Design theory and design process
- [ ] Aesthetics
- [ ] Representation and communication
- [ ] Community planning and design
- [ ] Water resource management
- [ ] Construction techniques
- [ ] Plants and materials
- [ ] Geospatial tools (e.g. GIS)
- [ ] Sustainable design
- [ ] The profession of landscape architecture
- [ ] Environmental psychology
- [ ] Health and landscape
- [ ] Professional ethics
- [ ] Public policy
- [ ] Site engineering (lighting, irrigation etc.)
- [ ] Grading and circulation

Other (please specify)

14. Do you have any general comments concerning knowledge, research and design? Please feel free to share with us.

Background Information

In order to understand why research-related beliefs and behaviors differ from one to another, we need to ask you some

personal questions. Information will only be used in a group manner and only for interpretative purpose and will not be shared in any way that may reveal your identity.

15. How many years have you practiced?

16. Age

17. Gender

18. Which of the following best describes your highest educational degree in landscape architecture?

- ◯ No degree
- ◯ Certificate program
- ◯ Bachelor Degree (4-5yrs)
- ◯ Master Degree
- ◯ Doctoral Degree

19. Do you hold a degree in field other than landscape architecture? Please list the degree and field. (e.g. BA in Architecture)

1
2
3
4

20. Which of the following best describes the types of organization in which you are currently working?

- ◯ Exclusively landscape architecture firm
- ◯ Multi-disciplinary firm -- predominately landscape architecture
- ◯ Multi-disciplinary firm -- predominately planning
- ◯ Multi-disciplinary firm -- predominately architecture
- ◯ Multi-disciplinary firm -- predominately engineering
- ◯ Multi-disciplinary firm -- balanced
- ◯ Government
- ◯ Education

Other (please specify)

21. In how many states, provinces or territories are you currently licensed as a landscape architect?

- ◯ None
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4-5
- ◯ 6-10
- ◯ 11 or more

22. Is your primary position concerned with landscape architecture?

- ◯ Yes (continue to next question)
- ◯ No (Please skip Question 23 & 24)

23. What is your position within your organization?

- ◯ Sole owner
- ◯ Partner or stockholder
- ◯ Manager/ director / department head
- ◯ Associate
- ◯ Employee
- ◯ Faculty member

Other (please specify)

24. What are your primary job functions in the firm at the present time? (Check as many as apply)

- [ ] Firm management
- [ ] Marketing/ promotion
- [ ] Code research
- [ ] Project management
- [ ] Client Relations/Programming
- [ ] Site/ Environmental Analysis
- [ ] Design
- [ ] Planning
- [ ] Construction documents and administration
- [ ] Sales
- [ ] Teaching
- [ ] Research
- [ ] On-site construction activities
- [ ] Construction contracting

Other (please specify)

Appendix B. Contacting Letters

B-1. Cover letter sent on February 14, 2012

Survey on Research in the Field of Landscape Architecture

Dear ****(name), ***(title),

I am a Ph.D. candidate in landscape architecture at Virginia Tech. I am researching how knowledge evolves in the profession of landscape architecture and how knowledge, and especially research, can improve practice. To understand these phenomena, I am analyzing a dataset collected from CELA educators in 2010 by myself and my colleagues, as well as, the Landscape Architecture Body of Knowledge (LABOK) dataset collected from both educators and practitioners in 2004 by ASLA and other organizations. With these data, there are still questions that need to be answered about how research is applied in practice. I have selected your e-mail address at random from the directory of ASLA members to request that you volunteer take a survey to help us understand this phenomenon. Your contribution is very important to put the last piece together.

I hope that you will assist in this effort by completing the on-line survey at: https://www.surveymonkey.com/s/SS585T2. The questionnaire will take about 10 minutes to complete. Participation is voluntary and the results will be reported in a manner that protects the anonymity of the participants. The survey has been approved by the Virginia Tech Institutional Review Board (IRB-11-1055). The IRB is responsible for overseeing the protection of human subjects who are involved in research. It is possible that the IRB at Virginia Tech will view this study's collected data for auditing purposes. This survey is part of an unfunded research project being undertaken at Virginia Tech. It is my intent to share the research result with the professional community through presentations at professional conferences and publications.

If you have any questions or comments regarding this questionnaire please feel free contact me, Zheng Chen (chenzh@vt.edu) or my Ph.D. advisor Dr. Patrick A. Miller (pmiller@vt.edu) .

Thank you for your help,

Zheng Chen
PhD Candidate,
Landscape Architecture
Virginia Polytechnic Institute and State University

B-2. Follow-up Letter sent on February 23rd, 2012

Survey Reminder: Research and practice in landscape architecture
Dear ****(name), ASLA (title),

You should have recently received a survey regarding research and practice in landscape architecture. Your completion of this survey will strengthen the results of the study and therefore contribute to our knowledge of research activities in our discipline.

https://www.surveymonkey.com/s/SS585T2

Please take ten minutes to complete the survey and submit it on-line. You may continue with your unfinished survey or make changes of you submitted survey, if you re-enter the survey with the same computer you used last time. Please remember to click "submit" when you finish.

Thank you for your contribution! If you have any questions or comments regarding this questionnaire please feel free contact me, Zheng Chen (chenzh@vt.edu) or my Ph.D. advisor Dr. Patrick A. Miller (pmiller@vt.edu) .

Sincerely

Zheng Chen
PhD Candidate,
Landscape Architecture
Virginia Polytechnic Institute and State University

B-3. Follow-up Letter sent on March 1st, 2012

Survey Reminder: Research and practice in landscape architecture

Dear ****(name), ASLA (title),

We notice that we have not received full response from you in our survey Research and practice in landscape architecture. Your completion of this survey will strengthen the results of the study and therefore contribute to our knowledge of research activities in our discipline.
https://www.surveymonkey.com/s/SS585T2

Please take ten minutes to complete the survey and submit it on-line. You may continue with your unfinished survey or make changes, if you re-enter the survey with the same computer you used last time. Please remember to click "submit" when you finish.

Thank you for your contribution! If you have any questions or comments regarding this questionnaire please feel free contact me, Zheng Chen (chenzh@vt.edu) or my Ph.D. advisor Dr. Patrick A. Miller (pmiller@vt.edu) .

Sincerely

Zheng Chen
PhD Candidate,
Landscape Architecture
Virginia Polytechnic Institute and State University

Appendix C. IRB Approval

VirginiaTech

Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24060
540/231-4606 Fax 540/231-0959
e-mail irb@vt.edu
Website: www.irb.vt.edu

MEMORANDUM

DATE: January 4, 2012

TO: Patrick A. Miller, Zheng Chen

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: The Accessibility and Application of Knowledge in Landscape Practice

IRB NUMBER: 11-1055

Effective January 3, 2012, the Virginia Tech IRB Chair, Dr. David M. Moore, approved the new protocol for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at http://www.irb.vt.edu/pages/responsibilities.htm (please review before the commencement of your research).

PROTOCOL INFORMATION:
Approved as: **Exempt, under 45 CFR 46.101(b) category(ies) 2**
Protocol Approval Date: **1/3/2012**
Protocol Expiration Date: **NA**
Continuing Review Due Date*: **NA**
*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:
Per federally regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

*Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

cc: File

Appendix D. Survey Results- General Descriptive Statistics

Q1	Please indicate the extent to which each of the following statements you agree and disagree with your definition of research (%)									
No.	Statements	not sure	strongly disagree	disagree	neutral	agree	strongly agree	UnDesignated	Mean	Std.D
Q1_1	Research is important to landscape architecture practice	0.0	2.1	0.8	2.5	37.7	56.5	0.4	4.46	0.78
Q1_2	Scholarship and research are the same thing	7.1	8.4	57.3	17.6	6.3	3.3	0.0	2.34	0.87
Q1_3	Design is a form of research	1.3	2.1	16.7	12.1	42.7	23.8	1.3	3.71	1.08
Q1_4	The design process and research methodology are two distinctively different approaches for solving problems	4.2	6.7	33.1	12.1	33.5	8.8	1.7	3.05	1.17
Q1_5	Research is a part of a landscape architect's everyday information gathering and fact processing	2.5	1.7	6.7	7.1	47.3	34.7	0.0	4.09	0.92
Q1_6	Combining information gathered from written sources, experts, and on-site investigations to guide design decisions is a type of research	0.8	0.8	3.8	1.7	51.0	41.4	0.4	4.30	0.76
Q1_7	Case studies for a design project are a type of research	0.8	0.8	3.3	3.3	57.3	34.3	0.0	4.22	0.74
Q1_8	Generating alternative design concepts is a type of research	2.1	3.8	28.0	13.4	38.1	14.2	0.4	3.32	1.15
Q1_9	The use of drawing to explain new designs is a type of research	2.9	5.0	41.0	18.0	22.2	10.0	0.8	2.91	1.13
Q1_10	It is important to be able to repeat a research study and obtain the same results	5.9	1.7	14.2	20.5	35.6	21.3	0.8	3.65	1.05
Q1_11	There is not enough research being done in landscape architecture	6.7	1.3	6.7	33.9	31.0	20.5	0.0	3.67	0.94
Q1_12	Most research is too theoretical to help practice	3.8	7.9	37.7	28.9	12.6	8.8	0.4	2.76	1.08
Q1_13	Most research is too general to help a specific project	1.7	8.8	46.4	23.4	13.0	6.7	0.0	2.62	1.04

Q2	Who do you believe should be PRIMARILY responsible for advancing knowledge in landscape architecture? (Check up to three)									
No.	Knowledge advancing responsibility								count	%
Q2_1	Educators in landscape architecture								202	84.5%
Q2_2	Educators from other disciplines								36	15.1%
Q2_3	Graduate students in landscape architecture								78	32.6%
Q2_4	Public practitioners								88	36.8%
Q2_5	Private practitioners								148	61.9%
Q2_6	Government agencies								33	13.8%
Q2_7	Companies that make products for use in landscape industry								78	32.6%

OTHERS

- combination of expertise/specializations
- all practitioners... some project require research and testing of ideas/products to make the project work..this information is not accumulated and shared easily
- research for one "primary" source is always flawed, i.e. typical criticism: academia to removed from reality, practitioners too busy to completely research
- interest groups
- Practicing professions collaborating with research professions, or practicing professional who are also researchers
- Any professional (public or private) that believes they have valid information to add to the profession
- Multiple parties
- all practitioners
- Writers
- Research institutes
- ASLA & LAF
- all can participate. depends on contracts, time, expertise. academia would include educators and students, practitioners would include both public and private, companies have extensive funding not always available to individual practitioners
- All practitioners
- Practicing Landscape Architect, public and private
- all of the above
- Artists sometimes spend their whole career researching an area the becomes very valuable for landscape
- I would add educators in LA if I could choose a 4th. It's mixed, my response is based more upon who is actually providing the research info I use.
- practitioners (public AND private)
- All should be involved
- all of course!
- Published articles and online documents by practitioners who discover new or unique solutions to specific problems (rain-gardens resulting from stormwater design challenges)
- Nonprofit Organizations/Foundations/Etc
- All of the above, but these 3 are typically at forefront.
- researchers worldwide

Q3	To what extent is each of the following central to you understanding of what the practice of landscape architecture should be concerned with? (%)									
No.	Concerns		Not at all	not too much	fair degree	great extent	very great extent	UnDesignated	Mean	Std. D
Q3_1	Esthetics		0.0	1.3	6.3	45.2	46.4	0.8	3.38	0.66
Q3_2	Ecological needs		0.0	0.0	4.6	33.5	61.5	0.4	3.57	0.58
Q3_3	Public welfare and enjoyment		0.0	0.4	3.3	27.2	68.6	0.4	3.66	0.54
Q3_4	Comfort and pleasure for the individual		0.0	0.0	8.8	48.5	41.8	0.8	3.33	0.63

Q4	How often do you use each of the following types of thinking or sources of knowledge in making decisions in your practice? (%)									
No.	Knowledge sources and types of thinking		not sure	rarely	occasionally	often	very often	UnDesignated	Mean	Std. D
Q4_1	Intuition		0.4	2.5	15.1	34.3	47.3	0.4	3.27	0.81
Q4_2	Common sense		0.0	0.4	1.7	25.9	71.5	0.4	3.69	0.52
Q4_3	Logic and reasoning		0.0	0.0	1.7	20.5	77.4	0.4	3.76	0.47
Q4_4	Research findings		0.0	5.0	28.0	39.7	26.8	0.4	2.89	0.86
Q4_5	Your professional experience		0.0	0.4	0.8	13.4	84.9	0.4	3.84	0.42
Q4_6	Your professional education		0.0	0.8	13.0	40.2	45.6	0.4	3.31	0.73
Q4_7	The work of other landscape architects		0.0	2.9	34.3	39.7	22.2	0.8	2.82	0.81
Q4_8	Technical standards		0.0	0.8	9.6	42.7	46.4	0.4	3.35	0.69
Q4_9	Historical information		0.0	3.8	31.4	42.3	22.2	0.4	2.83	0.81
Q4_10	Client expressed desires		0.8	0.0	3.8	31.8	63.2	0.4	3.60	0.56
Q4_11	Other specialists		2.9	2.9	21.8	44.1	25.1	2.9	2.97	0.79

OTHERS

- Professional magazines and literature sources
- Colleagues
- Relevant current events and public input
- My writing of landscape poetry as a form of research
- Books
- observation at the site, implicit client needs and tastes
- Professional Publications: Landscape Architecture Magazine
- building professionals, engineers, architects
- Books, magazines, image files, design studies, context studies
- Manufacturers
- users, public/citizenry
- Observation of nature and people
- examples from nature
- Horticulturists
- Vendors and contractors product and construction methods knowledge
- Budget

Q5	How often do you use the following for keeping up with new knowledge in the profession? (%)									
No.	Knowledge sources		not sure	rarely	occasionally	often	very often	UnDesignated	Mean	Std. D
Q5_1	Professional documents and reports		0.0	9.2	33.1	36.4	20.1	1.3	2.68	0.90
Q5_2	Design competitions		0.0	48.5	35.1	11.7	4.2	0.4	1.71	0.83
Q5_3	Refereed journals		3.3	35.6	36.0	18.0	6.7	0.4	1.96	0.91
Q5_4	Professional magazines		0.0	2.1	20.1	42.7	35.1	0.0	3.11	0.79
Q5_5	Books		0.0	4.6	26.8	43.1	25.5	0.0	2.90	0.84
Q5_6	Internet		0.0	1.3	7.9	37.2	53.6	0.0	3.43	0.69
Q5_7	Design- historic precedents		0.8	8.4	34.7	38.1	17.6	0.4	2.66	0.87
Q5_8	Short courses and workshops		0.0	13.4	47.7	29.3	9.6	0.0	2.35	0.83
Q5_9	Professional conferences		0.0	14.6	42.7	28.0	14.2	0.4	2.42	0.91
Q5_10	Professional newsletters		0.0	18.0	43.5	32.2	5.9	0.4	2.26	0.82
Q5_11	Professional databases		0.4	35.1	39.7	20.1	4.2	0.4	1.93	0.85
Q5_12	Other landscape architects		0.0	9.2	38.5	36.8	15.5	0.0	2.59	0.86
Q5_13	Related professionals		0.0	5.9	25.5	49.4	18.8	0.4	2.82	0.81
Q5_14	Clients		0.4	27.2	28.5	30.1	13.0	0.8	2.29	1.01
Q5_15	Travelling		0.0	11.3	32.6	32.6	23.0	0.4	2.68	0.95
Q5_16	Everyday life		1.3	2.1	18.8	44.4	32.6	0.8	3.10	0.78

OTHERS

- Teaching
- Landscape places (sub watersheds) and indigenous people teach use everything
- Pop culture
- Traveling out of town and country 2 x per year
- vendors and sales reps that make presentations in our office

Q6	How often do you use the following media to disseminate your research findings?(%)									
No.	Disseminating Media		not sure	rarely	occasionally	often	very often	UnDesignated	Mean	Std. D
Q6_1	Writing articles for professional magazines		2.1	72.4	18.4	5.0	0.8	1.3	1.32	0.61
Q6_2	Presentations and lectures at professional conferences		2.1	49.0	34.3	9.2	4.2	1.3	1.68	0.82
Q6_3	Presentations and lectures other than conference		2.9	42.7	34.7	13.0	5.4	1.3	1.80	0.88
Q6_4	Writing books		4.2	86.2	5.0	1.3	1.3	2.1	1.12	0.46
Q6_5	Writing articles for refereed journals		4.2	80.8	10.9	1.3	1.7	1.3	1.19	0.54
Q6_6	Publishing on web site		2.9	71.5	18.0	5.0	1.7	0.8	1.34	0.66
Q6_7	Teaching in universities		2.9	65.3	18.0	5.9	6.3	1.7	1.51	0.88
Q6_8	Teaching co-workers		1.7	16.3	21.3	33.9	24.7	2.1	2.70	1.03

OTHERS

- Practice
- Link to research findings on office website.
- Should have a category of "Never"
- local newspapers, public speaking at local meetings
- Landscape leadership in my community, setting an example, advocacy for local landscape
- Teaching graduate students
- I NEVER do any of these things...I don't have the time.
- Don't do research, per se.
- My firm does all of the above, even though I personally do not.
- collaboration with Other Professions: Engineers & Surveyors
- disseminate knowledge to general public thru published magazine articles
- Local organizations that deal w/ horticulture, throughout teaching art and painting to children re. nature subjects
- Just doing good design.
- guest critic in university classes

Q7	To what extend do you believe practice of landscape architecture today is based on the following knowledge?(%)									
No.	Knowledge Bases	not sure	not at all	not too much	fair degree	great extent	very great extent	UnDesignated	Mean	Std. D
Q7_1	Specialized knowledge and skills developed by	0.0	0.4	0.4	13.4	49.4	36.0	0.4	3.21	0.71
Q7_2	Scientific knowledge from natural sciences (e.g	0.0	0.8	10.0	36.8	43.5	8.4	0.4	2.49	0.82
Q7_3	Scientific knowledge from social sciences (e.g.	0.0	0.4	26.4	43.9	23.8	4.6	0.8	2.06	0.84
Q7_4	Abstract knowledge from humanistic discipline	0.8	1.3	15.9	46.0	29.3	5.9	0.8	2.23	0.84

Q8	How often do you consult with the following professions?(%)									
No.	Consulting professions		not at all	not too much	fair degree	great extent	very great extent	UnDesignated	Mean	Std. D
Q8_1	Architects and planners		0.8	6.7	32.2	46.9	13.4	0.0	2.65	0.83
Q8_2	Engineers		0.4	5.9	24.7	51.0	18.0	0.0	2.80	0.81
Q8_3	Behavioral scientists		52.3	37.2	6.7	2.9	0.4	0.4	0.61	0.78
Q8_4	Natural scientists		11.3	27.6	44.4	13.4	2.9	0.4	1.69	0.94
Q8_5	Humanistic academicians		60.3	33.5	4.6	1.3	0.4	0.0	0.48	0.68
Q8_6	Applied artists (e.g. industrial designers)		36.0	38.9	20.5	4.6	0.0	0.0	0.94	0.86
Q8_7	Liberal artists (e.g. painters)		32.6	40.6	23.0	3.8	0.0	0.0	0.98	0.84
Q8_8	Systems analysts and computer specialists		25.5	38.9	28.9	5.9	0.0	0.8	1.15	0.87

Q9: If you do seek the knowledge and expertise of other professionals in your work, which of those professionals provides knowledge and expertise that you consider to be is most important to your practice? Why?)

Professions	Number	Percentage
Engineers	88	35%
-Civil engineers	*45*	*18%*
-Structural engineers	*19*	*8%*
- Geotechnical c engineers	*5*	*2%*
Natural scientists in forestry, botany, biology and etc.	45	18%
Architects	37	15%
Planners	14	6%
Building contractors	10	4%
Landscape architects	9	4%
Artists	7	3%
Behavior scientists and other social scientists	5	2%
Developer and related economical experts	5	2%

Q10	In which of the following design stages do you believe research is an important source of knowledge?(%)									
No.	Design Stages		not sure	not important	somewhat important	important	very important	UnDesignated	Mean	Std. D
Q10_1	Identifying and framing problems		0.0	2.5	12.6	36.8	43.1	5.0	2.27	0.79
Q10_2	Gathering and analyzing information		0.0	1.3	5.4	30.5	58.2	4.6	2.53	0.67
Q10_3	Generating design solutions		0.4	1.7	11.6	36.0	42.7	4.6	2.26	0.78
Q10_4	Design construction and implementation		0.0	1.7	16.7	37.2	39.7	4.6	2.21	0.79
Q10_5	Evaluating post-occupancy performance		2.5	4.6	21.3	32.2	34.3	5.0	2.04	0.90

Q11	How often do you use research findings for the following purposes in your practice? (%)									
No.	Purposes of using research		not sure	rarely	occasionally	often	very often	UnDesignated	Mean	Std. D
Q11_1	To understand natural /human systems		0.4	15.5	33.9	25.5	20.5	4.2	2.54	1.00
Q11_2	To generate design solutions		0.4	10.9	28.5	34.7	20.9	4.6	2.69	0.94
Q11_3	To confirm my design decisions		0.4	14.6	32.6	30.5	16.7	5.0	2.52	0.96
Q11_4	To explain my design to my colleagues		0.4	17.6	35.1	28.0	14.2	4.6	2.41	0.96
Q11_5	To explain my design to my clients		1.3	14.2	29.3	27.6	23.0	4.6	2.63	1.01
Q11_6	To compete with other design firms		4.6	39.3	27.2	16.7	7.5	4.6	1.92	0.97
Q11_7	To distinguish landscape architecture from other professi		4.2	28.9	30.1	22.6	8.8	5.4	2.13	0.97

OTHERS

- To illustrate that landscape architects are better researchers than scientists are
- This question assumes that we engage in the design process. As educators, that is not always the case
- Should have Not Applicable choice
- To explain to elected officials

Q12	If you engage in the following as part of your practice, please indicate how often you use research on that topic (%)									
No.	Research topics		not part of my practice	rarely	occasionally	often	very often	UnDesignated	Mean	Std. D
Q12_1	History and culture		12.1	10.9	28.9	23.8	19.7	4.6	2.29	1.27
Q12_2	Garden history		16.7	15.1	37.7	17.6	7.9	5.0	1.84	1.17
Q12_3	Ecology		3.8	7.1	20.9	37.2	26.4	4.6	2.79	1.05
Q12_4	Design theory and design process		4.6	11.3	32.6	29.7	16.7	5.0	2.45	1.06
Q12_5	Aesthetics		1.7	6.7	24.3	29.7	33.1	4.6	2.90	1.02
Q12_6	Representation and communication		4.6	15.5	23.0	33.9	18.4	4.6	2.48	1.12
Q12_7	Community planning and design		9.2	7.9	21.3	33.9	22.6	5.0	2.56	1.22
Q12_8	Water resource management		9.2	6.7	21.8	31.8	25.1	5.4	2.60	1.23
Q12_9	Construction techniques		4.2	2.1	19.7	33.5	35.1	5.4	2.99	1.03
Q12_10	Plants and materials		1.3	1.3	10.5	35.6	47.3	4.2	3.32	0.82
Q12_11	Geospatial tools (e.g. GIS)		15.1	17.2	28.5	24.7	9.6	5.0	1.96	1.22
Q12_12	Sustainable design		1.7	0.8	14.2	41.8	36.8	4.6	3.17	0.84
Q12_13	The profession of landscape architecture		5.4	16.7	26.8	21.3	21.3	5.4	2.42	1.18
Q12_14	Environmental psychology		16.7	25.5	32.2	15.1	5.4	5.0	1.65	1.12
Q12_15	Health and landscape		10.5	16.3	35.1	24.3	8.8	5.0	2.05	1.11
Q12_16	Professional ethics		5.4	26.8	28.0	17.6	17.2	5.0	2.15	1.18
Q12_17	Public policy		10.0	14.6	27.2	23.1	18.8	5.9	2.28	1.25
Q12_18	Site engineering (lighting, irrigation etc.)		2.5	4.6	18.4	32.2	37.2	5.0	3.02	1.01
Q12_19	Grading and circulation		2.1	8.8	18.4	29.7	34.7	6.3	2.92	1.07

OTHERS

- tree research from arboriculture organization and websites
- Landscape road design landscape corridor design , wildlife corridor design, landscape watershed planning

Q13	In what areas do you believe additional research would help your practice? (Check all that apply)									
No.	Research topics								count	%
Q13_1	History and culture								88	36.8%
Q13_2	Garden history								46	19.2%
Q13_3	Ecology								131	54.8%
Q13_4	Design theory and design process								75	31.4%
Q13_5	Aesthetics								74	31.0%
Q13_6	Representation and communication								61	25.5%
Q13_7	Community planning and design								104	43.5%
Q13_8	Water resource management								148	61.9%
Q13_9	Construction techniques								144	60.3%
Q13_10	Plants and materials								126	52.7%
Q13_11	Geospatial tools (e.g. GIS)								53	22.2%
Q13_12	Sustainable design								149	62.3%
Q13_13	The profession of landscape architecture								46	19.2%
Q13_14	Environmental psychology								91	38.1%
Q13_15	Health and landscape								110	46.0%
Q13_16	Professional ethics								40	16.7%
Q13_17	Public policy								55	23.0%
Q13_18	Site engineering (lighting, irrigation etc.)								108	45.2%
Q13_19	Grading and circulation								85	35.6%

OTHERS

- arboriculture
- Ongoing research in all areas benefits our profession
- Negotiation and sales skills.
- Road design, wildlife park--zoo design, permaculture and organic farming, river planning, cultural landscape

description/mapping/writing, neighborhood leadership

- relevance of the profession to the common citizen
- Economics
- We design and build public parks so I would love to see more research on playgrounds and the surfacing used on playgrounds
- All - I wish I had more time to research all of the above.

Q15	How many years have you practiced?									
								UnDesignated	Mean	Std. D
								12	25.46	11.66

Q16	Age									
			25-34	35-44	45-54	55-65	65 and m	UnDesignated	Mean	Std. D
			10.5%	16.7%	25.9%	25.5%	9.2%	12.1%	4.1%	1.2%

Q17	Gender (%)									
								male	female	UnDesignated
								60.7%	24.3%	15.1%

Q18	Which of the following best describes your highest educational degree in landscape architecture? (%)									
No.	Degree								Count	%
	no degree								7	2.9%
	certificate program								4	1.7%
	bachelor degree (4-5 yrs)								124	51.9%
	master degree								87	36.4%
	doctoral degree								4	1.7%
	Undesignated								13	5.4%

Q19	Do you hold a degree in field other than landscape architecture? Please list the degree and field. (e.g. BA in Architecture) (%)									
		1	2	3	4					
		47.7%	11.7%	1.7%	0.4%					

Q20	Which of the following best describes the types of organization in which you are currently working?									
No.	Types of organizations								Count	%
Q20_1	exclusively landscape architecture firm								75	31.4%
Q20_2	multi-disciplinary firm -- predominately landscape architect								17	7.1%
Q20_3	multi-disciplinary firm -- predominately planning								3	1.3%
Q20_4	multi disciplinary firm predominately architecture								13	5.4%
Q20_5	multi-disciplinary firm -- predominately engineering								26	10.9%
Q20_6	multi disciplinary firm balanced								19	7.9%
Q20_7	government								30	12.6%
Q20_8	education								19	7.9%
	Undesignated								37	15.5%

OTHERS

- Landscape Architectural Design/Build
- Not for profit organization
- University Landscape Architect
- Freelance Landscape Designer
- Academic institution - not education though; University Landscape Planner
- Design build contractor
- Also have a private practice
- Independent consultant.
- Theme Park Company
- Sole proprietor - planning and landscape architecture
- Golf architecture planning and landscape architecture
- landscape construction
- Also work at large international land trust and scientific research organization (not as a landscape architect; as a coordinator)
- Design/Build LA
- Science Museum
- I also teach design part-time in a Landscape Architecture Program.
- maternity leave
- Self Employed Consultant - arboriculture, land arch, planning, natural resource issues
- Retired from Government
- sole practice - planning and landscape design
- Downtown Improvement District
- My firm is landscape design with heavy collaboration with licensed civil engineer. Focus on residential design with horticulture consultatio
- Golf Course Architecture
- Health Care
- Environmental Planning/Landscape Architecture
- Also have a practice
- Landscape Architecture-based Design + Build
- Design-build firm-- strictly landscape architecture
- Corporate Owner
- Now retired. But answered the questions based upon my work as a Landscape Architect
- Development
- But spent 20 years in private sector multi-disciplinary engineering
- Retired from government; now a nonprofit org volunteer
- Self Employed as registered LA-mostly design build.

Q21	In how many states, provinces or territories are you currently licensed as a landscape architect?									
No.	Answers								Count	%
	none								24	10.0%
	1								113	47.3%
	2								39	16.3%
	3								20	8.4%
	4-5								21	8.8%
	6-10								5	2.1%
	11 or more								5	2.1%
	Undesignated								12	5.0%

Q22	Is your primary position concerned with landscape architecture?									
No.	Answers								Count	%
	yes								203	84.9%
	no								24	10.0%
	Undesignated								12	5.0%

Q23	What is your position within your organization?									
No.	Statement								Count	%
	sole owner								55	23.0%
	partner or stockholder								44	18.4%
	manager/director/department head								33	13.8%
	associate								24	10.0%
	employee								35	14.6%
	faculty member								15	6.3%
	Undesignated								33	13.8%

OTHERS

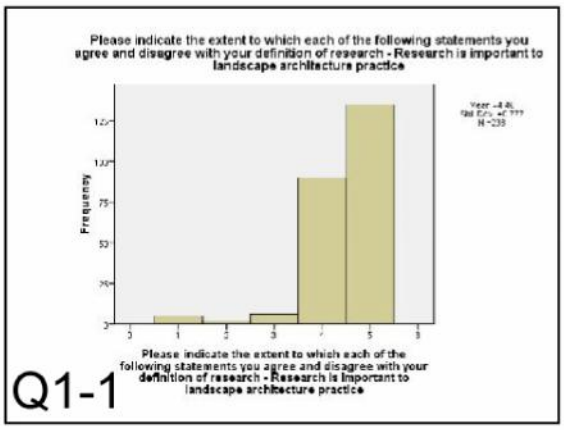
- Owner - Design/Build Company
- Landscape designer/project manager
- Program Chair
- associate principal, 1 of 2 team leaders
- Disaster Recovery Planning Consultant
- Also an art teacher for children and adults, in order to extend my cultural heritage, I teach Chinese brush painting in a local Community Education class at a junior college.
- and sole owner
- Senior landscape architect for public practice
- President, all volunteer land trust organization
- Project Manager

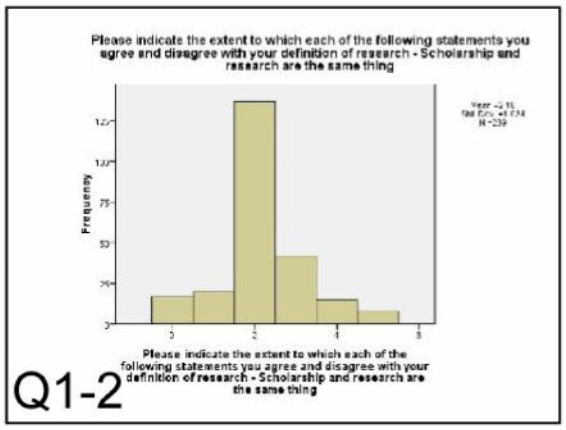
Q24	What are your primary job functions in the firm at the present time? (Check as many as apply)									
No.	Job functions								count	%
Q24_1	Firm management								109	45.6%
Q24_2	Marketing/ promotion								121	50.6%
Q24_3	Code research								58	24.3%
Q24_4	Project management								159	66.5%
Q24_5	Client Relations/Programming								137	57.3%
Q24_6	Site/ Environmental Analysis								138	57.7%
Q24_7	Design								193	80.8%
Q24_8	Planning								138	57.7%
Q24_9	Construction documents and administration								146	61.1%
Q24_10	Sales								51	21.3%
Q24_11	Teaching								44	18.4%
Q24_12	Research								58	24.3%
Q24_13	On-site construction activities								99	41.4%
Q24_14	Construction contracting								28	11.7%

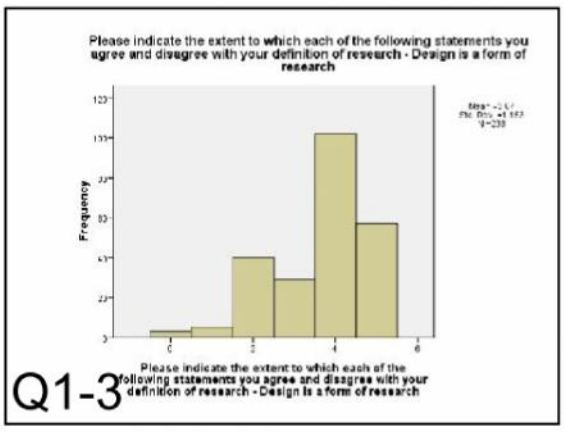
OTHERS

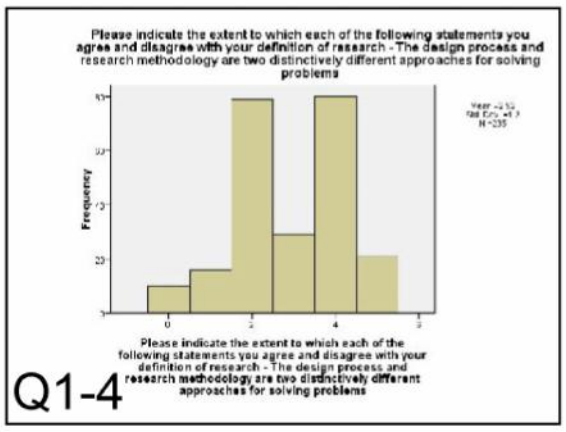
- Community involvement & outreach to the community
- Emeritus principal in design, client relations, research, site/environmental analysis, teaching
- Everything
- Administration
- Administration
- Setting parameters of company culture, ethics and vision.
- Please see No. 20 above.
- Retired
- Program management, administration, marketing of program and profession, dissemination of licensure requirements to alumni
- team mentorship, quality assurance (drawing review)
- I don't work for a firm. I work for the government. I manage personnel and planning projects and assist with design review.

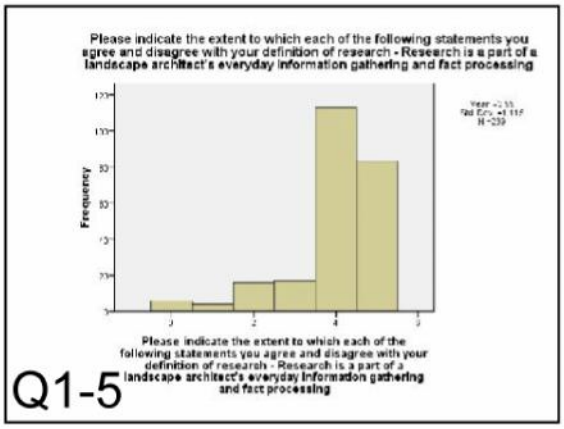
Appendix E. Survey Results- Histogram

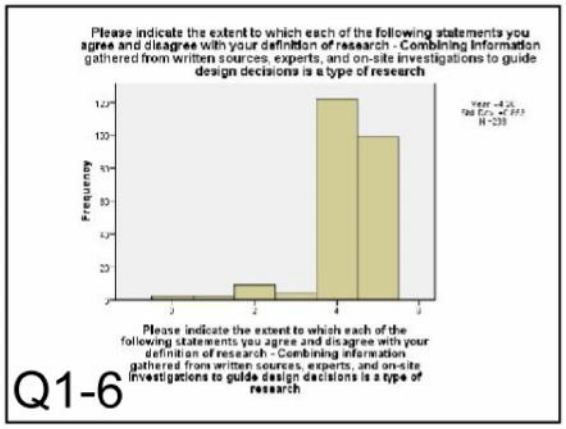


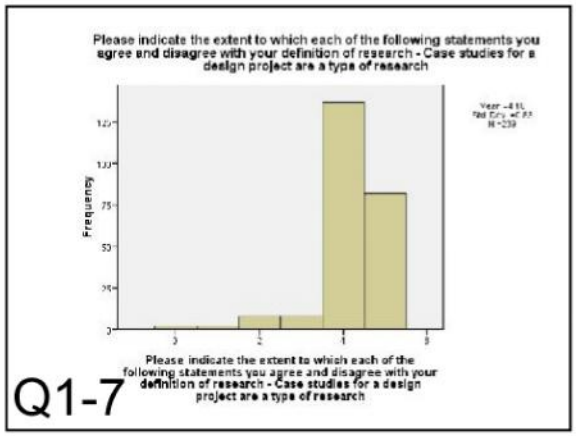


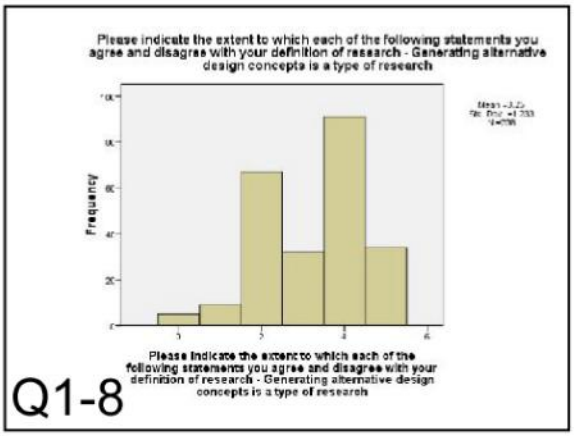


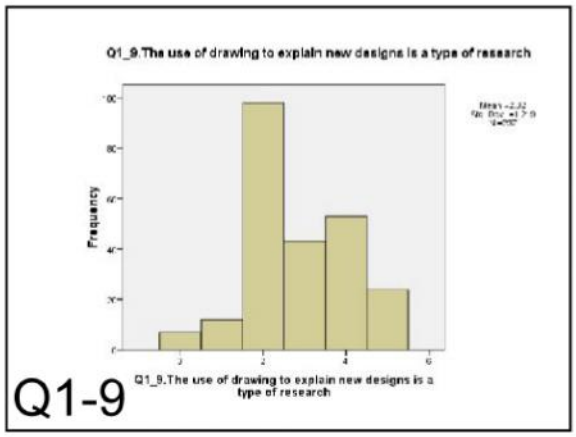


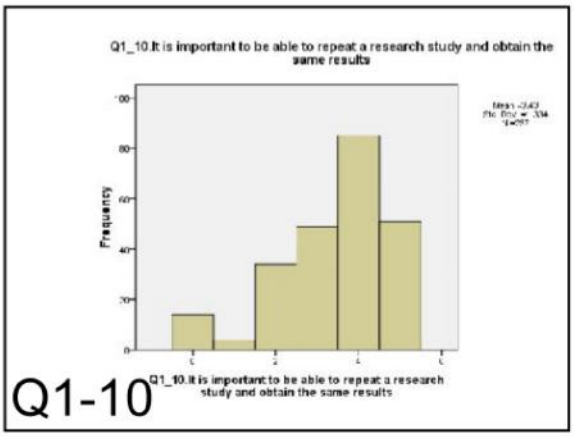


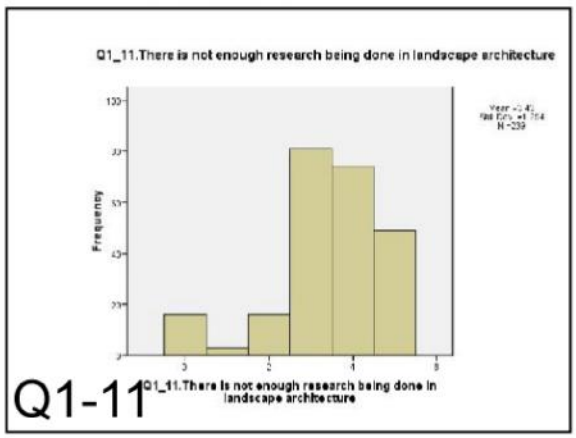


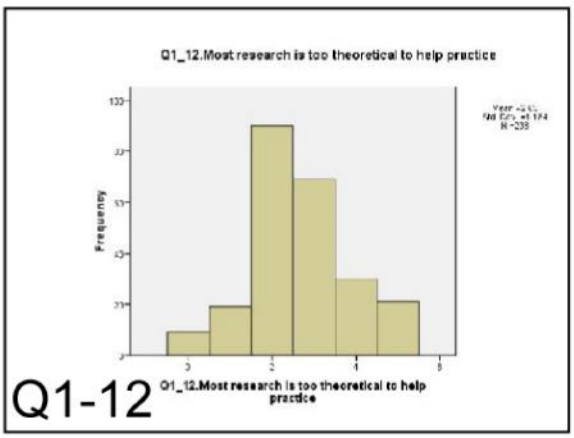

Please indicate the extent to which each of the following statements you agree and disagree with your definition of research - Case studies for a design project are a type of research
Frequency
Please indicate the extent to which each of the following statements you agree and disagree with your definition of research - Case studies for a design project are a type of research
Q1-7

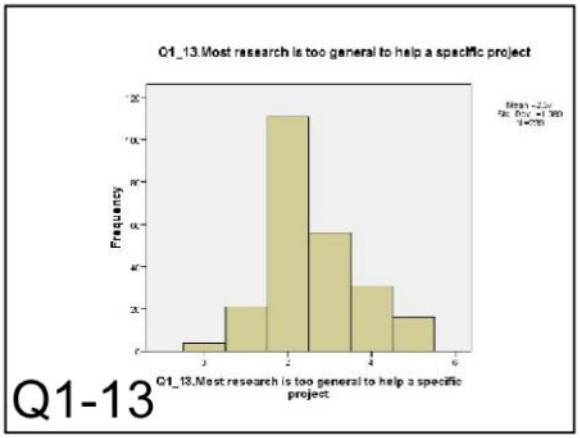

Please indicate the extent to which each of the following statements you agree and disagree with your definition of research - Generating alternative design concepts is a type of research
Frequency
Please indicate the extent to which each of the following statements you agree and disagree with your definition of research - Generating alternative design concepts is a type of research
Q1-8

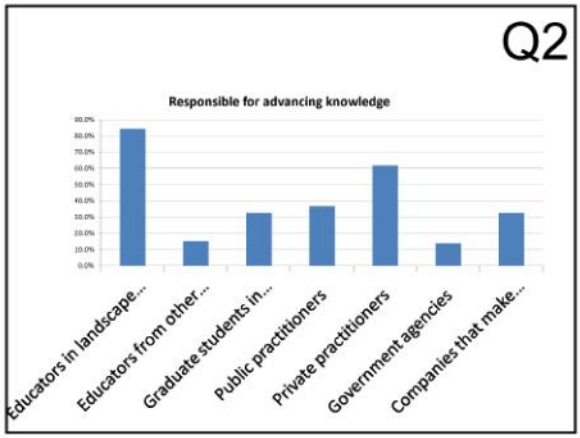

Q1_9.The use of drawing to explain new designs is a type of research
Frequency
Q1_9.The use of drawing to explain new designs is a type of research
Q1-9

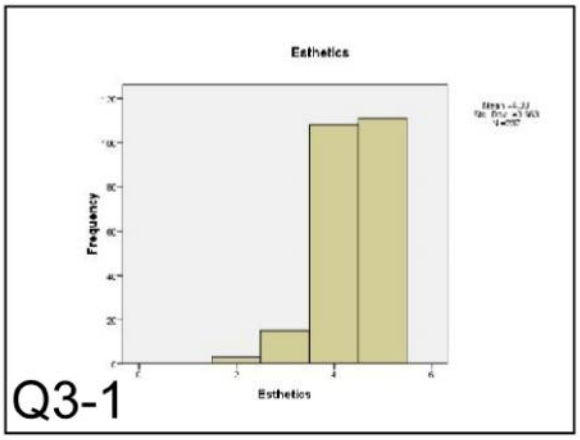

Q1_10.It is important to be able to repeat a research study and obtain the same results
Frequency
Q1_10.It is important to be able to repeat a research study and obtain the same results
Q1-10

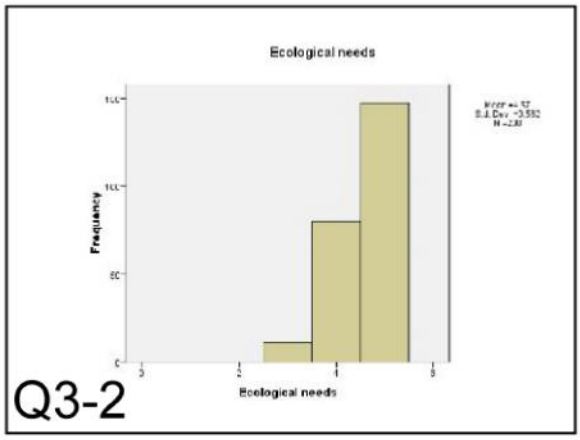

Q1_11.There is not enough research being done in landscape architecture
Frequency
Q1_11.There is not enough research being done in landscape architecture
Q1-11

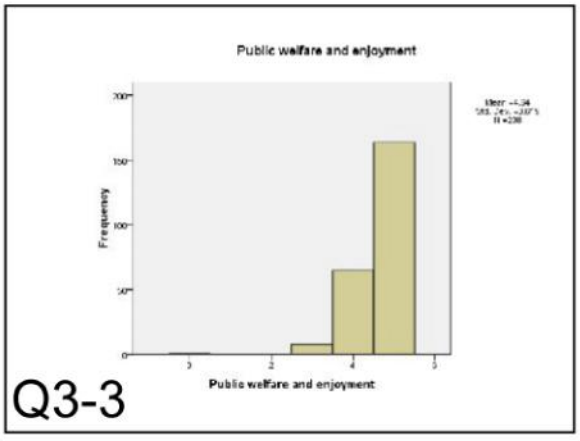

Q1_12.Most research is too theoretical to help practice
Frequency
Q1_12.Most research is too theoretical to help practice
Q1-12

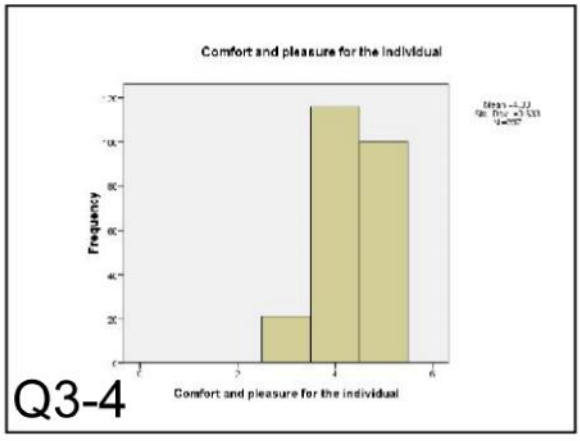

Q1_13.Most research is too general to help a specific project
Frequency
Q1_13.Most research is too general to help a specific project
Q1-13

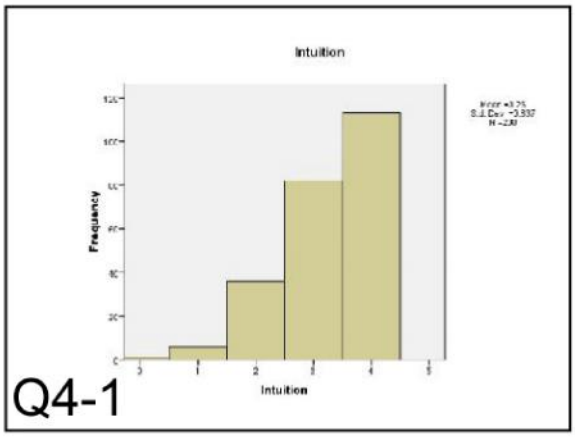

Q2
Responsible for advancing knowledge
Educators in landscape...
Educators from other...
Graduate students in...
Public practitioners
Private practitioners
Government agencies
Companies that make...

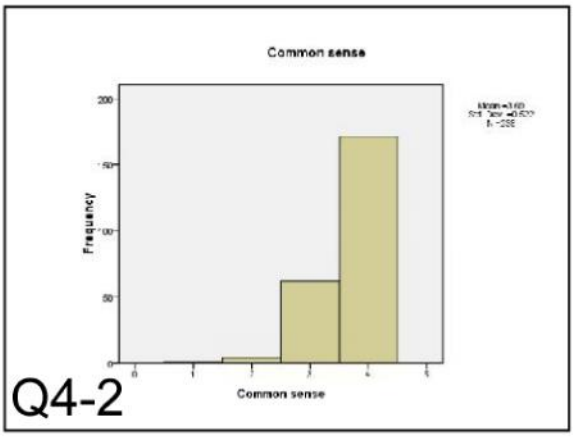

Esthetics
Frequency
Esthetics
Q3-1

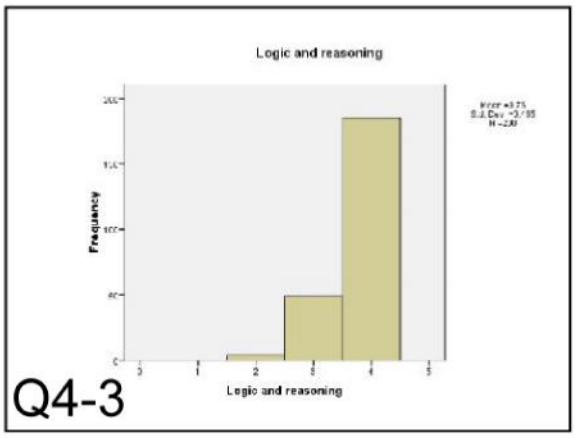

Ecological needs
Frequency
Ecological needs
Q3-2

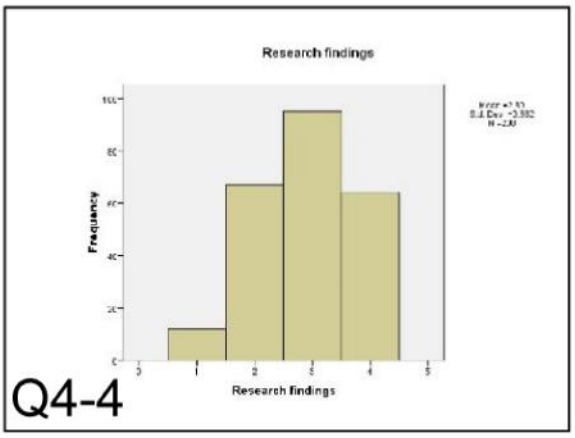

Public welfare and enjoyment
Frequency
Public welfare and enjoyment
Q3-3

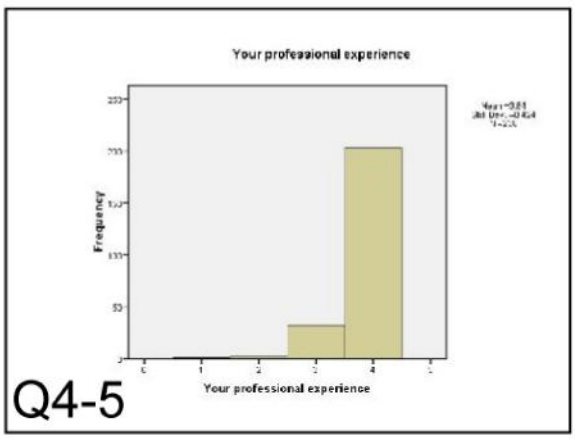

Comfort and pleasure for the individual
Frequency
Comfort and pleasure for the individual
Q3-4

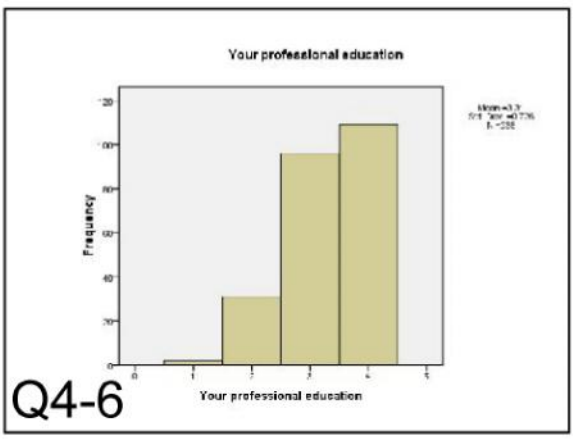

Intuition
Frequency
Intuition
Q4-1

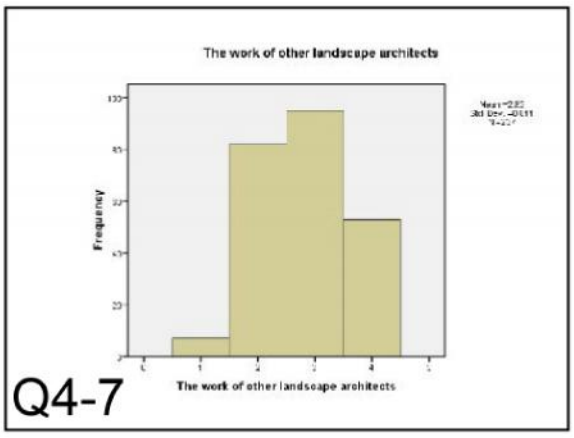

Common sense
Frequency
Common sense
Q4-2

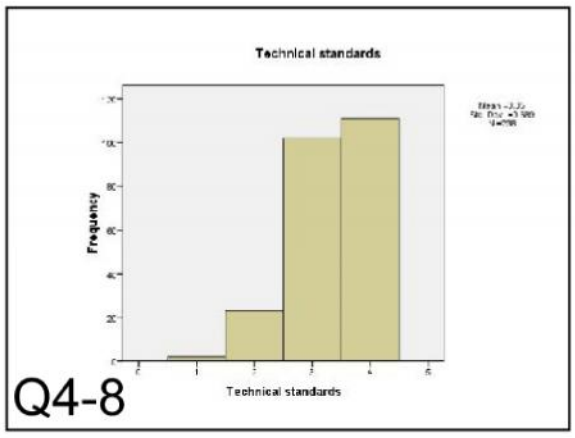

Logic and reasoning
Frequency
Logic and reasoning
Q4-3

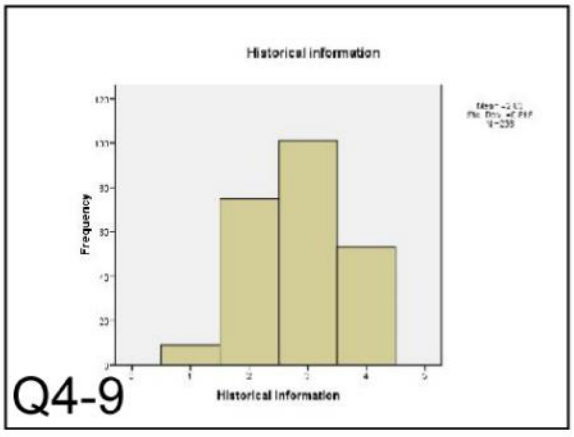

Research findings
Frequency
Research findings
Q4-4

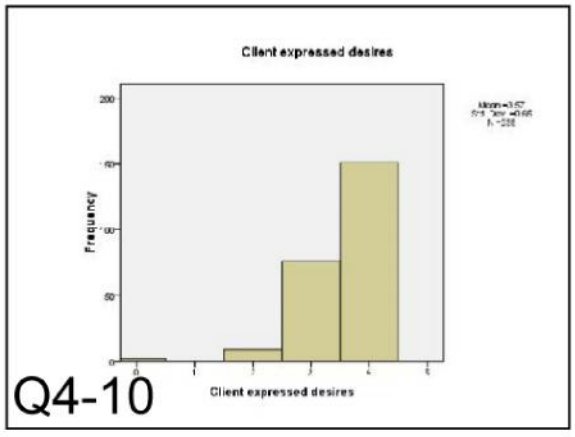

Your professional experience
Frequency
Your professional experience
Q4-5

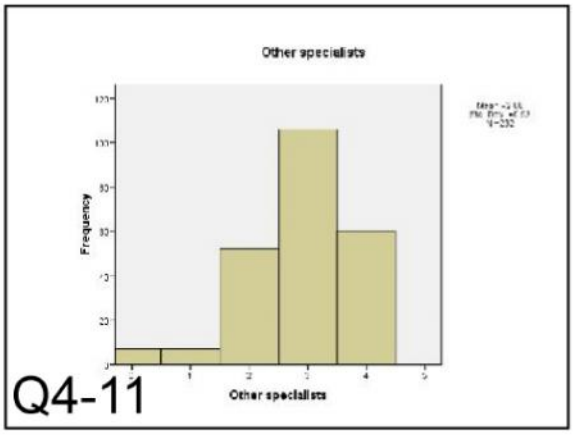

Your professional education
Frequency
Your professional education
Q4-6

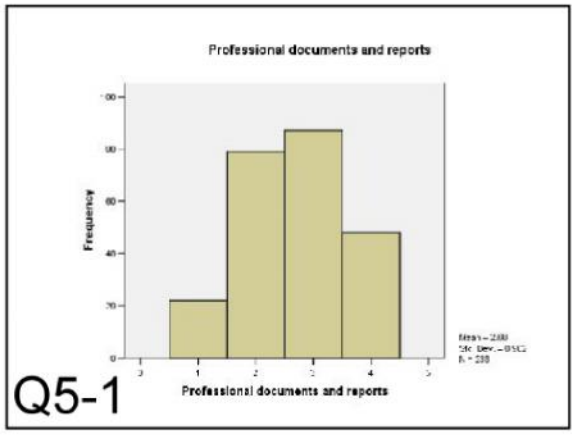

The work of other landscape architects
Frequency
The work of other landscape architects
Q4-7

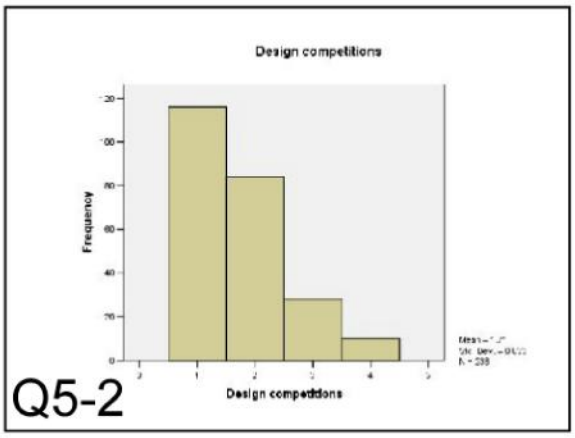

Technical standards
Frequency
Technical standards
Q4-8

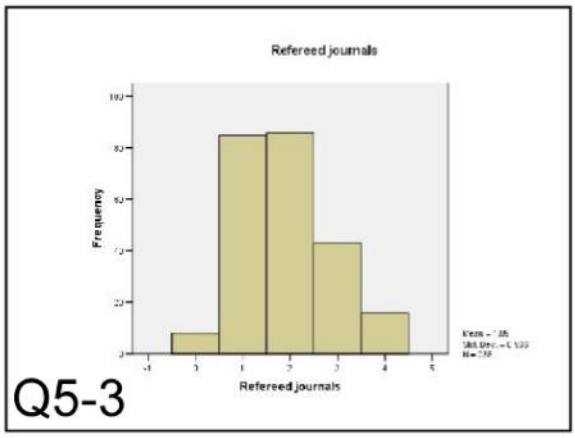

Historical information
Frequency
Historical information
Q4-9

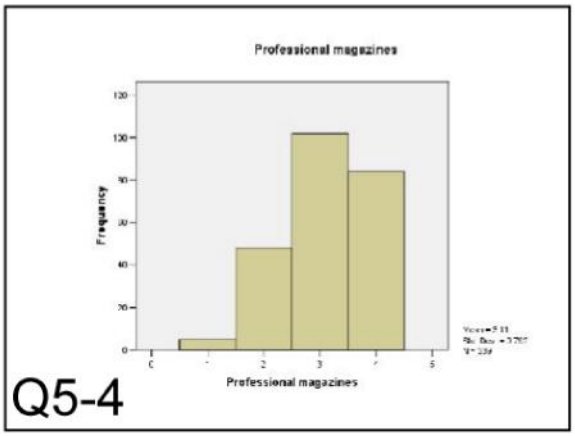

Client expressed desires
Frequency
Client expressed desires
Q4-10

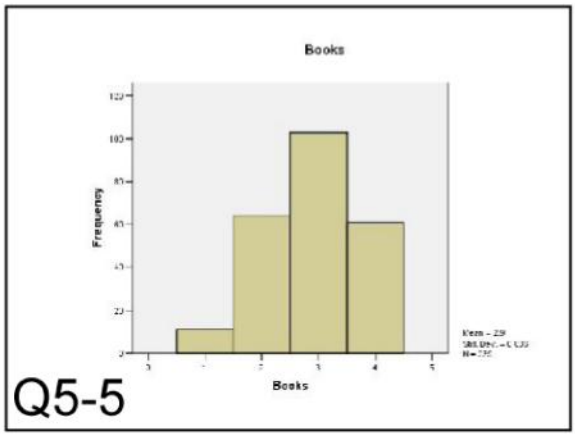

Other specialists
Frequency
Other specialists
Q4-11

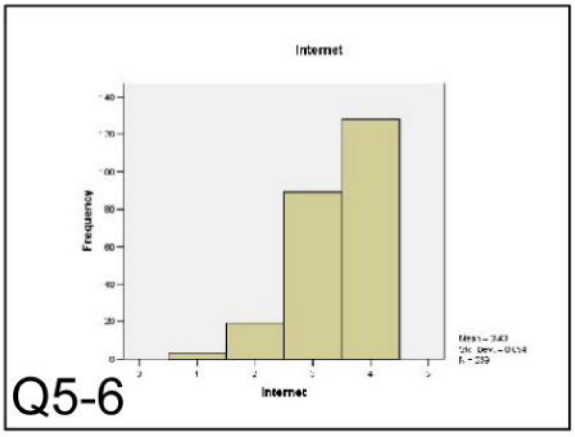

Professional documents and reports
Frequency
Professional documents and reports
Q5-1

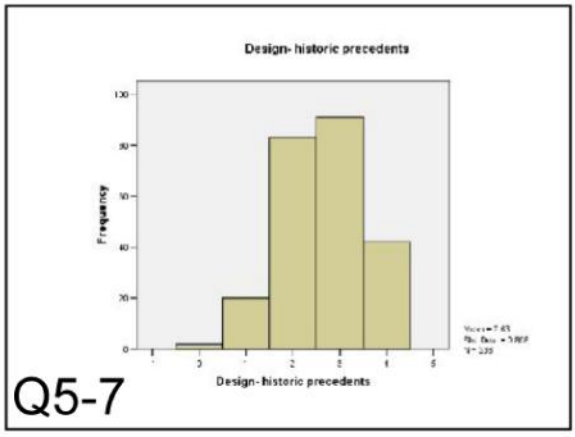

Design competitions
Frequency
Design competitions
Q5-2

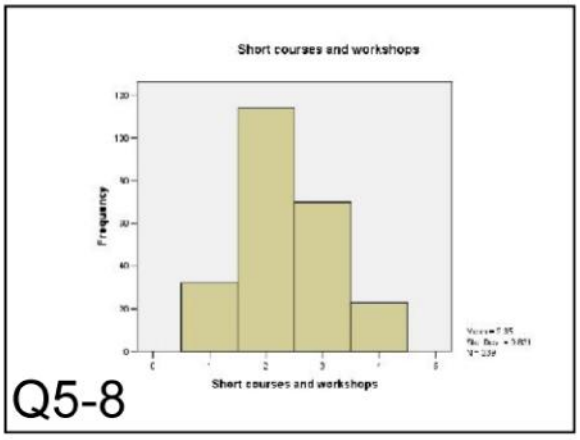

Refereed journals
Frequency
Refereed journals
Q5-3

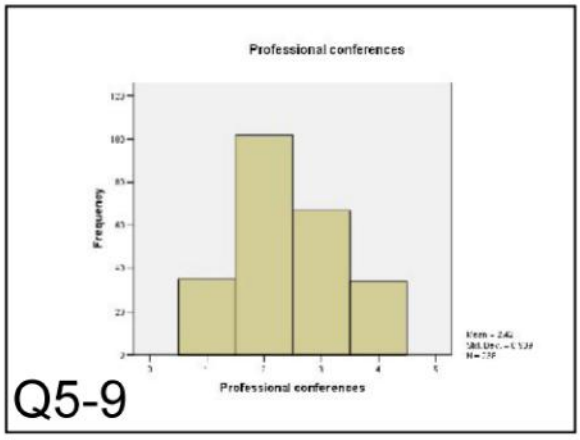

Professional magazines
Frequency
Professional magazines
Q5-4

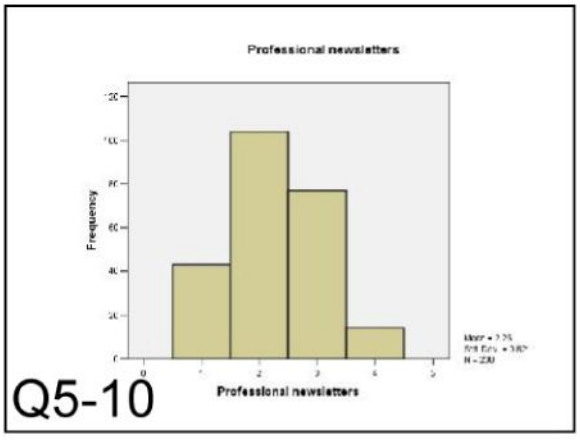

Books
Frequency
Books
Q5-5

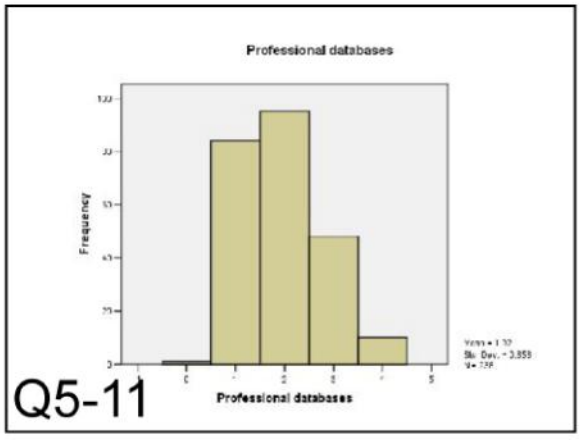

Internet
Frequency
Internet
Q5-6

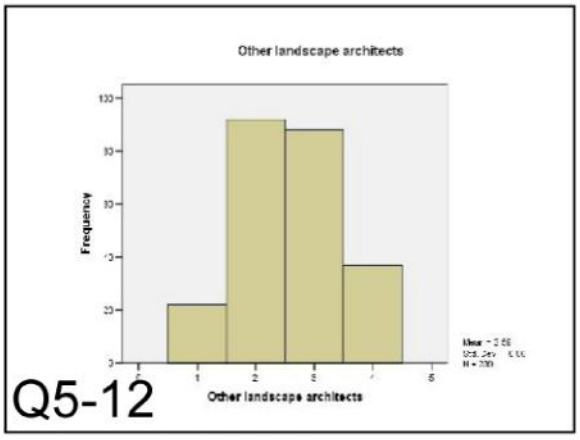

Design- historic precedents
Frequency
Design- historic precedents
Q5-7

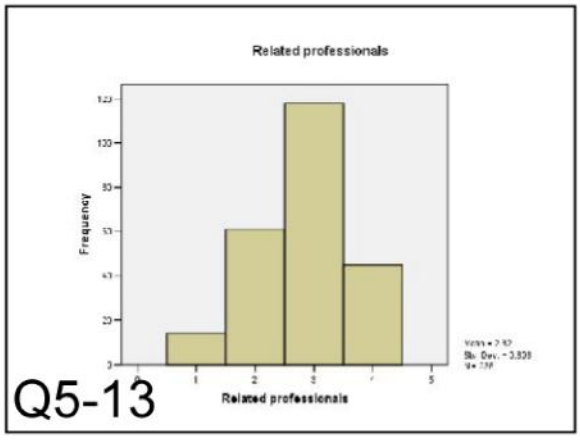

Short courses and workshops
Frequency
Short courses and workshops
Q5-8

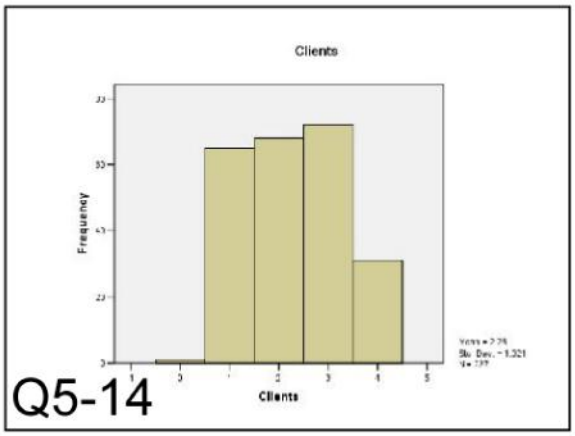

Professional conferences
Frequency
Professional conferences
Q5-9

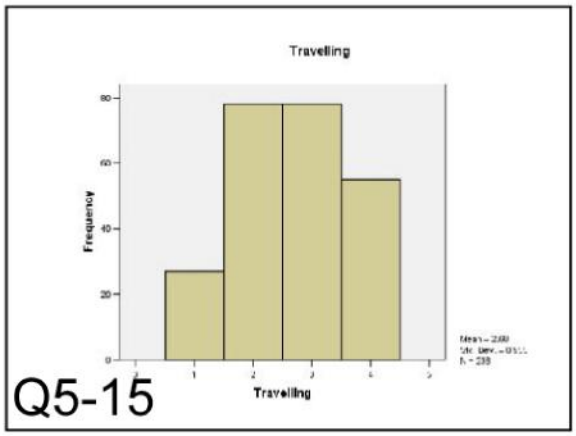

Professional newsletters
Frequency
Professional newsletters
Q5-10

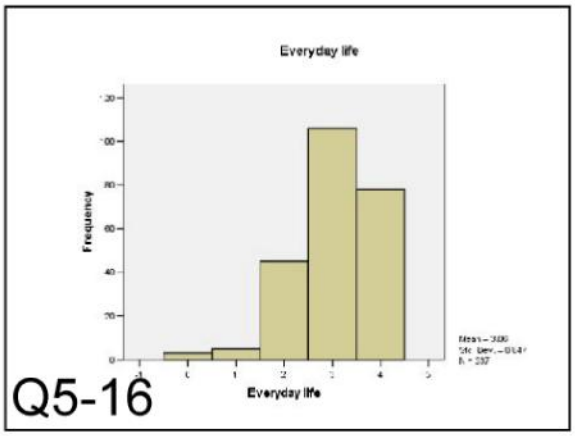

Professional databases
Frequency
Professional databases
Q5-11

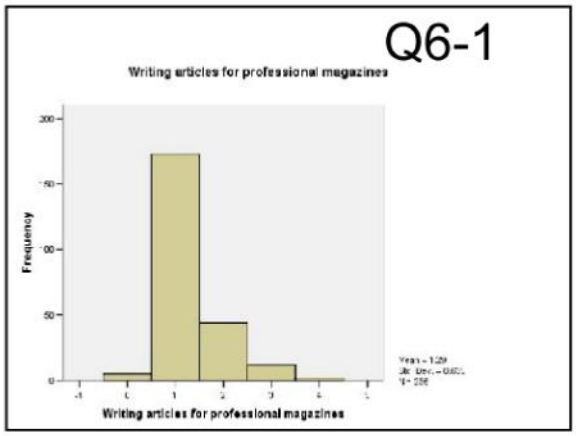

Other landscape architects
Frequency
Other landscape architects
Q5-12

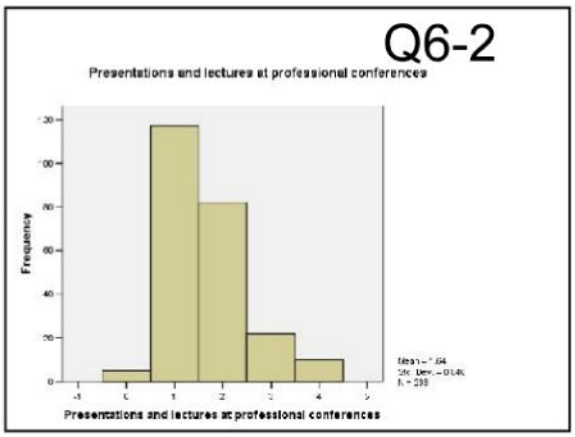

Related professionals
Frequency
Related professionals
Q5-13

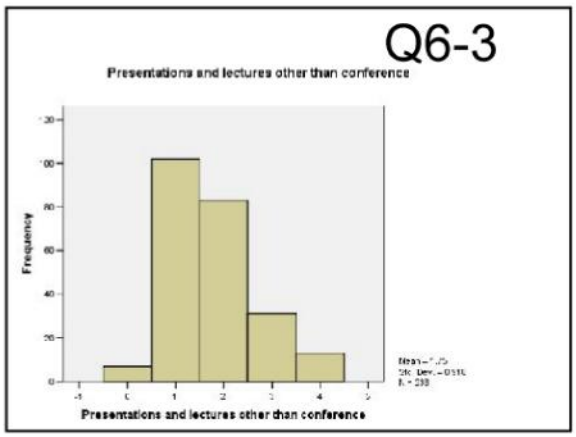

Clients
Frequency
Clients
Q5-14

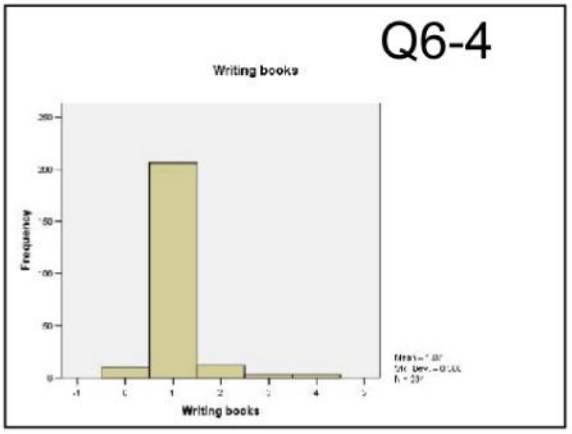

Travelling
Frequency
Travelling
Q5-15

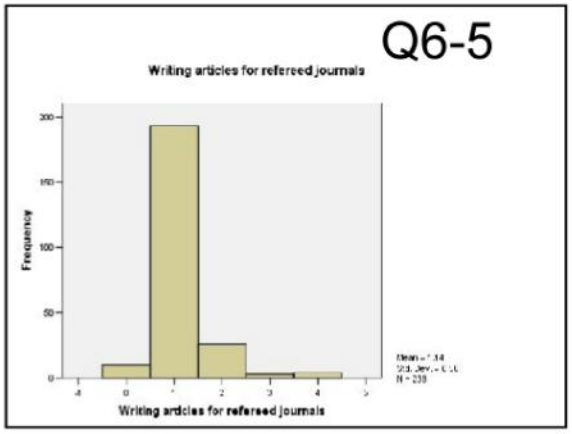

Everyday life
Frequency
Everyday life
Q5-16

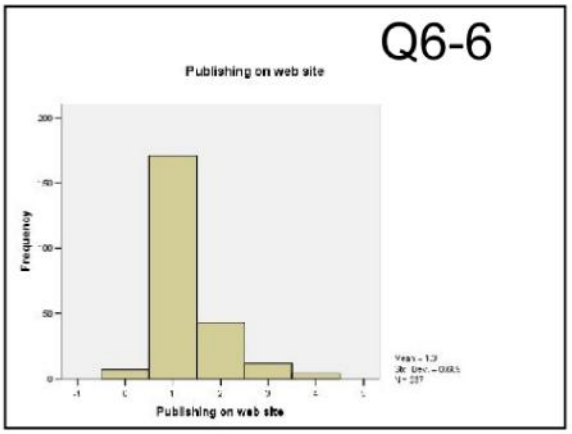

Q6-1
Writing articles for professional magazines
Frequency
Writing articles for professional magazines

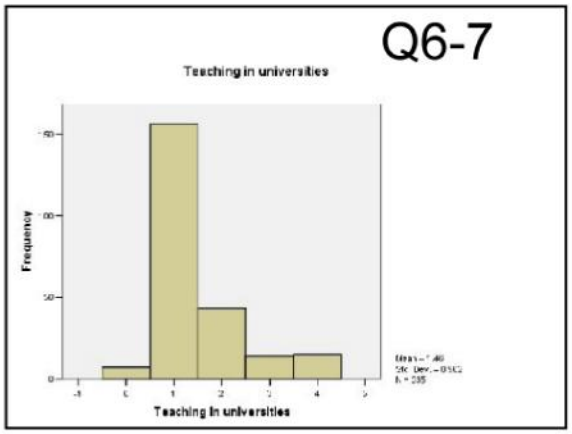

Q6-2
Presentations and lectures at professional conferences
Frequency
Presentations and lectures at professional conferences

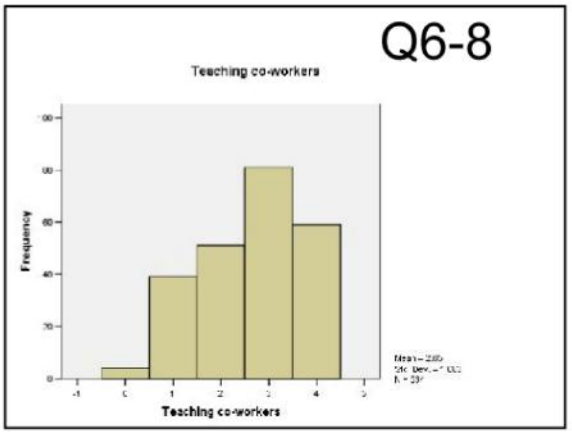

Q6-3
Presentations and lectures other than conference
Frequency
Presentations and lectures other than conference

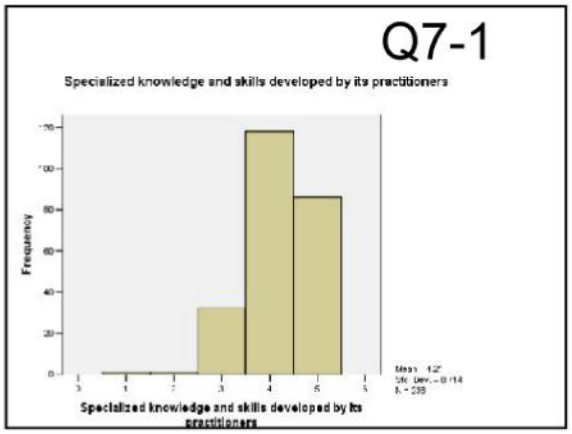

Q6-4
Writing books
Frequency
Writing books

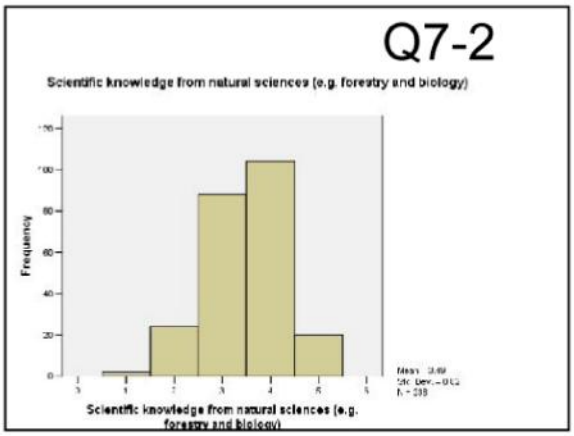

Q6-5
Writing articles for refereed journals
Frequency
Writing articles for refereed journals

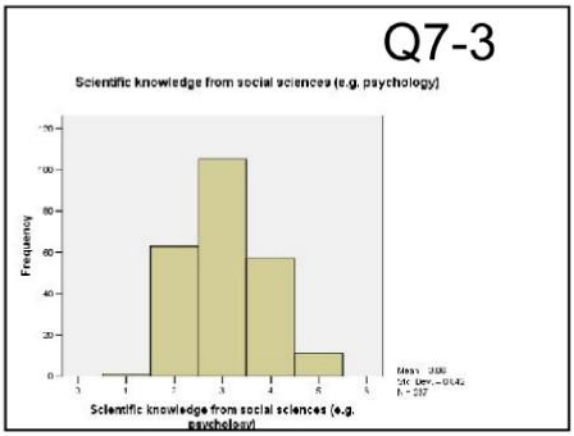

Q6-6
Publishing on web site
Frequency
Publishing on web site

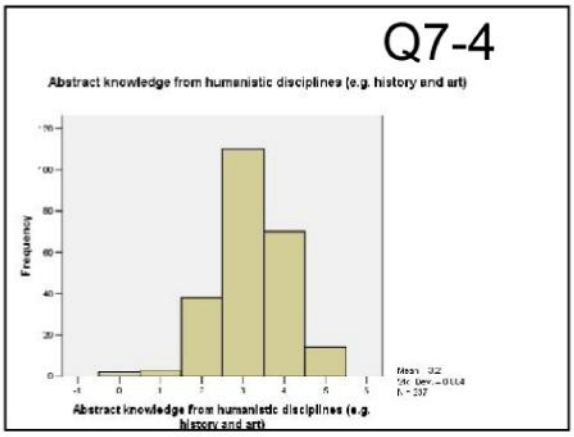

Q6-7
Teaching in universities
Frequency
Teaching in universities

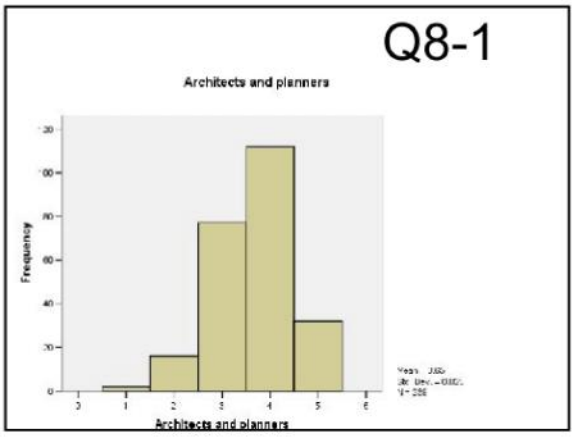

Q6-8
Teaching co-workers
Frequency
Teaching co-workers

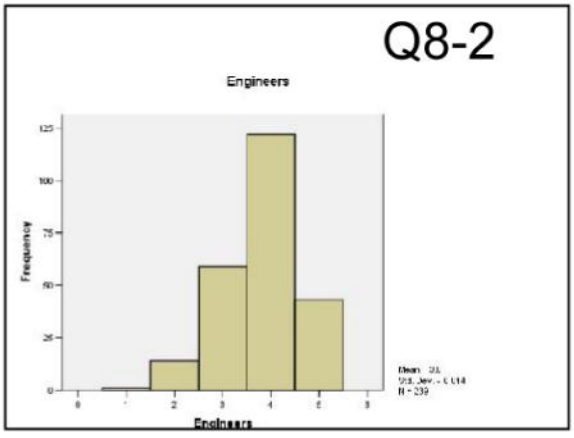

Q7-1
Specialized knowledge and skills developed by its practitioners
Frequency
Specialized knowledge and skills developed by its practitioners

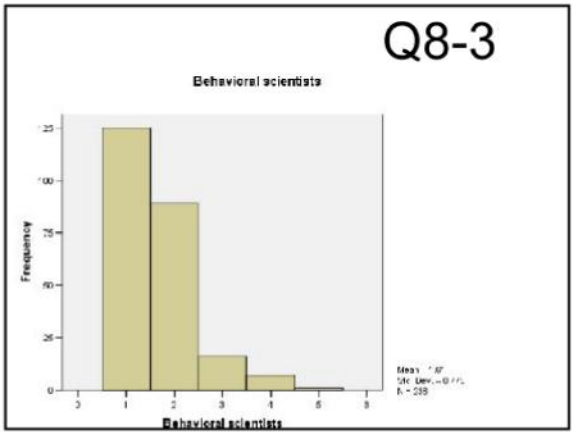

Q7-2
Scientific knowledge from natural sciences (e.g. forestry and biology)
Frequency
Scientific knowledge from natural sciences (e.g. forestry and biology)

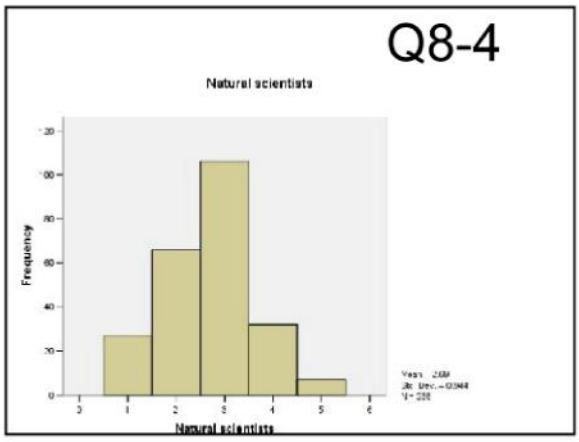

Q7-3
Scientific knowledge from social sciences (e.g. psychology)
Frequency
Scientific knowledge from social sciences (e.g. psychology)

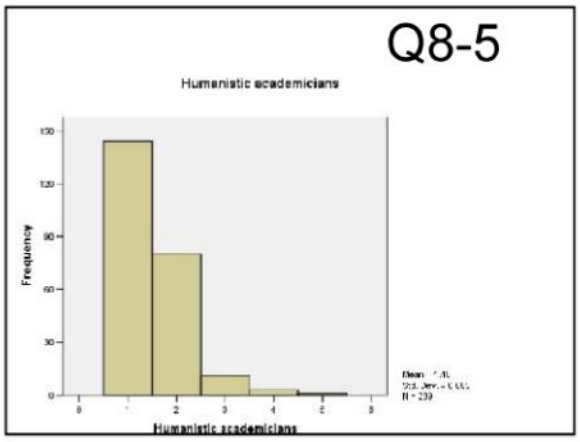

Q7-4
Abstract knowledge from humanistic disciplines (e.g. history and art)
Frequency
Abstract knowledge from humanistic disciplines (e.g. history and art)

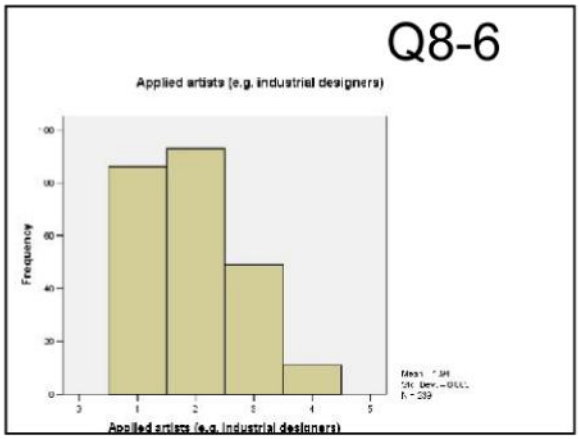

Q8-1
Architects and planners
Frequency
Architects and planners

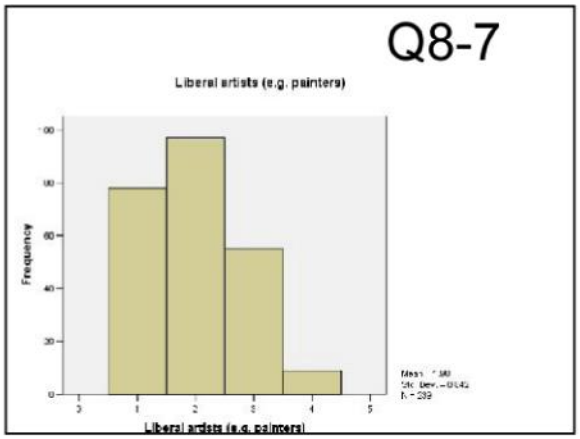

Q8-2
Engineers
Frequency
Engineers

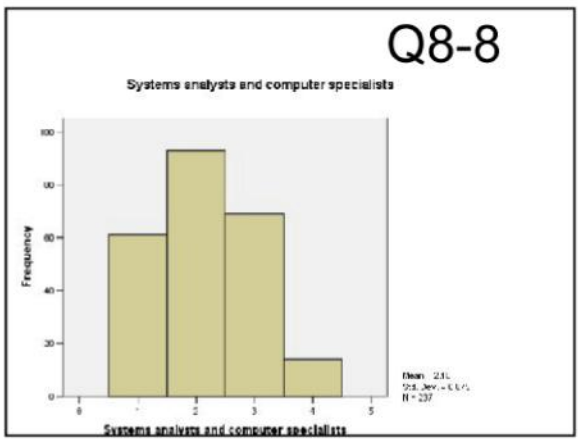

Q8-3
Behavioral scientists
Frequency
Behavioral scientists

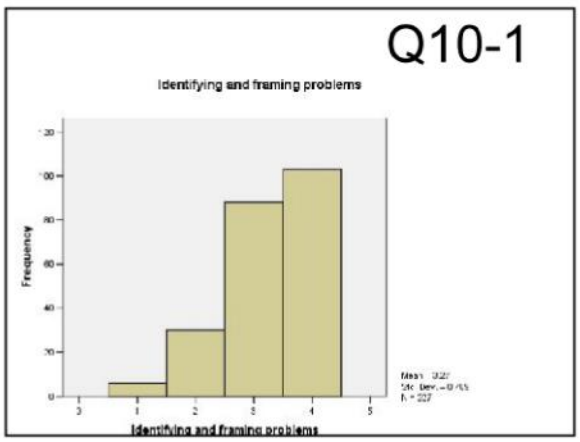

Q8-4
Natural scientists
Frequency
Natural scientists

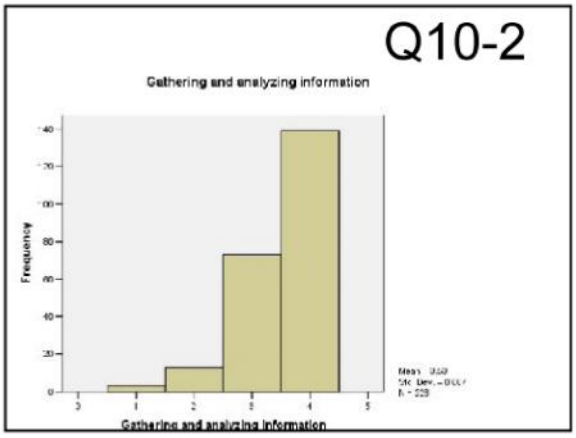

Q8-5
Humanistic academicians
Frequency
Humanistic academicians

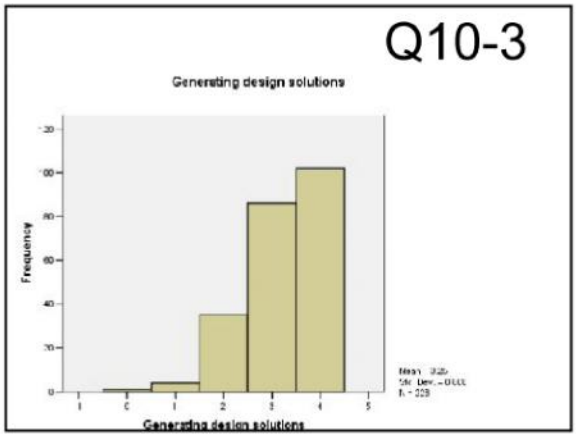

Q8-6
Applied artists (e.g. industrial designers)
Frequency
Applied artists (e.g. industrial designers)

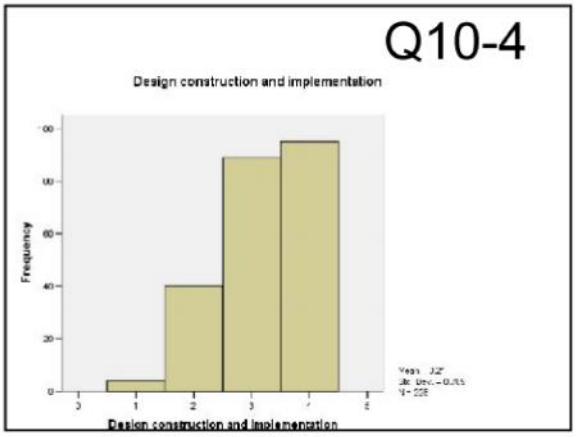

Q8-7
Liberal artists (e.g. painters)
Frequency
Liberal artists (e.g. painters)

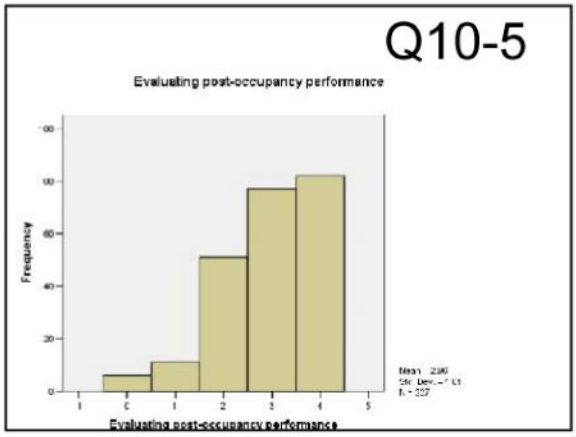

Q8-8
Systems analysts and computer specialists
Frequency
Systems analysts and computer specialists

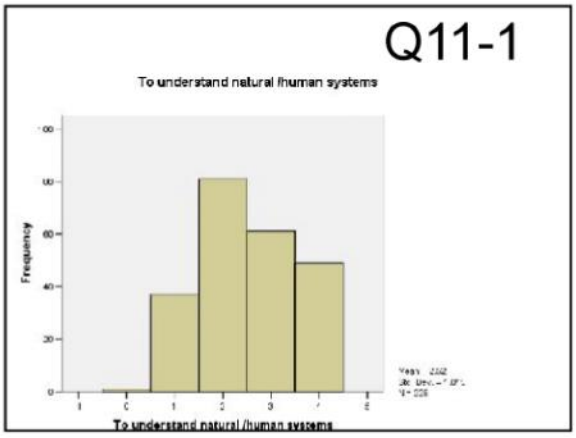

Q10-1
Identifying and framing problems
Frequency
Identifying and framing problems

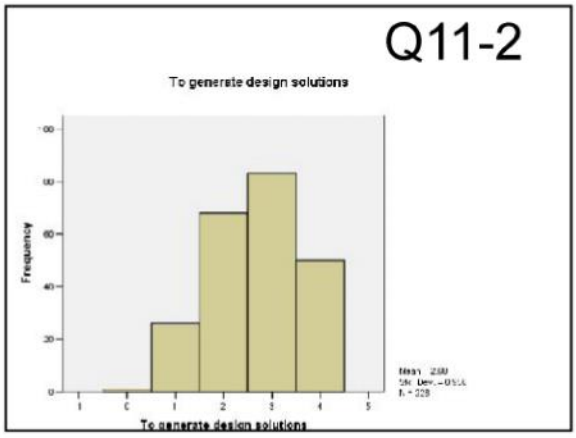

Q10-2
Gathering and analyzing information
Frequency
Gathering and analyzing information

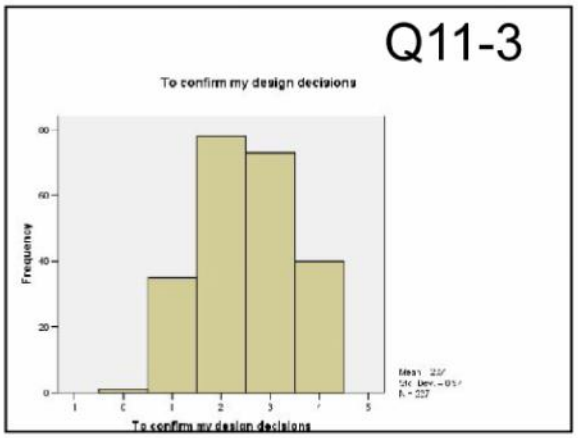

Q10-3
Generating design solutions
Frequency
Generating design solutions

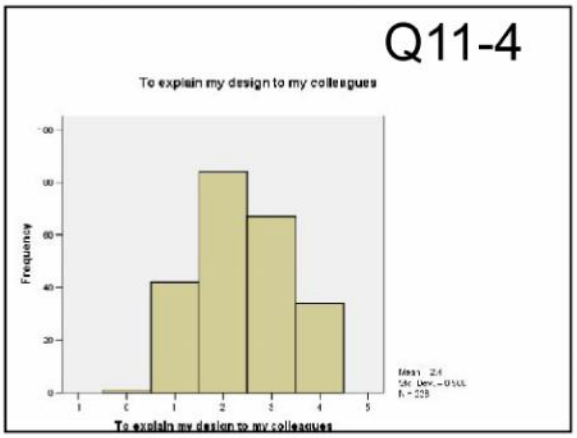

Q10-4
Design construction and implementation
Frequency
Design construction and implementation

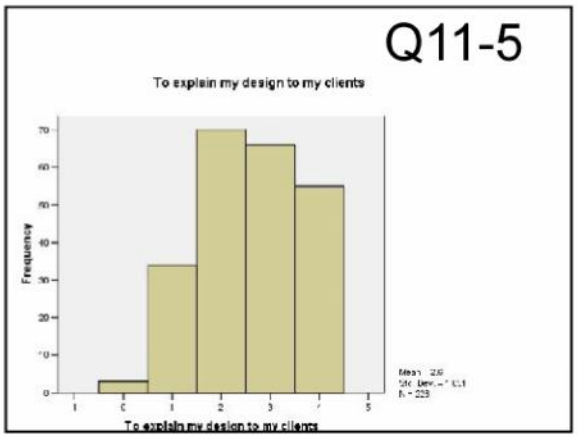

Q10-5
Evaluating post-occupancy performance
Frequency
Evaluating post-occupancy performance

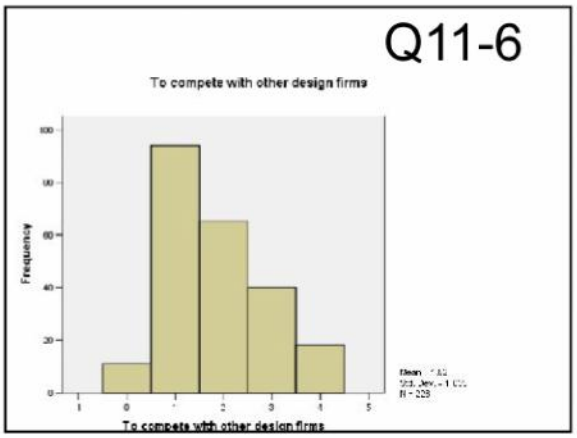

Q11-1
To understand natural /human systems
Frequency
To understand natural /human systems

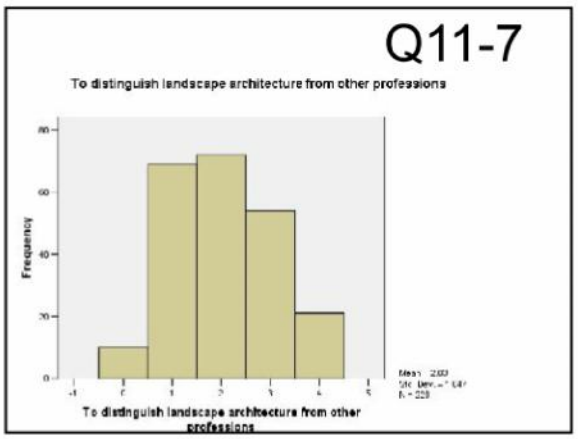

Q11-2
To generate design solutions
Frequency
To generate design solutions

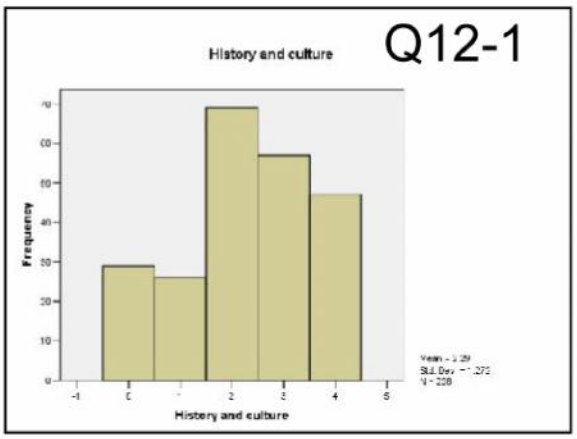

Q11-3
To confirm my design decisions
Frequency
To confirm my design decisions

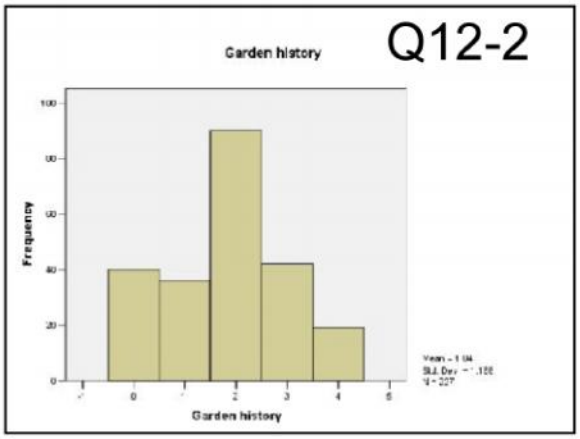

Q11-4
To explain my design to my colleagues
Frequency
To explain my design to my colleagues

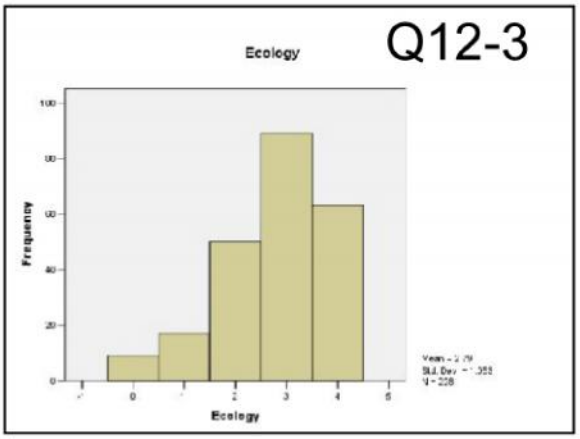

Q11-5
To explain my design to my clients
Frequency
To explain my design to my clients

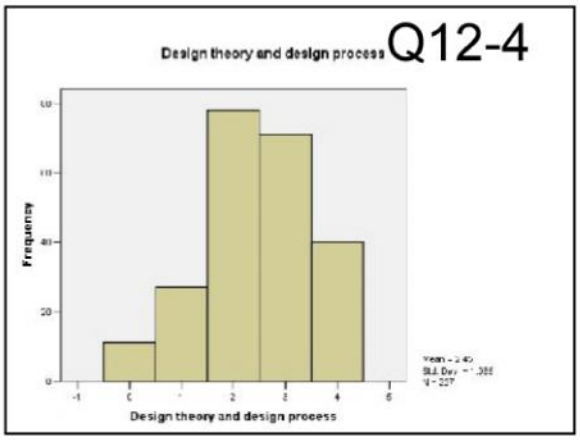

Q11-6
To compete with other design firms
Frequency
To compete with other design firms

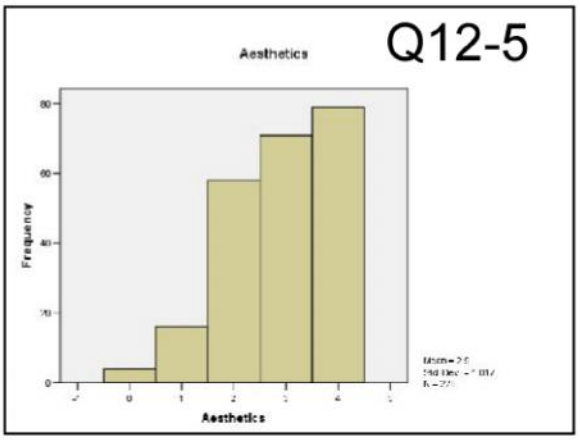

Q11-7
To distinguish landscape architecture from other professions
Frequency
To distinguish landscape architecture from other professions

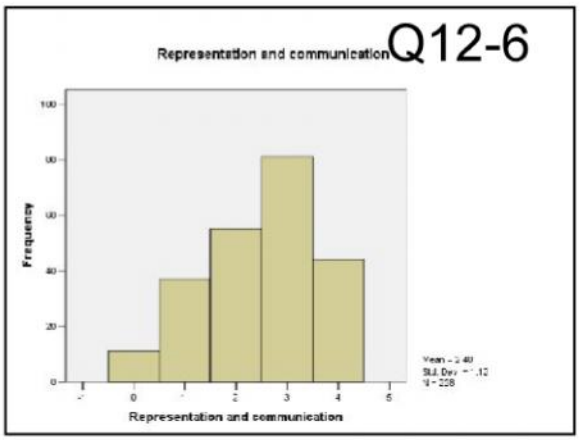

Q12-1
History and culture
Frequency
History and culture

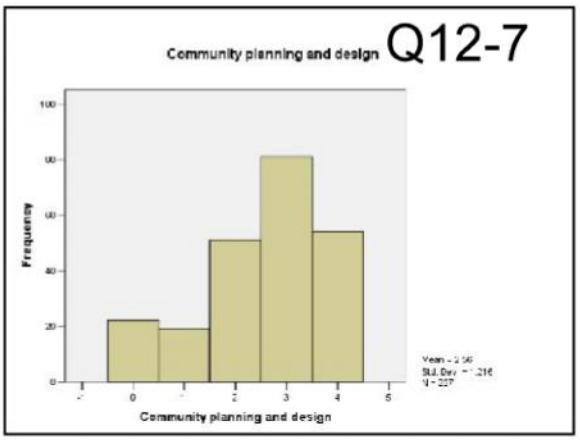

Garden history
Q12-2
Frequency
Garden history

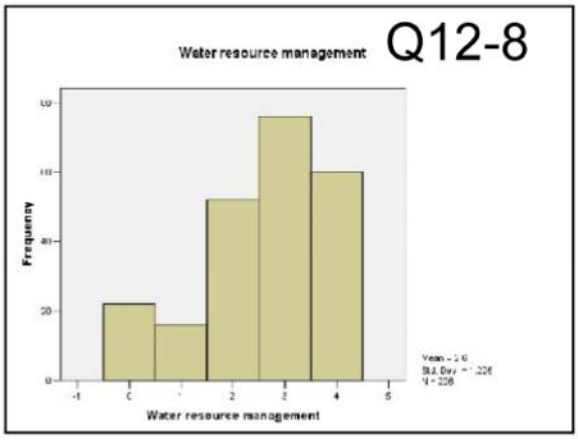

Ecology
Q12-3
Frequency
Ecology

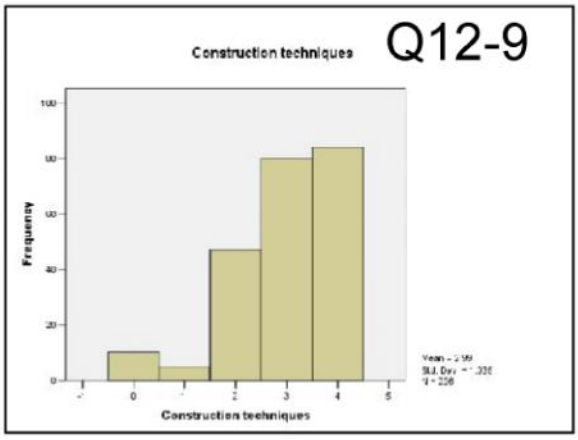

Design theory and design process
Q12-4
Frequency
Design theory and design process

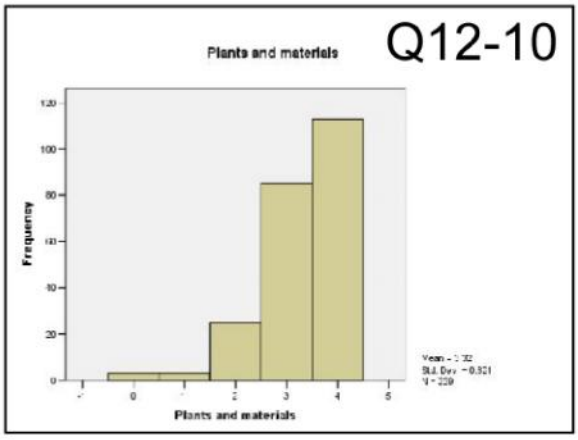

Aesthetics
Q12-5
Frequency
Aesthetics

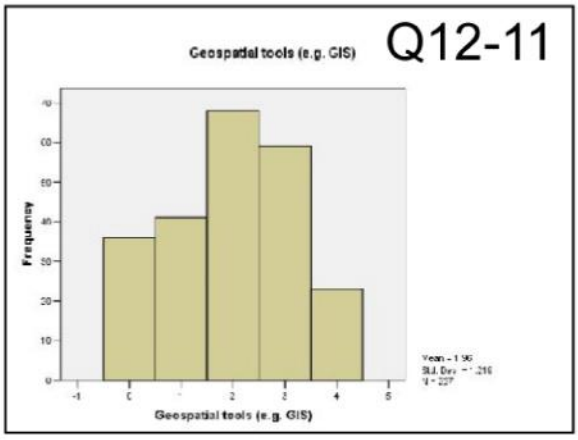

Representation and communication
Q12-6
Frequency
Representation and communication

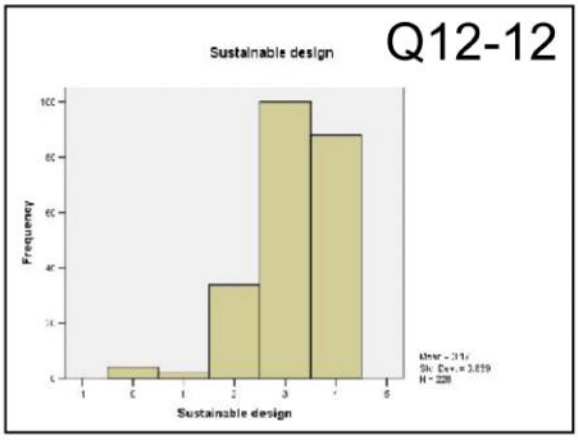

Community planning and design
Q12-7
Frequency
Community planning and design

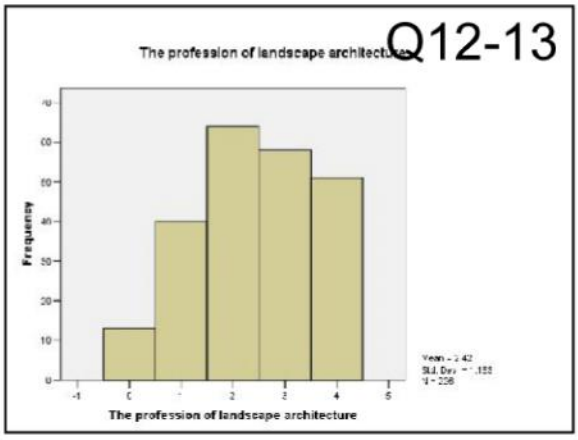

Water resource management
Q12-8
Frequency
Water resource management

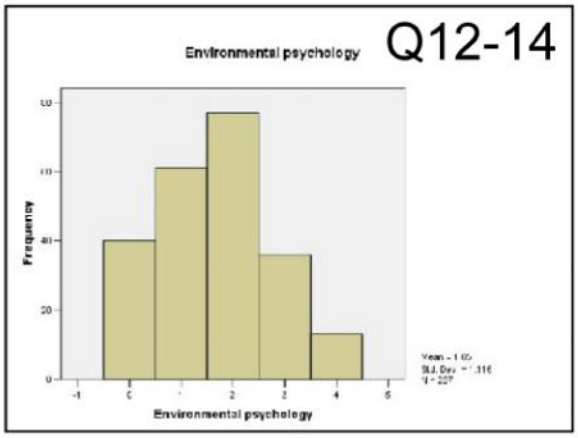

Construction techniques
Q12-9
Frequency
Construction techniques

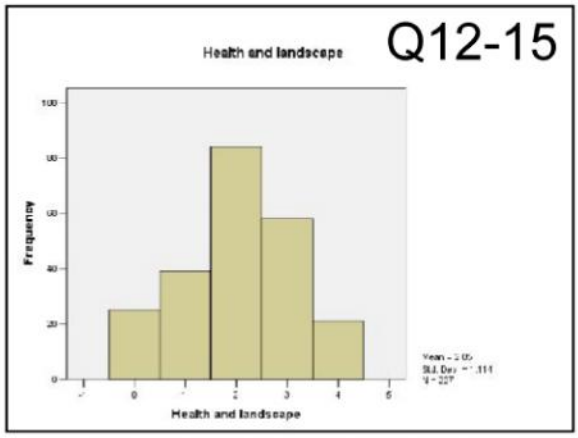

Plants and materials
Q12-10
Frequency
Plants and materials

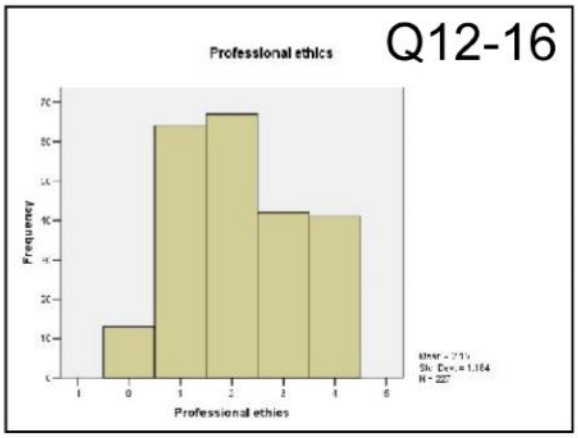

Geospatial tools (e.g. GIS)
Q12-11
Frequency
Geospatial tools (e.g. GIS)

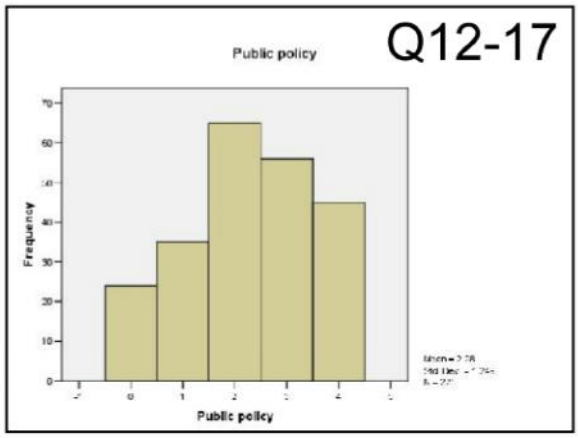

Sustainable design
Q12-12
Frequency
Sustainable design

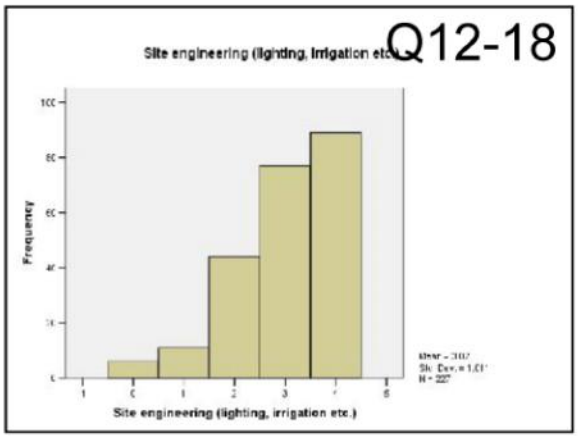

The profession of landscape architecture
Q12-13
Frequency
The profession of landscape architecture

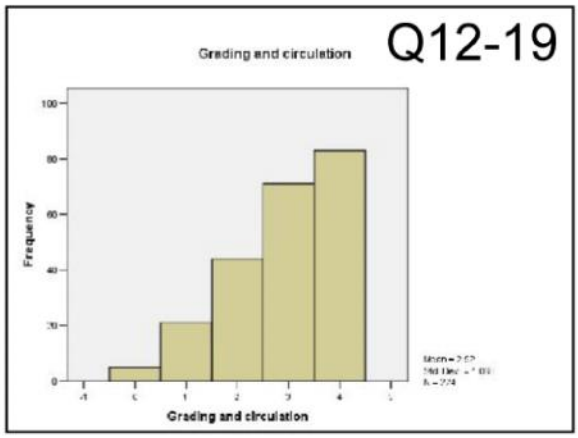

Environmental psychology
Q12-14
Frequency
Environmental psychology

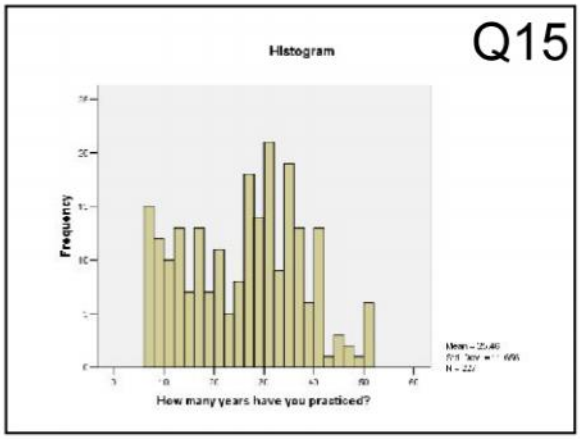

Health and landscape
Q12-15
Frequency
Health and landscape

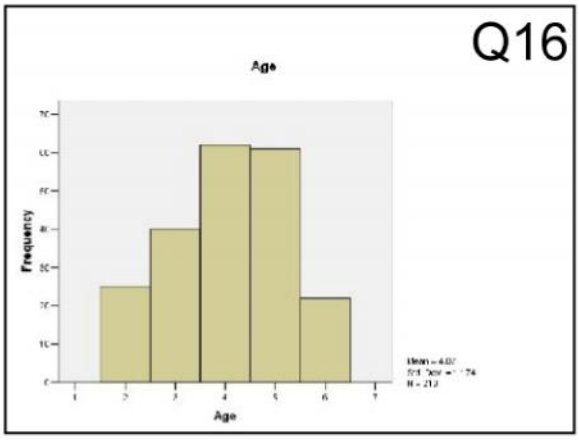

Professional ethics
Q12-16
Frequency
Professional ethics

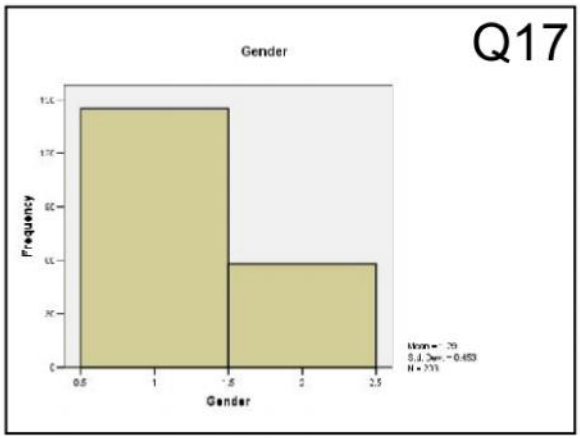

Public policy
Q12-17
Frequency
Public policy

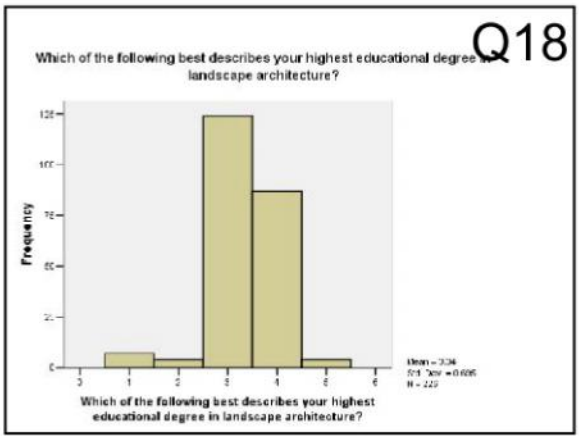

Site engineering (lighting, irrigation etc.)
Q12-18
Frequency
Site engineering (lighting, irrigation etc.)

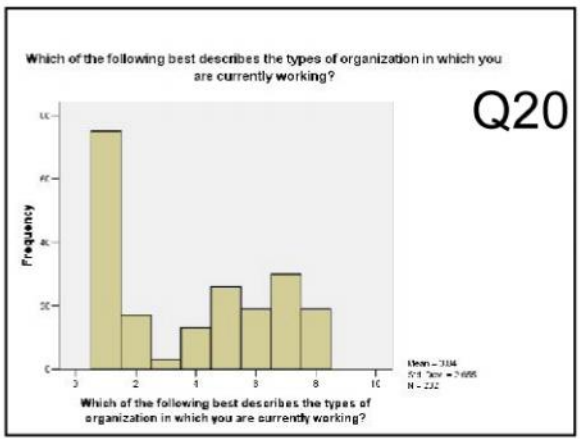

Grading and circulation
Q12-19
Frequency
Grading and circulation

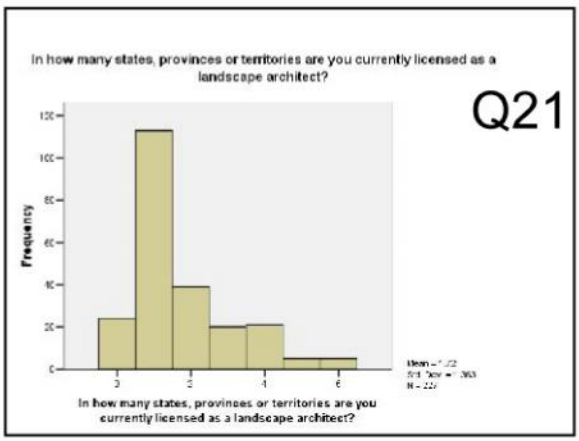

Histogram
Q15
Frequency
How many years have you practiced?

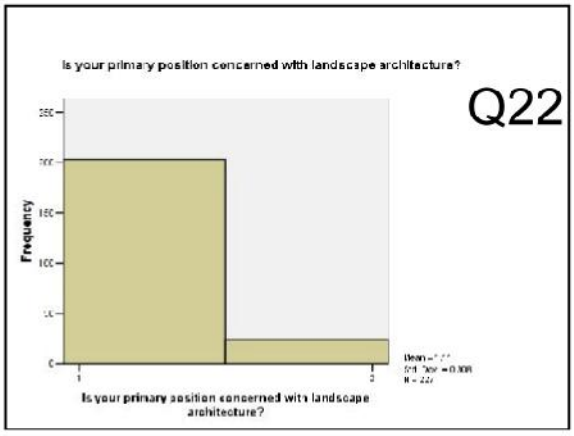

Age
Q16
Frequency
Age

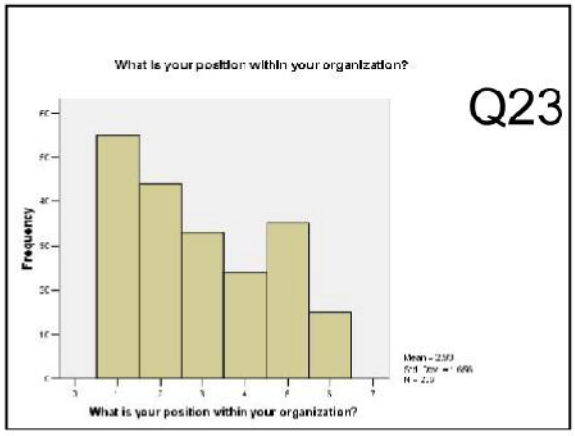

Gender
Q17
Frequency
Gender

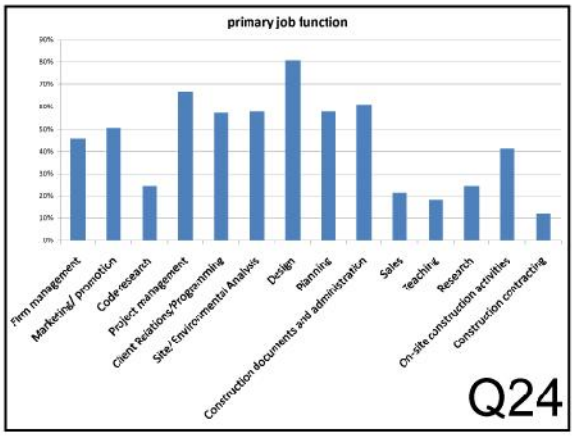

Which of the following best describes your highest educational degree in landscape architecture?
Q18
Frequency
Which of the following best describes your highest educational degree in landscape architecture?


Which of the following best describes the types of organization in which you are currently working?
Q20
Frequency
Which of the following best describes the types of organization in which you are currently working?


In how many states, provinces or territories are you currently licensed as a landscape architect?
Q21
Frequency
In how many states, provinces or territories are you currently licensed as a landscape architect?


Is your primary position concerned with landscape architecture?
Q22
Frequency
Is your primary position concerned with landscape architecture?


What is your position within your organization?
Q23
Frequency
What is your position within your organization?


primary job function
Firm management
Marketing/ promotion
Code research
Project management
Client Relations/Programming
Site/Environmental Analysis
Design
Planning
Construction documents and administration
Sales
Teaching
Research
On-site construction activities
Construction contracting
Q24