

Utah State University

DigitalCommons@USU

All Graduate Theses and Dissertations

Graduate Studies

5-2014

Identification of the Constraints and Barriers to the Adoption of Distributed Design Education

Benjamin H. George
Utah State University

Follow this and additional works at: <https://digitalcommons.usu.edu/etd>



Part of the [Education Commons](#)

Recommended Citation

George, Benjamin H., "Identification of the Constraints and Barriers to the Adoption of Distributed Design Education" (2014). *All Graduate Theses and Dissertations*. 3965.
<https://digitalcommons.usu.edu/etd/3965>

This Dissertation is brought to you for free and open access by the Graduate Studies at DigitalCommons@USU. It has been accepted for inclusion in All Graduate Theses and Dissertations by an authorized administrator of DigitalCommons@USU. For more information, please contact digitalcommons@usu.edu.



IDENTIFICATION OF THE CONSTRAINTS AND BARRIERS
TO THE ADOPTION OF DISTRIBUTED DESIGN EDUCATION

by

Benjamin H. George

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Instructional Technology & Learning Sciences

Approved:

Brett Shelton, Ph.D.
Major Professor

Sean Michael, Ph.D.
Committee Member

Andrew Walker, Ph.D.
Committee Member

Keith Christensen, Ph.D.
Committee Member

Deborah Fields, Ph.D.
Committee Member

Mark McLellan, Ph.D.
Vice President for Research and
Dean of the School of Graduate
Studies

UTAH STATE UNIVERSITY
Logan, Utah

2014

Copyright © 2014 by Benjamin H. George

All Rights Reserved

ABSTRACT

Identification of the Constraints and Barriers to
the Adoption of Distributed Design Education

by

Benjamin H. George, Doctor of Philosophy

Utah State University, 2014

Major Professor: Dr. Brett Shelton
Department: Instructional Technology & Learning Sciences

The design field of landscape architecture has yet to witness the broad adoption of online education, despite multiple studies that have demonstrated the efficacy of online education in design fields, or distributed design education (DDE), in teaching design. While previous research has focused on the structural, institutional, social, and pedagogical aspects of DDE, little work has focused specifically on barriers to the adoption of DDE from a faculty perspective. This dissertation reports the results of a meta-synthesis of the current literature on DDE and a national Delphi study. A list of the identified constraints of DDE was created through the use of the meta-synthesis. This list of constraints was subsequently used in the creation of the Delphi study to identify the critical barriers to the adoption of online education in landscape architecture. There were 24 barriers assessed during the Delphi study, 7 of which were identified as critical barriers. Findings indicate that faculty remain skeptical of the precedents reported in the

literature, do not receive adequate compensation for online course development, and have significant concerns about the ability of online education to replicate the social environment of the design studio. A comparison of the ranked barriers and the most commonly researched constraints suggests that the current research on DDE does not adequately address the concerns of faculty.

(179 pages)

PUBLIC ABSTRACT

Identification of the Constraints and Barriers to
the Adoption of Distributed Design Education

by

Benjamin H. George, Doctor of Philosophy

The design field of landscape architecture has yet to witness the broad adoption of online education, despite multiple studies that have demonstrated the efficacy of online education in design fields, or distributed design education (DDE), in teaching design. While previous research has focused on the structural, institutional, social, and pedagogical aspects of DDE, little work has focused specifically on barriers to the adoption of DDE from a faculty perspective. This dissertation reports the results of a meta-synthesis of the current literature on DDE and a national Delphi study. A list of the identified constraints of DDE was created through the use of the meta-synthesis. This list of constraints was subsequently used in the creation of the Delphi study to identify the critical barriers to the adoption of online education in landscape architecture. There were 24 barriers assessed during the Delphi study, 7 of which were identified as critical barriers. Findings indicate that faculty remain skeptical of the precedents reported in the literature, do not receive adequate compensation for online course development, and have significant concerns about the ability of online education to replicate the social environment of the design studio. A comparison of the ranked barriers and the most commonly researched constraints suggests that the current research on DDE does not adequately address the concerns of faculty.

ACKNOWLEDGMENTS

First, I would like to thank God in Heaven for the talents and abilities that have made this possible. While in the moment, life can seem chaotic; in hindsight I can see His guiding hand throughout the process.

While this dissertation bears my name as the author, such limited credit fails to acknowledge the profound impact and support I have received, and I would be remiss if I did not thank those individuals who have played a role in my completion of this project. I am especially grateful to my committee chair, Brett Shelton, for his guidance and support throughout the process. Sean Michael, for his mentorship and encouraging my initial spark of interest in this area to grow. Andrew Walker, for his willingness to share his expertise and feedback. Keith Christensen, for providing feedback and advice throughout this process. And to Debbie Fields, for showing me how to successfully prepare for my comps and make it through that stressful time. I feel fortunate to have a committee that has been very supportive and professional.

Thank you to those who agreed to participate in the Delphi survey. I know it is a long process, and I truly appreciate the commitment in time and knowledge that each panelist contributed to enable me to conduct my research.

To my parents, who have provided so much support and encouragement and have always been there to provide help in the form of babysitting, a listening ear, or proof-reading.

And finally to my wife, Pamela, I will be eternally gratefully for her support and incredible patience in this process. She had no idea how long her husband would be in

school when we got married, but has been supportive through it all. No one else has spent so much time and effort in supporting me, and has kept me inspired and upbeat through the entire process. And, Hollis, now you can get your car.

Benjamin H. George

CONTENTS

	Page
ABSTRACT	iii
PUBLIC ABSTRACT	v
ACKNOWLEDGMENTS	vi
LIST OF TABLES.....	xi
LIST OF FIGURES	xii
CHAPTER	
I. INTRODUCTION.....	1
Definition of Terms	3
Theoretical Frameworks	4
Purpose of This Work.....	5
Dissertation Structure	6
II. LITERATURE REVIEW	8
Education in Landscape Architecture.....	8
Theorization of the Design Studio Environment.....	11
Research in Distributed Design Education.....	12
III. METHODS	
Introduction	19
Research Question	19
Study Design and Methodology	20
Meta-Synthesis of DDE Literature	20
Delphi Study	29
IV. RESULTS.....	41
Identification of Constraints in the Meta-Synthesis	41
Gaps in the Literature Identified in the Meta-Synthesis.....	51
Identification of Critical Barriers in the Delphi Study	53
Ranking of Barriers	56
Correlations	94

Summary of Results.....	96
V. DISCUSSION.....	97
Summary of Study and Results	97
Conclusions	97
Implications	98
Relationship to the Literature	115
Recommendations for Future Research.....	117
Limitations.....	121
Final Opinions	123
REFERENCES	125
APPENDICES	133
Appendix A: Additional Theoretical Frameworks	134
Appendix B: Institutional Review Board Letter of Information for Participants.....	138
Appendix C: Delphi Survey	142
Appendix D: Demographic Survey	148
Appendix E: Comments from Panel on Critical Barriers	151
VITA	161

LIST OF TABLES

Table	Page
1. DDE Publication Types	21
2. List of the Coded Constraints and Barrier from the Meta-Synthesis	26
3. Timeline of the Delphi Survey	36
4. List of the Constraints Identified in the Literature and the Instances Found	42
5. Participation Rates in the Delphi Study.....	54
6. Panel Demographic Data	55
7. Delphi Results for Barriers to Adoption.....	57
8. Number of Comments Per Round by Theme for Question 1	61
9. Number of Comments Per Round by Theme for Question 24	63
10. Number of Comments Per Round by Theme for Question 9	65
11. Number of Comments Per Round by Theme for Question 13	68
12. Number of Comments Per Round by Theme for Question 20	70
13. Number of Comments Per Round by Theme for Question 2	72
14. Number of Comments Per Round by Theme for Question 19	74
15. Number of Comments Per Round by Theme for Question 3	76
16. Number of Comments Per Round by Theme for Question 4	77
17. Number of Comments Per Round by Theme for Question 5	78
18. Number of Comments Per Round by Theme for Question 6	79
19. Number of Comments Per Round by Theme for Question 7	80

20. Number of Comments Per Round by Theme for Question 8	81
21. Number of Comments Per Round by Theme for Question 10	82
22. Number of Comments Per Round by Theme for Question 11	84
23. Number of Comments Per Round by Theme for Question 12	85
24. Number of Comments Per Round by Theme for Question 14	86
25. Number of Comments Per Round by Theme for Question 15	87
26. Number of Comments Per Round by Theme for Question 16	88
27. Number of Comments Per Round by Theme for Question 17	89
28. Number of Comments Per Round by Theme for Question 18	90
29. Number of Comments Per Round by Theme for Question 21	91
30. Number of Comments Per Round by Theme for Question 22	92
31. Number of Comments Per Round by Theme for Question 23	94
32. The Seven Most Common Constraints and Barriers Compared.....	98
33. The Common Themes from the Comments of the Critical Barriers	111
34. Proposed Mitigations for the Identified Critical Barriers.....	112
35. Comparison of the Mean Rank From the Meta-Synthesis to Panel Results.....	116

LIST OF FIGURES

Figure	Page
1. Studio social hierarchy	12
2. Chronological history of publications in DDE	16
3. The development of the list of potential barriers from the constraints identified in the meta-synthesis	28
4. Mean rankings of the barriers	58
5. Distribution of responses to question 1	59
6. Distribution of responses to Question 24	62
7. Distribution of responses to Question 9	64
8. Distribution of responses to Question 13	66
9. Distribution of responses to Question 20	68
10. Distribution of responses to Question 2	71
11. Distribution of responses to Question 19	73
12. Distribution of responses to Question 3	75
13. Distribution of responses to Question 4	76
14. Distribution of responses to Question 5	78
15. Distribution of responses to Question 6	79
16. Distribution of responses to Question 7	80
17. Distribution of responses to Question 8	81
18. Distribution of responses to Question 10	82
19. Distribution of responses to Question 11	83

20. Distribution of responses to Question 12	84
21. Distribution of responses to Question 14	85
22. Distribution of responses to Question 15	86
23. Distribution of responses to Question 16	87
24. Distribution of responses to Question 17	88
25. Distribution of responses to Question 18	90
26. Distribution of responses to Question 21	91
27. Distribution of responses to Question 22	92
28. Distribution of responses to Question 23	93
29. A comparison of the final barrier rankings and most common constraints.....	117

CHAPTER I

INTRODUCTION

Distance education has steadily gained in both popularity and importance across higher education over the last several decades. This growth has been increasingly spurred on by new technological innovations including high-speed internet, Web 2.0, content management systems, and internet-mediated communication which have led to the large-scale acceptance of on-line education across disciplines (Anderson, Boyles, & Rainie, 2012; Lokken & Mullins, 2014). Despite the rapid advances, innovation, and demonstrated efficacy of online education, the design fields of landscape architecture, architecture, and interior design have been slow to adopt on-line education models (Bender & Good, 2003; Li, 2007).

At the same time, there is an increasing demand for landscape architects in the global market, but a recent roundtable of landscape architecture CEOs noted that the current educational system is unable to meet these increased demands (Landscape Architecture CEO Roundtable, 2007). This is partially due to the fixed capacities of landscape architecture programs, and the requirement that programs be accredited by the Landscape Architectural Accreditation Board. Though preserving the educational standards of the field, accreditation processes limit the expansion abilities of the system by making it cumbersome for universities to create and maintain programs (Dill, 1998). Likewise, it is expensive and difficult to expand existing landscape architecture programs because of the physical space requirements and low student-teacher ratios required for studio classes (Group, 2013; Hunter, 2012).

Combined with a projected increased demand for landscape architects in both developed and emerging economies, it is likely that the existing educational system in landscape architecture is insufficient to graduate enough students to meet the growing demands of the market (Commission for Architecture and the Built Environment, 2010; Grantham, 2011; Smulian, 2010). And as on-line education is increasingly popular in the curricular, structural, and budgetary approaches of universities, it is likely that the design fields will face increased pressure from colleagues and administrators to develop and offer an increasing number of on-line courses within the design disciplines (Christensen & Eyring, 2011; Lokken & Mullins, 2014).

Faced with this likelihood, it is important to conduct a systematic evaluation of the existent knowledge and implications of on-line design education, hereafter referred to as distributed design education (DDE), and how pedagogical and technological solutions can be applied to facilitate DDE. There is a pressing need for this, as the existing research on DDE over the previous two decades is somewhat limited in quantity and evidence regarding the efficacy of DDE (Bender, 2005; Li, 2007). What research has been conducted on DDE has produced results that are both diverse and contradictory, producing a confusing picture of when and how DDE might be best utilized, and to what effect (Bender, Wood, & Vredevoogd, 2004). Additionally, the research has largely focused on the technological, or structural, aspects of DDE and neglected the pedagogical implications associated with transferring a design studio to an online format (Brown & Cruickshank, 2003). Importantly, while the research has noted faculty opposition to the use of DDE, there has not been a systematic analysis of the underlying factors of this

opposition and how those factors may be mitigated (Bender, 2005; Ham & Schnable, 2011; Radclyffe-Thomas, 2008).

This research benefits the field of landscape architecture education by addressing many of the gaps in DDE research that currently exist. Unlike previous work on DDE, which has been largely post-hoc, project-centered, and show-and-tell in nature, this work takes a systematic and deliberate approach in identifying the constraints and barriers to the adoption of DDE. This work uses a meta-synthesis of the current literature to provide clarity on the primary constraints of DDE and, through a national Delphi study, reveals the critical barriers to the adoption of DDE by landscape architecture faculty. Additionally, this work evaluates the rigor and methods used in prior DDE studies to determine research trends and ways that DDE research might be strengthened and expanded.

Faced with looming shortages in education, combined with administrator attitudes towards online education, this work provides a critical lynchpin for the future of DDE. It provides a comprehensive understanding of both the practical and theoretical challenges associated with DDE and lays the groundwork for future research in DDE and the creation of a pedagogy tailored to the unique challenges and characteristics of DDE.

Definition of Terms

Distributed design education (DDE) – Any method of design education wherein teachers and students communicate and collaborate in a geographically distributed format. Although not always the case, for the purpose of this study, it is assumed that DDE occurs in a digital, online format.

Constraint of DDE – Any number of features associated with the implementation of DDE that are perceived to restrict, or negatively alter or impact, the effectiveness of learning in design education. Constraints are largely learner-centric.

Barriers to the adoption of DDE – A barrier to the adoption of DDE is any number of features associated with DDE that prevent or discourage an educator to utilize DDE. Barriers to adoption are largely teacher-centric.

Physical design studio (PDS) – The traditional setting for the reflective process of design education wherein expert teachers mentor students. The PDS is an open or semi-open physical environment intended to encourage rich levels of learning, collaboration, and exploration through intense, project-based learning experiences.

Virtual design studio (VDS) – A digital networked space meant to replicate the experiences of rich learning, collaboration, and exploration found in the PDS. Similar to the PDS, a VDS is designed to foster interaction between teachers and students, but no standard format has been agreed upon in the literature.

Theoretical Frameworks

The primary theoretical framework of this work is Schön's theory of design. Reference is also made to several theories of learning and collaboration, which are described in Appendix A.

Schön's Theory of Design

Schön's (1985) theory of reflective practice in design serves as the foundation for an understanding of the design process and how the PDS functions. Schön's theory is

regarded as the most important theoretical description of the design process, and has become the most widely cited theory of design. Schön theorized that design occurs through a reflective conversation between the designer and the problem, in which the designer works through a series of iterations, carefully assessing the impacts, before selecting one and moving forward in the process. Schön (1985) believes that the act of designing requires students to learn a new process, language, and way of thinking – all of which can be overwhelming to a new student – before they are able to learn to design. However, in the classic paradox described by Schön, (1985) while the learner does not know what it is that he must do, it is only by doing that he is able to learn what he must know. This paradox helps to enshrine the master-student relationship in the design studio, where the student is able to safely practice design while under the careful eye and instruction of a master designer.

Purpose of This Work

This work provides clarity to past findings and fills some of the gaps in the existing research on DDE. The literature on DDE currently describes a field that is unsure of its position. It has often been pursued as a curio, something that has been explored with interest, but the study of DDE has rarely been subject to systematic examination. As such, the constraints of the medium and the barriers to adoption remain unclear, and there remains a significant number of contradictory conclusions on the application, impact, and efficacy of DDE (Bender, 2005; Dave & Danahy, 2000). For example Bender and colleagues (2004), Kvan (2001), and Park (2011) cite increased time commitments as a constraint of DDE. In contrast, Brown and Cruickshank (2003),

Matthews and Weigand (2001), and Radclyffe-Thomas (2008) cite improved time efficiency as a benefit of DDE. Similar disagreement exists on issues related to faculty use of technology, compatibility of DDE with traditional studio pedagogy, monetary cost, and communication and rapport building. Additionally, there has been little research conducted on the barriers to the adoption of DDE by faculty, and what research has been conducted has identified only a handful of barriers (Bender & Good, 2003).

As a result of the confusion on the reported constraints of DDE and the barriers to the adoption of DDE by faculty, it is difficult for landscape architecture educators and institutions to make well-informed decisions on pursuing DDE. There is a need for greater clarity in the research in order for educators to better design DDE courses and mitigate for the constraints and barriers of DDE. In light of these criticisms, this dissertation addresses the following two research questions related to DDE:

1. What are the reported constraints to the use of DDE in the literature, how might these be categorized, and what areas need additional research?
2. What are the perceived barriers to the adoption of DDE by landscape architecture faculty?

Dissertation Structure

This dissertation has the following structure. Chapter II discusses the current literature on DDE and collaborative and learning theories relevant to design education. Chapter III describes the methods utilized in the study to determine the constraints of DDE through a meta-synthesis of the literature, and the use of a Delphi study to identify the critical barriers to adoption. Chapter IV describes the results of both the meta-

synthesis and the Delphi study. Chapter V discusses the results of the study and the implications of the identified critical barriers, future research needs, and the limitations of the study.

CHAPTER II

LITERATURE REVIEW

Education in Landscape Architecture

Modern design studio pedagogy and the PDS trace their origins to the École des Beaux-Arts, the Parisian art and design school that came to prominence in the 19th century. The pedagogical approach of the École was built on the principles of the earlier guilds and apprenticeship systems in place for centuries, and focused largely on instruction in and mastery of design and artistic skills. Design students worked on projects under the close supervision of master teachers, who provided modeling, instruction, and criticism to the students (Anthony, 1991; Rogers, 2001). Students participated heavily in artistic classes, which oftentimes consisted of copying detailed illustrations prepared by a master or noted artist (Anthony, 1991; Rogers, 2001). Thus the instruction of the École may best be conceptualized as a blending of design practice and traditional rote memorization, as students were often evaluated on their ability to reproduce existing artwork.

Throughout the 20th century there was a shift from a significant emphasis on the teaching of artistic skills, in the model of the École des Beaux-Arts, to an emphasis on teaching design process. In the design fields, the Bauhaus introduced significant alterations to design pedagogy by promoting a holistic approach to design that placed greater emphasis on process and the intermingling of the design fields. However, the basic tenants of the pedagogy and learning environment continued in the form of the PDS

and the master-learner relationship (Blumenfeld et al., 1991; Hubbard & Kimball, 1917; Itten, 1975).

The shift to an emphasis on process began in earnest following World War II, when new designers and educators introduced methods, materials, and styles that challenged the established paragon of design and design education. Driven from Germany by the Nazi regime, many of the leading instructors of the Bauhaus, such as Walter Gropius, Marcel Breuer, Josef Albers, and Laszlo Moholy-Nagy, would obtain academic positions at the most influential design and art schools in the United States. In these positions, their influence would be an important impetus for the elevation of the process-driven curriculum in design education (Rogers, 2001). Later, under the influence of luminaries such as Christopher Alexander (1964), Ian McHarg (1969), and Herbert Simon (1996), the design process came to be seen as a rational approach, with the process being crafted in such terms as design problems, solutions, and alternatives (Alexander, 1964; Dorst, 2003).

Despite the shift over the last century to a rational, process-focused approach in design education, the PDS remains as the fundamental instructional environment (Bender, 2005; Broadfoot & Bennett, 2003). While the curriculum and design approach underwent significant alterations, the basic pedagogical tenants of design education remain relatively constant. These are, in summary, that students learn best in an environment that provides ample opportunities for instruction and modeling from a master, and where students can freely observe and collaborate with their peers. The studio is meant to be a rich learning environment in which students must confront the

complexities of realistic design situations and, by so doing, advance their understanding and skills.

While the studio has served as the foundation of design education for nearly two centuries, it was not until the 1980s that the learning processes occurring within the studio were theorized by Donald Schön (Webster, 2009). Schön proposes a theory of design learning in which the studio is a setting for “reflective practice,” the process whereby the designer continually analyzes the problem, process, and their actions in order to arrive at an optimal design solution (Schön, 1983, 1985). Schön describes this process as a conversation between the designer and the design, implying an iterative process not entirely controlled by the designer, that results in moments of struggle and serendipity as the designer navigates the process (Schön, 1985). The design process is a somewhat nebulous exercise in directed exploration and problem solving.

The complexity and ambiguity of the design process is what precipitates the master-learner relationship in the studio. On its face, good design may seem easy to perform; yet the student quickly learns that the process is difficult to master. Schön (1983) emphasizes the need for the master to tutor the student when he describes the paradox of the design studio: the student cannot know what needs to be done to design successfully, yet the student can only learn what needs to be done by designing. By its very nature this would imply a frustratingly circular learning situation in which the student must muddle through the process, learning in fits and starts by trial, error, and exploration, and a setting in which the careful guidance of a master to provide instruction and modeling is highly valued.

Theorization of the Design Studio Environment

In addition to the historical and pedagogical foundations of the design studio, it is also important to discuss the social organization and functions of the studio, including the relationship between the master and learner, and between learners. The nature of the master-learner teaching relationship of the PDS can be theorized by LPP theory, and the studio environment by DisCog and AfS theory, in which students are exposed to authentic design activities under the guidance of a studio master in an open environment in which students are free to observe, learn, and collaborate with each other (Black, 2008; Gee, 2004; Lave & Wenger, 1991; Schön, 1985). This intensive social learning environment is the critical element of studio education, and is venerated by design educators as the most important mechanism in teaching design (Schön, 1985). As a result of the development of a more rationalistic approach to design, the social structure of the studio increasingly resembles the collaborative learning environment Hutchins (1995) describes in DisCog theory, that is, a rational, replicable, approach to design, where the process is separated into discrete tasks. This means that more advanced students are better able to act as tutors to less advanced students as they master each task. Similar to Hutchins' (1995) description of naval crewmen learning from those above them and tutoring those below them, in the modern studio there is an expectation that upperclassmen learn from the studio master while simultaneously providing instruction and modeling to lower classmen.

As a student masters each task they assume a new role as a teacher and are then able to act in the role of a teacher to help tutor other students. This shifting of social

learning roles within the studio, based on knowledge and competencies, closely resembles AfS theory, wherein a fluid social structure enables members of the learning community to simultaneously maintain an identity as a master and learner, dependent upon the discrete design activity being performed. Thus, the social hierarchy of the studio may be envisioned as static only at the top (between the studio master and the students) and then students engage in a fluid social hierarchy based on their individual competencies in design or other technical tasks (see Figure 1) (Black, 2008; Gee, 2004).

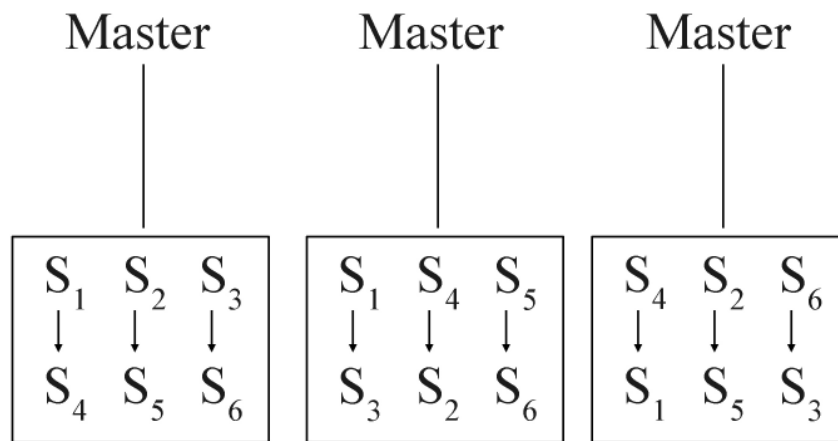


Figure 1. Studio social hierarchy. This graphic demonstrates the shifting social hierarchy in the studio in which different students may act as mentors within different realms of knowledge.

Research in Distributed Design Education

Beginning in 1995, there was a great deal of interest generated by the exploration and development of early DDE techniques in the form of the VDS. Early models of

VDSs were used in architectural programs at the National University of Singapore, the University of Sydney, the University of British Columbia, Cornell University, and George Washington University (Broadfoot & Bennett, 2003; Dale, 2006; Maher, Bilda, & Gül, 2006; Sagun, Demirkan, & Goktepe, 2001). These early experiments were typically built around a short design project, few appeared to have much longevity beyond their initial use, and they are best viewed as forward-thinking explorations of the use of technology for both design and collaboration. By today's technological standards these early VDS projects are rudimentary, but at the time they demonstrated an important proof of concept that would encourage continued exploration by researchers and instructors.

Unfortunately, these early descriptions focus most of their commentary on the technological tools being utilized, a trend that has since continued in most of the disseminated work on DDE, and the majority of articles detailing the use of a VDS do not consider or emphasize the social and pedagogical implications of a VDS (Bender & Good, 2003; Budd, Vanka, & Runton, 1999; Maher & Simoff, 1999; Maher, Simoff, & Cicognani, 1996; Simoff & Maher, 1997). There are notable exceptions to this focus on the novel use of technology for collaboration. For example, Cheng (1998) explores the potential of DDE to mimic and improve upon the social relationships that exist in a PDS, and explicitly discussed the unique challenges of establishing authentic social identities and relationships in a VDS. Kvan (2001) is an early example, and one of only a handful, who addresses the fact that the use of a VDS precipitates a reevaluation of the accepted design studio pedagogy because it so alters the physical environment in which learning occurs.

From the period of 1999-2003, there is a considerable amount of material published on the subject of DDE, with 19 journal articles or conference proceedings existent in the literature. However, the publication rate ebbed beginning in 2004 before rising again in 2008, coinciding with the maturation of Web 2.0 technology, and again in 2011 as advanced communication programs, technologies, and mobile devices began to see widespread use (see Figure 2). During the first decade of the literature, there is an excitement about the potential of DDE to provide learning opportunities unavailable within the PDS model. Researchers repeatedly discuss the benefits of the VDS to design education. Researchers especially note the ability of DDE to provide students with access to geographically dispersed individuals, enabling collaboration with other students, educators, practitioners, critics and clients that would not have been possible in a PDS (Dave & Danahy, 2000; Kvan, 2001; Levine & Wake, 2000). DDE offers the ability to expose students to foreign cultures and practices, potentially altering the way they perceive and think about design and social values (Kvan, 2001; Sagun et al., 2001). Utilizing a VDS increases time flexibility and efficiency in teaching, enabling higher contact rates between the student and instructor and more time spent in deeper discussion about topics (Brown, Hardaker, & Higgett, 2000; Kvan, 2001; Li & Murphy, 2004; Shannon, 2002). Researchers also suggest that DDE could enable a greater emphasis and understanding of the design process through the preservation and efficient organization of data related to the iterative development of a student's design (Brown et al., 2000; Matthews & Weigand, 2001; Sagun et al., 2001; Schnable, Kvan, Kruiff, & Donath, 2001).

Despite the apparent excitement about the potential of DDE, interest wanes somewhat after 2003, and the literature becomes more critical in its evaluation of the medium, possibly due to a disappointment with the ability of the contemporary technology to mimic the PDS (Radclyffe-Thomas, 2008). Several researchers cite a perception by teachers that DDE was incompatible with the studio teaching method, and therefore not suitable for teaching design (Bender, 2005; Radclyffe-Thomas, 2008; Saghafi, Franz, & Crowther, 2012b). Closely connected with suggestions of incompatibility are reports of faculty opposition to the adoption and use of DDE, especially because of technical requirements such as mastering new programs and technology (Bender & Vredevoogd, 2006; Li, 2007; Radclyffe-Thomas, 2008). Concerns are also frequently repeated that both the start-up and ongoing costs of offering a DDE course were too expensive for both programs and students, and that a successful implementation of DDE was simply too cost prohibitive (Bender et al., 2004; Brown & Cruickshank, 2003; Park, 2011). Finally, it appears that the early efforts in DDE do not provide adequate social scaffolding, and researchers believe that, while the medium demonstrates promise, neither the technology nor digital environment provide for the rich social interactions that occur within a PDS (Broadfoot & Bennett, 2003; Niculae, 2011; Saghafi et al., 2012b).

Many of these shortcomings are noted in the earliest work on DDE, especially the social shortcomings of early experiments, but these shortcomings are typically framed as areas of study that need refinement, and not as major stumbling blocks (Cheng, 1998; Kvan, 2001). However, later examinations of DDE are more stinging in their criticisms, unequivocally describing DDE as unable to teach “difficult subjects such as theory or

mathematical calculations” (Li, 2007) and unable to “replace the [sic] traditional architectural [design] education” (Niculae, 2011).

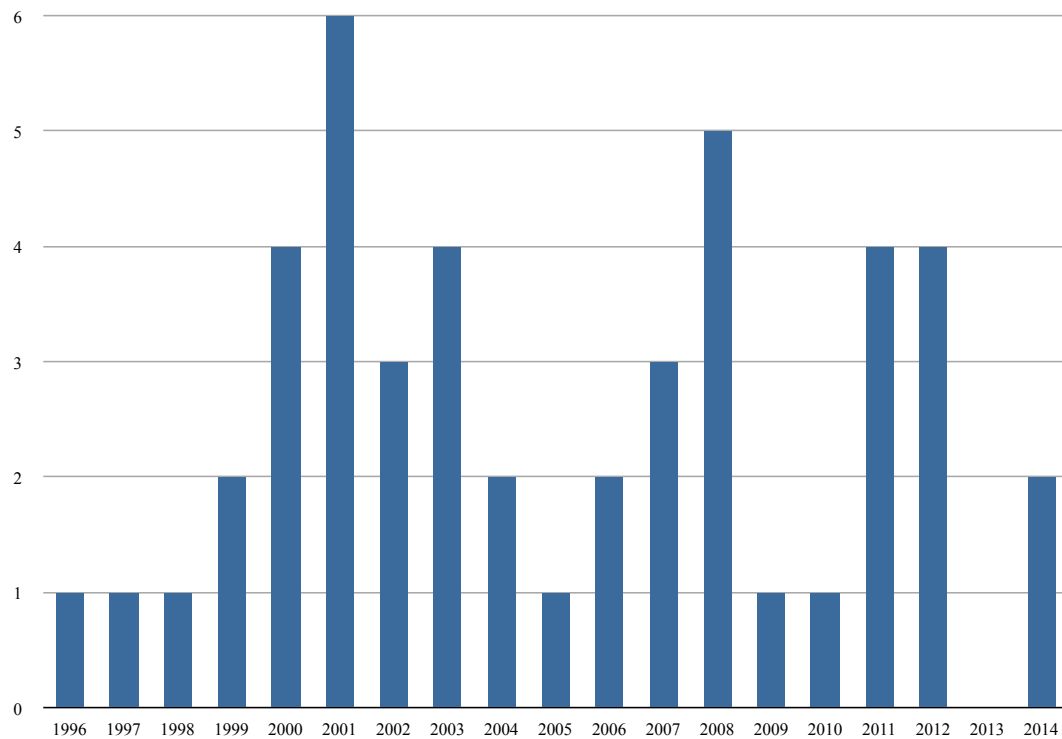


Figure 2. Chronological history of publications in DDE.

Since 2011, there has been a revival of interest, and a guarded optimism, in the ability of new technology to enable DDE to overcome the described constraints. Saghafi, Franz, and Crowther (2012a) undertook an analysis of the role of DDE in design education, concluding that DDE is well suited to supplement traditional design education because of the flexibility that DDE offers and its ability to provide greater control to the learner. The widespread use of new technologies and platforms, such as social media and virtual worlds, also provides researchers with expectations that earlier problems with

social interaction will be overcome with time, especially with a new generation of students who have grown up using these online social tools (Ham & Schnable, 2011; Wang, 2011).

Beyond the quantity of the work published, it is important to discuss the nature of the work published on the subject. The large majority of work published on DDE consists of show-and-tell pieces in which most evaluation of DDE is done in a discursive format, information is collected by convenience, and analysis methods develop post-hoc. Of the 46 publications in the literature review, 30 do not provide any rigorous method of analysis, either quantitative or qualitative. Readers are left to essentially accept the researcher's conclusions *carte blanche*, as sparse evidence is provided to justify the conclusions. The remaining 16 articles incorporate a critical research element into their analysis of DDE with varying degrees of rigor.

Furthermore, the majority of the published work focuses on design projects using more mature design students and focus on the design process, but there is limited discussion in the literature related to design pedagogy. Subsequently, much of the analysis presented in the literature focuses on facilitating collaboration between students, including a focus on the sharing and presentation of information and technical aspects of distance collaboration. Little analysis exists on the pedagogy and learning implications of DDE, namely to what degree can DDE facilitate the teaching of design, especially when dealing with novice design students.

Finally, interest in DDE remains limited to a relatively small number of researchers, and nine authors account for over half of all published material on DDE. Bender and Good (2003) note that while there is considerable interest in online education

amongst many art fields, a National Education Association survey found that only 1% of educators in artistic fields had taught an online course. This has important implications for both the dissemination and development of research on DDE. After nearly two decades of work, it would appear that research on DDE has developed only a limited groundswell in interest from new researchers. The relatively small research pool also creates an insular environment of mainly DDE acolytes, a state of affairs that may have contributed to the development and continuation of less-rigorous research practices in the field, as there have been fewer detractors to answer.

CHAPTER III

METHODS

Introduction

This chapter describes the meta-synthesis and Delphi methodology used in this study. The meta-synthesis method was first proposed by Noblit and Hare (n.d.) as meta-ethnography, a method for synthesizing qualitative studies. It is used for analyzing and synthesizing the findings of qualitative studies, which rarely share similar methods of measurement or analysis.

The Delphi method was developed in the 1940s by researchers at the RAND Corporation as a means of strategic military forecasting, and has proven remarkably robust in its ability to be applied to a variety of subjects (Linstone & Turoff, 1979). It is especially valuable for studying subjects where theories and concepts are ill-defined or nascent, making it an ideal choice for studying DDE.

Research Questions

This research was conducted to answer the following research questions:

1. What are the reported constraints to the use of DDE in the literature, how might these be categorized, and what areas need additional research?
2. What are the perceived barriers to the adoption of DDE by landscape architecture faculty?

Study Design and Methodology

Two primary methods are utilized in this study to answer the research questions. To answer question 1, a meta-synthesis of the literature is used to identify and code the constraints of DDE as reported in the literature. To answer question 2, a Delphi study is used to identify the barriers to the adoption of DDE by landscape architecture faculty.

Meta-Synthesis of DDE Literature

Because the majority of the research on DDE is qualitative in nature and does not use statistical measures, a meta-synthesis is utilized to analyze, code and synthesize the literature in order to identify the constraints of DDE. Meta-synthesis is an increasingly popular technique used to “explain the findings of a group of similar qualitative studies” (Walsh & Downe, 2005). A specific meta-synthesis approach, thematic synthesis, is utilized to synthesize the results of DDE research and identify the constraints of DDE (Barnett-Page & Thomas, 2009).

Identification of Literature

Discovery of the literature was initiated using Google Scholar and the search term “online design education.” Because of the unique use of the studio method in design education, the literature included in the meta-synthesis was limited to published literature describing the use of DDE in the fields of landscape architecture, architecture, or interior design. The initial handful of articles were mined for additional search terms, and more terms were discovered by consulting the Academic Search Premier subject terms

database. From this follow-up search, the following terms were subsequently used to search for articles on Google Scholar: “online design education architecture,” “online design education landscape architecture,” “online design education interior design,” “distance design education,” “web-based design education,” “virtual design studio,” “online design studio,” “online architecture studio,” and “distance education studio.”

The use of these search terms led to the discovery of 16 publications. The reference sections of each of these publications (and subsequently discovered articles) were mined for additional publications related to DDE. In addition, a search was conducted of literature citing each identified DDE publication using Google Scholar. This mining of references continued until no new DDE publications were discovered, and resulted in the identification of 46 publications (see Table 1 for a description of the literature found).

Table 1
DDE Publications Types

<i>Type of Publication</i>	<i>#</i>
Journal Article	27
Conference Proceeding	15
Book	1
Book Chapter	2
Industry Publication	1

Thematic Synthesis Method

There are three steps to the thematic synthesis process. In the first step, the literature is open-coded line by line. In the second step, the initial list of codes is

analyzed and similar codes are grouped together. In the third step, analytical themes are developed which both synthesize the literature and propose new theoretical constructs through which to understand the body of research (Thomas & Harden, 2008).

Thomas and Harden (2008) discussed the inherent difficulty of synthesizing results from qualitative studies in the initial coding stage, noting there is often difficulty assessing the quality and clearly identifying the results of studies. The present study has identified the need for improved rigor in both the design and reporting of DDE studies. However, because of the limited number of studies in DDE, no studies were excluded from the meta-synthesis on the basis of quality.

Following the model for a thematic synthesis, the literature was open-coded using a line-by-line analysis. In identifying the results of the literature, each explicit statement deemed to describe a constraint was coded as a specific constraint. A couple of statements from Brown and Cruickshank (2003) can be used to demonstrate the coding process. Brown and Cruickshank (2003) stated “It became apparent that students following the online version of the module found it difficult to keep up the pace of study.” This statement was not coded as a constraint because the statement is too broad in its scope and does not provide specific rationale. Later in the same paragraph, Brown and Cruickshank provided two statements that explicitly clarify the first quotation, both of which were coded as constraints. The first statement: “Informal feedback revealed that students did not feel they had to prioritise [sic] online study because if they did not meet a deadlines they would not have to face a tutor, only a text message“ was coded as: Requires motivated and organized student. The second statement: “Another emergent problem was lack of student confidence that they understood what was required of them”

was coded as: More scaffolding needed to give students direction. Every instance of a constraint of DDE identified in the first phase of the meta-synthesis was compiled in a spreadsheet listing the specific constraint or barrier, and the number of instances mentioned. After reviewing all of the literature, the list of constraints and barriers were consolidated into a list of 24 codes.

These codes evolved through a constant comparison process, in which code sources from individual articles were compared throughout the process (Barnett-Page & Thomas, 2009). In a meta-synthesis, this procedure of constantly comparing and altering codes is related to the process of translation, which is the method of identifying and comparing similar concepts found in different studies. This iterative process is fundamental to a meta-synthesis because qualitative studies do not utilize standardized measures and reporting (in contrast to quantitative studies), and therefore it is often necessary to identify similar concepts that are described using different terms and constructs.

To demonstrate this translation process, and its role in coding, excerpts from the following three articles provide an example of the process in developing the DDE constraint code: *perceived incompatibility with studio method*. Saghafi et al. (2012b) posited that “design education needs face-to-face activities such as peer-learning and cannot be successful in a full online mode”. This statement was originally coded as: *lack of face-to-face interaction* (not of concern in the present example) and *online design courses are unsuccessful*. Bender and Good (2003) stated that educators do “not believe that studio courses are suitable for distance education delivery.” This was originally coded as *faculty believe studio courses can't be taught online*. However, in the process

of constantly comparing the codes and the coded statements, it was determined that Saghafi, Franz and Crowther and Bender and Good were both referring to the same constraint, the belief, justified or otherwise, that studio courses can not be taught online. A third article, by Radclyffe-Thomas (2008), stated that failure to use online education “may result from teachers’ pedagogical belief that the computer does too much for the student, or that the computer itself is a barrier to students’ artistic expression with students using ‘found material’ in preference to creating their own visuals.” This statement is very similar to that made by Bender and Good (2003), but Radclyffe-Thomas included the term *pedagogy* in describing teacher’s attitudes about DDE. Combined with the previous two statements, this suggests that the constraint may not be the inability of DDE to structurally replicate the studio, but the incompatibility is related to the studio pedagogy. Although each of these three articles describe the constraint in slightly different terms, all three discuss the same fundamental issue. All three were coded together and the final code was *perceived incompatibility with studio method*.

This translation process also occurred in the second phase of the meta-synthesis when, following the development of the coding list, each publication was again reviewed to confirm that the described constraints or barriers were accurately coded, and adjustments to the codes were made where necessary. As a result of this second review, an additional two codes were created, when the code *feelings of isolation by students* was separated from *building rapport and a sense of community takes longer/not possible*, and *unreliability of some internet resources* was separated from *technical constraints or difficulties*. This results in a list of 26 coded constraints (see Table 2).

After the second round the constraints were ranked using an instance count of the number of articles that identified each coded constraint. This provides a measure of magnitude with which to compare the relative importance of the constraints identified in the meta-synthesis with the barrier rankings from the Delphi study.

To confirm the viability of the final code list, three publications were open-coded by a second researcher. The coding results of the study author and the second researcher were compared and, in instances of disagreement between the coding, a discussion ensued as to which code was most accurate. As a result of this review, the coding scheme was validated with no changes warranted. The result of the coding process is a concise picture of the findings from the literature and provided a number count ranking of the number of instances each barrier was mentioned.

The third phase of the thematic synthesis process is the synthesis of the studies to produce “additional concepts, understandings or hypotheses” beyond the findings of the literature reviewed (Thomas & Harden, 2008). In the case of this study, the synthesis of the third stage is most concerned with the categorization of the identified constraints and the development of a list of potential barriers to the adoption of DDE.

In order to categorize the constraints, the list of codes were first organized into groups of constraints that shared a similar thematic component. For instance, the following constraints are deemed to have an overriding social component to them:

1. Building rapport and sense of community takes longer/not possible
2. Lack of face-to-face interaction / communicating non-verbal cues
3. Difficulty with collaboration
4. Feelings of isolation for student

Table 2
List of the Coded Constraints from the Meta-Synthesis

<i>Coded Constraints</i>
1. Lack of face-to-face interaction / communicating non-verbal cues
2. Time and resources needed to develop/teach online courses
3. Technical constraints or difficulties
4. Issues with faculty technology adoption
5. Student technology proficiency required
6. Building rapport and sense of community takes longer/not possible
7. Advanced technologies may be too expensive
8. Perceived incompatibility with studio method
9. Difficulty with collaboration
10. Unreliability of some internet resources
11. Faculty spent too much time online
12. Faculty opposition
13. Limited adoption by faculty
14. Requires motivated and organized student
15. Feelings of isolation for student
16. Potential negative impact on creativity
17. Fears that technology will replace faculty and/or staff
18. Lack of precedent
19. Students may need to purchase new technology
20. More scaffolding needed to give students direction
21. Cultural conflicts with collaborators
22. Lack of interaction with a physical site
23. Unsuitable for difficult design subjects
24. Difficulties conducting juries
25. Perception of technologically produced designs as inferior
26. Students focus on learning technology instead of the design process

For each of these constraints, the common thread uniting them is social interaction between students or between a teacher and students. When it was not readily apparent how a coded barrier should be categorized, the coded statements from the

literature were consulted. For instance, *difficulty with collaboration* could also potentially be categorized as either pedagogical or structural. However, upon consulting the literature, it becomes clear that researchers were more concerned about the social nature of collaboration, ie. the interaction between students. For instance, Saghafi et al. (2012a) related the concerns of students that a VDS is “not conducive to collaboration.” In describing why this is the case, the VDS is described in social terms such as individuals and independence. Additionally, Brown et al. (2000) described a lack of networking, another primarily social concern.

The second important aspect of the synthesis phase was the use of the constraints to develop the potential barriers to adoption to use in the Delphi survey. As previously defined, constraints are any number of features associated with the implementation of DDE that are perceived to restrict or negatively impact the effectiveness of learning. It is reasoned that constraints, while distinctly separate and different, could be closely related to barriers, and therefore serve as the foundation from which to theorize on the potential barriers to adoption. For instance, an identified constraint of DDE is that *building rapport and sense of community takes longer/not possible*. From this constraint, we can induce that if faculty were to believe students are not able to build rapport in an online course, than this belief would constitute a barrier to the adoption of DDE. Not all of the identified constraints implied the existence of a potential barrier. For instance, the constraint *cultural conflicts with collaborators* does not imply a barrier to adoption because collaborating with other cultures is not a requisite part of DDE, and an instructor could adopt DDE without requiring students to collaborate with individuals from other

Coded Constraints	Barrier
Lack of face-to-face interaction / communicating non-verbal cues Lack of interaction with a physical site	Lack of face-to-face interaction prevents verbal and non-verbal communication in a distributed design
Time and resources needed to develop/teach online courses	Upfront costs may deter development of design courses for distributed delivery.
Advanced technologies may be too expensive	Ongoing costs may deter the continued offering of a distributed design course.
Unreliability of some internet resources	Technologies necessary for distributed delivery are too expensive for programs to purchase.
Technical constraints or difficulties	Internet resources may be unreliable due to disruption of an internet connection or the moving of a web link or web content.
Issues with faculty technology adoption	Faculty members struggle to adopt technology necessary for distributed design education.
Student technology proficiency required	Faculty members are unwilling to adopt technology necessary for distributed design education.
Building rapport and sense of community takes longer/not possible	The technological proficiency required of students in a distributed design course is unreasonable.
Perceived incompatibility with studio method	Building rapport with others is difficult in a distributed environment.
Difficulty with collaboration	Instructors believe the studio method cannot be replicated using a distributed design environment.
Faculty spent too much time online	It is difficult for students to collaborate in a distributed design course.
Faculty opposition	Teaching/managing a distributed course consumes unacceptable amounts of faculty time.
Requires motivated and organized student	Faculty members oppose the use of distributed design education because of theoretical or pedagogical disagreements with online education.
More scaffolding needed to give students direction	Only motivated and organized students are able to succeed in a distributed design environment.
Feelings of isolation for student	Students feel socially isolated from their peers and may suffer from a lack of social interaction with their peers in a distributed learning environment.
Potential negative impact on creativity	Characteristics of the distributed environment constrain a design student's creative process.
Students focus on learning technology instead of the design process	Faculty are concerned that distributed design courses will lead to a decrease in tenured faculty positions.
Fears that technology will replace faculty and/or staff	Private concern that distributed design courses will threaten personal job security.
Lack of precedent	A lack of precedent in distributed design education deters programs from committing to developing such courses.
Limited adoption by faculty	Technologies necessary for distributed learning are too expensive for students to purchase.
Students may need to purchase new technology	Critiquing student work is difficult in a distributed environment.
Difficulties conducting juries	Designs produced solely using computers are inferior.
Perception of technologically produced designs as inferior	Dropped - collaborating with other cultures is not a requisite part of DDE
Cultural conflicts with collaborators	Dropped - implies use of DDE for only a specific cohort of students or type of project
Unsuited for difficult design subjects	

Figure 3. The development of the list of potential barriers from the constraints identified in the meta-synthesis.

cultures. Figure 3 illustrates the synthesis decisions in which the potential barriers to adoption were extracted from the identified constraints.

Delphi Study

The Delphi method has been used in many different disciplines as a means of building consensus (Pollard & Pollard, 2004). The Delphi achieves this through a mediated discussion designed to control for the biases of face-to-face discussion, namely undue influence by dominant individuals, distracting and non-essential communication, and pressure for an individual to conform to group opinion (Fischer, 1978). While controlling for these biases, the Delphi also encourages involvement and ownership of the research process amongst participants, making the Delphi an attractive method when dialogue and consensus-building are critical aspects of a project, as is the case in identifying the barriers to the adoption of DDE (Keeney, Hasson, & McKenna, 2001).

Justification for Use

The Delphi method is particularly well suited to a study identifying the barriers to adoption of DDE for several reasons. First, the method has been identified as an ideal way to study subject areas that have remained ill-defined, or where there is little knowledge and certainty (Baker, Lovell, & Harris, 2006; Hasson, Keeney, & McKenna, 2000; So & Bonk, 2010). As was discussed, much of the work on DDE has focused on descriptive practices and has not explored the underlying theories and methodologies; and what work has been done has typically been less rigorous in nature and produced

contradictory results. Secondly, there is precedent for the use of the Delphi in determining the perceived obstacles to implementation of practices, which is one of the major concerns of this study (Herring, 2004; Kramer, Walker, & Brill, 2007; So & Bonk, 2010). Third, the Delphi allows for a continued discursive evaluation of a subject that cannot be easily quantified or in other ways studied (Pollard & Pollard, 2004). DDE deals with theories and practices that are best explored in a continuous method that allows for discussion amongst participants. Fourth, the Delphi provides a cost-effective solution when it is not possible to bring together many experts or panelists to a physical location (Pollard & Pollard, 2004; So & Bonk, 2010). Fifth and finally, the Delphi provides for a mediated discourse between panelists by controlling for many of the drawbacks of a face-to-face discussion (Fischer, 1978; Hasson et al., 2000).

The Delphi is also valuable in an academic setting because it helps mitigate social power structures in the panel. With a subject such as DDE, that is perceived to potentially threaten many long-held design teaching traditions and beliefs, it is important that individuals are able to freely and openly convey their opinion without undue influence from particularly powerful individuals, or pressured to conform to traditional positions. It is possible the power structure between tenured and pre-tenured faculty would significantly alter or suppress the opinions of pre-tenured faculty participants, who may not want to be seen to disagree with their tenured peers. The anonymous nature of the Delphi ensures that discussion of DDE can occur in a setting free of the tenure power structure

Sampling Procedure

A Delphi study is composed of a series of moderated surveys distributed to an expert panel. At the heart of the Delphi is the concept of the expert, an individual who is qualified to discuss and help form consensus on a subject. The panelists provide a readily accessible source of informed opinion that can be leveraged by the researcher to produce informed and defensible group conclusions (Baker et al., 2006).

Panel

Perhaps the most important step in the Delphi process is the selection of the panel. The selection of the panel is where the greatest chance of bias in the process exists, and the researcher needs to work to ensure that the composition of the panel does not intentionally favor one outcome over the other (Keeney et al., 2001). Baker et al. (2006) have noted that the panel composition should represent as heterogeneous a group as possible, as it is believed any consensus that emerges from such a diverse group carries more legitimacy. This survey attempted to use as large a panel as possible.

As the target population of this study is educators at accredited landscape architecture schools within the United States and Canada, the expert panel was initially drawn from educators who participated in the Design Teaching and Pedagogy track of the Council of Educators in Landscape Architecture Annual Conference (CELA) in 2011, 2012, or 2013. CELA is the national body of landscape architecture higher education programs, and their annual conference represents the largest gathering of landscape architecture educators in the United States, providing a simple and effective recruiting ground for educators who are active in research and teaching in the field. It is believed

that individuals who presented in the Design Teaching and Pedagogy track at CELA constitutes a pool of qualified experts to participate in the panel because of these individual's demonstrated interest in critically analyzing the many aspects of landscape architecture education and design pedagogy.

Presenters were solicited to participate in the Delphi study via a personalized email delivered through the Qualtrics survey system. In addition to panelists drawn from CELA, solicitations were also sent to the department heads of every Landscape Architectural Accreditation Board accredited or candidate landscape architecture program in the United States. Department heads have a holistic understanding of faculty attitudes and concerns, and of the university system, that enables them to critically value the potential barriers to the adoption of DDE. Additionally, as educators and administrators in the field, both CELA presenters and department heads are important stakeholders and decision-makers, and their participation provides an important degree of legitimacy to the research.

Because many qualified individuals may not have presented at CELA, and to mitigate any potential selection bias, active recruitment of additional participants for the study was done using a snowball sampling procedure during the initial solicitation of participants. Potential participants were asked to refer other design educators or design professionals they believed were ideally suited to participate in the panel. Recommended individuals needed to meet at least one of the following criteria to be included in the panel:

1. Currently teaches a design studio class at a LAAB, AIA, or CIDA accredited or candidate program.
2. Has taught a design studio class at a LAAB, AIA, or CIDA accredited or candidate program within the last five years.

Solicitations to participate in the survey were initially sent to 188 identified potential participants. A total of seven respondents provided three additional potential participants, who were subsequently invited to participate, bringing the total to 191 total invitations sent. Of those, 43 agreed to participate on the panel (40 original invitees and 3 referrals), for an initial participation rate of 22.5%. This participation percentage is lower than reported in similar Delphi studies (Brancheau, Janz, & Wetherbe, 1996; Kramer et al., 2007), but the total number of participants is consistent or larger than many reported Delphi surveys in other fields (Fischer, 1978; Ono & Wedemeyer, 1994; So & Bonk, 2010). Traditionally, the panel has been made up of a modest number of panelists (10-30), although it has been demonstrated that larger groups can be used successfully (Fischer, 1978; Herring, 2004; Kramer et al., 2007; Schmidt, Lyytinen, Keil, & Cule, 2001). Because the total number of participants was within the range of other successful Delphi studies, the participation rate on the panel was deemed satisfactory for this study.

Ethical Treatment of Study Participants

When dealing with human subjects, it is important to take appropriate safeguards to ensure proper protection for the subjects and guard against unethical behavior by the researcher. Prior to the recruitment phase, the instruments and methodology of this

Delphi study were submitted for review, and was approved by the Institutional Review Board at Utah State University as an IRB-exempt study on March 11, 2014.

Instruments

The survey rounds were conducted online via Qualtrics. During the surveys, quantitative data was collected using a 7-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree). A comment field was included with each question to collect qualitative data in the form of declarative statements.

The coded constraints identified in the meta-synthesis were utilized to create the questions describing the potential barriers to the adoption of DDE. Each question consisted of a single barrier to adoption contextualized in a statement. Panelists were asked to indicate on the Likert-scale to what degree they agreed that the suggested barrier in the question represented an actual barrier to the adoption of DDE. It was important that the survey was worded in a manner to avoid both confusion and response bias because some of the concepts and barriers associated with DDE may have been unfamiliar to panelists. To mitigate for these potential problems, the first-round survey was reviewed by faculty in the Landscape Architecture & Environmental Planning Department at Utah State University. As a result of feedback from faculty members, adjustments were made to the survey to clarify the meaning of the wording on a couple questions.

The first-round survey included 22 potential barriers to faculty adoption of DDE in landscape architecture that were identified during the meta-synthesis (see Appendix

B). In order to fully utilize the knowledge of the panel, the first round survey also provided an opportunity for panelists to suggest additional barriers they believed should be considered by the panel. If a newly coded barrier was suggested by 5% of the panel (2.1 persons), it was added to the second round survey. Because of the number of questions presented to the panelists, and in an attempt to reduce participant burnout while completing the survey, the survey was delivered across multiple webpages, with each webpage containing, at most, five questions to consider.

The collection of declarative statements encourages participants to justify their position to other participants and enable a richer level of understanding in the final analysis. It is believed that asking respondents to provide explanations for their choices helps to mitigate any tendency by panelists to make snap judgments or merely conform to the group (Hill & Fowles, 1975).

A demographic survey was appended to the first round to collect data on the age, gender, highest degree completed, studio teaching experience, online teaching experience, computer literacy, and private practice experience of the panelists (see Appendix C). The collection of demographic data provided a basis for sub-analysis of the data and to reaffirm the credibility of the panel (Schmidt, 1997).

Survey Rounds

Each survey round was distributed via Qualtrics with a deadline of three weeks to complete the round. In each round, a reminder email was sent out after two weeks to those who had not yet completed the survey. During the third round a second reminder was sent out a couple of days before the deadline. Four days elapsed between each

round, during which time the declarative statements from the previous round were coded and the survey for the next round was created and reviewed for accuracy (see Table 3).

Table 3
Timeline of the Delphi Survey

<i>Survey Phase</i>	<i>Duration</i>
Recruitment	28 days
Round one	21 days
Analysis of data from round one	4 days
Round two	21 days
Analysis of data from round two	4 days
Round three	21 days

Round 1

The first round consisted of a prepared survey constructed from the findings of the meta-synthesis. The survey included a list of the barriers to the adoption of DDE and a short description of each barrier to provide clarity and context. Panelists were asked to rate the importance of each barrier on a 7-point Likert scale, and were provided a space to submit written a declarative statement about that particular barrier. The results of the first-round survey were analyzed using a variety of statistical measures, including standard statistical distribution measures and a measure of stability (discussed in Chapter IV).

While most Delphi studies utilize an open-ended first round survey in the initial round to solicit the panel's expertise on the subject and to provide a rich set of information from which to construct the subsequent surveys, there is also precedent for using a prepared survey (Hasson et al., 2000; Herring, 2004). A prepared survey has some benefits over using an open survey, including reducing the number of rounds and

reducing the number of potential barriers to a more manageable size, as it was noted that an initial open-ended round may produce very lengthy surveys that deter continued participation by experts (Keeney et al., 2001).

Suggestions for additional barriers were collected during the first round. All of the suggestion barriers were coded to determine if they fell within a current barrier, or represented a new barrier to be added to the survey. In addition to the 22 original barriers, two panel-suggested barriers from the first round met the inclusion threshold of 5% and were included in the second round, bringing the total number of barriers to 24.

Round 2

Following the completion of the first round, the second-round survey was constructed using the same barriers (plus the two new barriers), questions, and data collection methods as the first round. However, in the second round, panelists were also shown their previous response on the Likert scale for each question, as well as the panel's mean, standard deviation, and any submitted declarative statements for each question. The statements were included unedited, except in cases where the comments may have revealed the identity of a panelist. In these instances, the statement was modified to render it anonymous without changing the intent of the comment. Upon considering the statistical feedback and declarative statements from other panelists, each panelist was asked to reconsider their response to each question.

Round 3

Round three followed the same format as round two. The statistical measures and declarative statements from the second round were provided to the panelists and they were once again asked to measure their agreement on each question.

Conclusion of the Delphi

Most Delphi studies are concluded after a pre-determined number of rounds or once the distribution of the responses fall within a pre-determined IQR range. However, this Delphi, utilizes Scheibe, Skutsch, and Schofer's (1975) stability measurement formula at the conclusion of the third round to determine if the distribution of each particular barrier was stable, or if further consensus is unlikely to be achieved (Schmidt, 1997). Scheibe et al. (1975) method utilizes the absolute difference in responses measured by total scale units on the Likert-scale to produce a percentage of variation that can be attributed to the natural data oscillation that is expected to occur. Stability is determined by dividing the percentage of respondents whose responses were on the mode, who then left the mode in subsequent rounds, by the total unit change across all three rounds of the survey. This percentage is deemed to represent the natural level of oscillation expected within the distribution, and any barriers that show a change in stability below this percentage are deemed to have reached stability.

The natural oscillation percentage for this study was found to be 20%. After the third round it was found that 23 of the 24 barriers met this stability threshold, suggesting that further consensus was unlikely to be achieved on these barriers. Because of this, and a declining participation rate, by the third round the participation rate from the first round

had declined by 30% (33 responses in the first round, 28 responses in the second round, 23 responses in the third round), it was decided to end the survey after the third round. Additionally, the only barrier not to achieve stability had the fourth lowest mean score, indicating that it was not as critical to the success of the study.

Panel dropouts

The discussion element of a Delphi study, while being the core strength of the method, can also be a weakness of the method because of the amount of time required of participants. Unlike many surveys that are completed in a single sitting, in a Delphi study participants routinely are asked to answer three or more rounds of surveys. Additionally, because of the need to read and consider the declarative statements, the amount of time to complete each round is substantial. As a result, it is not uncommon to see declining participation rates over the course of a Delphi study.

Because of this possibility, decisions were made on how to deal with the data from dropouts prior to the start of the Delphi. Data from participants who dropped out of the survey was included in the analysis of the data and in calculating the statistical data to provide to the panel in the following round. It is reasoned that once a panelist has participated in a round, they have contributed to the discussion and evolution of the panel's opinion, and it would therefore be inappropriate to subsequently try to expunge that panelist's responses in the final analysis of the data if they were to drop out. However, in calculating the measure of stability, which relies on measuring the change in responses from individual panelists across three rounds, it was necessary to exclude

response data from dropouts and only include data from panelists who completed all three rounds.

CHAPTER IV

RESULTS

This chapter presents the findings of the meta-synthesis and the Delphi study in regards to the research questions of identifying the constraints to DDE and the perceived barriers to the adoption of DDE by landscape architecture faculty. The first section of this chapter discusses the findings of the meta-analysis. The second section discusses the findings of the Delphi study, and is divided into sections discussing the demographics of the panel, the panel-identified critical barriers, and the panel-identified less-critical barriers.

Identification of Constraints in the Meta-Synthesis

Research Question: What are the reported constraints to the use of DDE in the literature, how might these be categorized, and what areas need additional research?

Forty-six published pieces of literature were found through the literature search. The literature is composed of 25 journal articles, 17 conference proceedings, two book chapters, and one industry publication. From these, the constraints of DDE were identified and coded into 26 categories. The constraints and the number of instances mentioned in the literature are provided in Table 4.

Table 4
List of the Constraints Identified in the Literature and the Instances Found

<i>Barrier or constraint</i>	<i>Count</i>
1. Lack of face-to-face interaction / communicating non-verbal cues	10
2. Time and resources needed to develop/teach online courses	9
3. Technical constraints or difficulties	8
4. Issues with faculty technology adoption	6
5. Student technology proficiency required	6
6. Building rapport and sense of community takes longer/not possible	6
7. Advanced technologies may be too expensive	5
8. Perceived incompatibility with studio method	4
9. Difficulty with collaboration	4
10. Unreliability of some internet resources	4
11. Faculty spent too much time online	4
12. Faculty opposition	3
13. Limited adoption by faculty	3
14. Requires motivated and organized student	2
15. Feelings of isolation for student	2
16. Potential negative impact on creativity	2
17. Fears that technology will replace faculty and/or staff	1
18. Lack of precedent	1
19. Students may need to purchase new technology	1
20. More scaffolding needed to give students direction	1
21. Cultural conflicts with collaborators	1
22. Lack of interaction with a physical site	1
23. Unsited for difficult design subjects	1
24. Difficulties conducting juries	1
25. Perception of technologically produced designs as inferior	1
26. Students focus on learning technology instead of the design process	1

Categorization and Description of the Constraints

In the final phase of the meta-synthesis, the constraints identified in the literature were categorized into four broad themes: pedagogical, social, structural, and institutional. Pedagogical constraints concern issues relating to instructional theory, learning outcomes, and teaching preferences and choices by the instructor. Social constraints

concern issues relating to interaction and communication between students and instructors in the socio-cultural setting of design. Structural constraints concern issues related to the technology, tools, organization, and nature of the DDE medium. Institutional constraints concern issues relating to the implementation and acceptance of DDE within institutions of higher education, such as funding and staffing.

I developed these themes by analyzing the constraints of DDE to identify shared thematic components between the constraints. These thematic components were narrowed down into the four themes. Once these themes were identified, the literature describing each constraint was consulted to ensure that the constraints were accurately categorized.

In some instances, the decision to include a constraint in a specific category is nuanced; the constraint of critiquing student work (conducting juries), for instance. This constraint was originally categorized as pedagogical, as it was felt that the act of critiquing was an important aspect of the pedagogical approach of design education. However, the broader literature on the role of critiques, specifically Schön's (1985) analysis of the critique between a studio master and a student, suggests that the act of critiquing is akin to the social enculturation of novices in legitimate peripheral participation theory (Lave & Wenger, 1991). Additionally, based on the DDE literature, the primary component of concern amongst researchers is the impact on communication during the critique, which is the social component of the critique (Dave & Danahy, 2000; Schnable et al., 2001). Thus, in this instance, it was determined that the constraint of critiquing work was primarily a social barrier. A similar process of initial categorization,

consultation of the literature, and revision of the categorization of the constraints was conducted with all of the remaining constraints to arrive at the four identified categories.

Pedagogical

Discussion of the pedagogical implications of DDE is conspicuously absent from most of the literature. As noted previously, the majority of articles adopt a show-and-tell format that is largely focused on describing and evaluating technological applications for facilitating communication and collaboration within the scope of a design project. The heavy representation of this type of report in the literature is partially explained by the fact that most design educators view technology as simply an additional tool, on the same level as pen and paper, and do not adequately anticipate the broader pedagogical implications of the technology (Wood, 2004). When the pedagogical ramifications of DDE are considered, a concern expressed in the literature is a perceived incompatibility between traditional design pedagogy and DDE, with its associated technologies. Some suggest that design education cannot be successful in an online format (Niculae, 2011). Bender and Good's (2003) evaluation of DDE amongst interior design faculty found that instructors perceive DDE to be contradictory to traditional studio methods, especially the principle of the face-to-face critique session. Faculty express an emotional attachment to traditional methods that hinder their acceptance or adoption of DDE, and Bender and Good (2003) openly wondered if "design programs are currently too rooted in tradition to contemplate an explorative technology-based pedagogy such as distance education."

Kvan (2001) noted that in DDE, the role of the teacher often takes on an additional instructional role as a facilitator for a raft of new technologies, as the teacher

must often provide training and trouble-shooting or risk collapse of the learning environment. However, this criticism is also applicable in a F2F classroom that incorporates technology, as students expect instruction and trouble-shooting from the teacher for their technological problems. Of broader concern, some researchers suggest that the technology used in DDE limits a student's artistic expression and hinders their development as designers (Radclyffe-Thomas, 2008).

Importantly, some foundational activities of the PDS may be difficult to reproduce in a VDS, such as sketching, rendering, and critiquing, but any such impacts may be expected to be mitigated as technology improves (Radclyffe-Thomas, 2008; Saghafi et al., 2012a; Silva & Lima, 2008). However, the change from a physical environment to a virtual one would seem to undercut some of the core principles of the PDS, most notably the ease of modeling and social integration available within the PDS (Kvan, 2001).

However, DDE should only be seen as altering this, and other, paradigms, and not eliminating them entirely. If we theorize that the learning and interaction that happens within a PDS is similar to Hutchins' (1995) Horizon of Observation, then a VDS simultaneously may limit and expand the ability of students to observe their peers. The ability to instantly observe an immediate set of peers may be lost, but through mechanism such as digital pinups and archiving, a student may be able to observe the work of all of his peers on a more regular basis than is possible in a PDS. This highlights one of several positive pedagogical implications of DDE that have been identified. The use of digital media and a content management system can enable teachers to more closely monitor student progress and tailor feedback accordingly. This may produce a review process

more akin to a true master-apprentice relationship than is possible in a PDS (Kvan, 2001; Li, 2007). Additionally, the indexing and persistence of digital materials may enable the teacher and student to be more cognizant of the changing nature of a design and to readily re-evaluate and reference past iterations, enabling the student to have a broader understanding and control of their learning and of the design process (Sagun et al., 2001).

The digital medium and flexibility of a DDE may facilitate an array of different learning styles, practices, and schedules that cannot be accommodated in a PDS, and this flexibility can permit adaptable curriculum and pedagogy so that students could customize their learning experience to best suit their unique needs (Ham & Schnable, 2011; Radclyffe-Thomas, 2008). With DDE, learners are able to re-access learning material from earlier in the course, so if a student is struggling with a particular skill or concept they can re-watch the demonstration or lecture until they have mastered the material (Silva & Lima, 2008). This type of persistent access to course materials, coupled with the nature of the medium, encourages students who participate in DDE to become active learners, instead of passive receivers, as they must take a more active role in accessing and mastering the learning material than their F2F peers (Park, 2011).

Social

There are a number of components that, taken together, define the social environment in which learning occurs in design education. Several of these components have the potential to be significantly altered by the use of DDE. Most notably, criticism is leveled at the lack of face-to-face interaction in a DDE environment (Bender & Good, 2003; Sagun et al., 2001). There is concern that the lack of physical interaction between

students and teachers prevents serendipitous moments of discovery in the design process, constrains the amount and quality of time that is spent between teachers and students, and makes it difficult for students to form strong social bonds (Brown & Cruickshank, 2003; Matthews & Weigand, 2001; Saghafi et al., 2012a).

Student comments from a VDS organized by Cheng (1998) indicate that students feel it takes longer to build rapport in a digital environment than a physical one, and similar conclusions are drawn by Kvan (2001) and Ozturk and Ülnü (2014). How students and instructors communicate in a VDS is also different from a PDS. Kvan (2001) noted that communication is more structured, and tends to eliminate casual interaction between students and instructors. This raises concerns about the organic nature of dialogue and discovery in the design process. The very character of communication is also altered, as individuals behave and share information differently than they would face-to-face, and thus new norms need to be established to ensure that communication happens in familiar patterns in order to avoid errors or breakdowns in communication. However, Matthews and Weigand (2001) found this structured form of communication more beneficial, and the impersonalized communications of DDE resulted in students directly discussing the merits of a design without the social pressures that derive from closely interacting with an individual. While Kvan (2001) noted that some students express frustration over the use of digital communication tools, Sagun et al. (2001) noted that many students found these communication tools more convenient than face-to-face communication.

Others authors feel that today's students are more comfortable communicating and interacting in the digital environments of a VDS, and that this familiarity with digital

communication can be used to improve collaboration amongst students. These digital natives, or generation net, are believed to be fluent in a variety of technologies and adept at acquiring new proficiencies (Ham & Schnable, 2011; Li, 2007). This generation of students rely on digital tools to quickly find information and communicate, and are regularly multi-taskers (Bennett, Maton, & Kervin, 2008; Crowther, 2010). These digital tools also have the potential to extend collaboration beyond any set class period or studio time, opening the door to students being able to collaborate anytime and anywhere (Bender & Vredevoogd, 2006; Ham & Schnable, 2011). All of these skills are critical to a successful designer, and would suggest that a heavier use of technology in the learning experience may help these students to leverage their digital fluency.

Structural

DDE is also noted to influence structural issues of design education. A great deal of discussion has revolved around time costs and efficiencies in DDE. Bender (2005) states that faculty spend large amounts of time integrating the required technology into their courses, and faculty also spend a great deal of time preparing and developing DDE-specific course content (Brown et al., 2000). While this time commitment is cast in a negative light, it should be noted that a face-to-face course requires significant amounts of up-front time investment when creating a new course, and so this criticism is not limited to DDE. Once a course is developed, it is found that DDE courses were either as, or more, time efficient than comparable face-to-face courses (Bender et al., 2004; Brown & Cruickshank, 2003; Radclyffe-Thomas, 2008). There is some evidence to suggest that, while there may not be a clear time efficiency benefit of DDE, time spent in a DDE

environment is more effective for learning, as instructors are able to automate information delivery and spend greater amounts of time interacting with students in higher-level discussion and analysis (Bender et al., 2004).

Importantly, DDE offers a degree of time flexibility impossible in a PDS.

Students are able to access course materials, work on assignments, and collaborate at times most convenient to them, which produces greater satisfaction among students (Bender & Good, 2003; Ham & Schnable, 2011; Sagun et al., 2001). This high-degree of flexibility is a concern to some educators, who worry that students will develop unrealistic expectations of interaction with instructors at all times of the day (Ham & Schnable, 2011).

This time flexibility, combined with geographic flexibility, also enables a new type of collaborative environment where students are able to interact with peers and professionals distributed throughout the globe. Practitioners no longer need to travel to interact with students, as the internet can enable the instantaneous sharing of designs and feedback (Broadfoot & Bennett, 2003). This distance interaction with practitioners can extend to critiquing, where practitioners are able to view and critique a student's work at a time most convenient to them and without having to visit a campus (Bender & Vredevoogd, 2006). It is also possible for teachers at different institutions to jointly teach a shared class, or to combine classes, sharing expertise and resources in a way normally not possible in a PDS (Dave & Danahy, 2000; Elger & Russel, 2001).

The technological demands of a VDS are generally considered to be higher than those of a PDS. This is seen as a benefit to students, who are able to gain greater exposure and expertise with various forms of media, technologies, and software programs

(Brown & Cruickshank, 2003; Dave & Danahy, 2000; Gül, Williams, & Gu, 2012). The technology-centric character of DDE is believed to help prepare students to better participate in the professional realm, where technological skills have become highly valued (Dave & Danahy, 2000). Students who do not believe they are receiving enough exposure to current technological trends in their education may become disenchanted and feel that they are being disadvantaged in comparison to students elsewhere (Radclyffe-Thomas, 2008). The opportunity to master technology during a student's educational career should enable them to continue learning after graduation in their professional careers (Sagun et al., 2001).

While there are many perceived benefits associated with the prevalence of technological tools in DDE, such heavy reliance also creates several issues that must be addressed. Technical and practical aspects, such as the availability of certain technological tools, bandwidth, and the monetary cost to students, may be barriers to the widespread use of DDE (Kvan, 2001; Park, 2011). Despite belief in a generation net, computer use and proficiency is not standard amongst students. For students who are unfamiliar with computers, the reliance on these tools in DDE is a barrier (Levine & Wake, 2000; Saghafi et al., 2012a). The same is true for instructors, as technology illiteracy or distaste for computer use in a design setting may preclude many instructors from designing or teaching DDE courses (Bender & Good, 2003; Radclyffe-Thomas, 2008). Amongst educators, technology barriers can be reduced through training programs, although these are often time-consuming, expensive, and on-going (Bender, 2005; Li, 2007).

Institutional

Institutional structures and norms either hinder or facilitate the use of DDE.

There is often faculty opposition to DDE due to a belief that DDE course offerings will negatively impact programs by replacing face-to-face course offerings, increasing class sizes, and reducing staff (Radclyffe-Thomas, 2008). Online education is also perceived to be of less value in the tenure review process, discouraging young faculty from heavily participating (Bender & Good, 2003). At the same time, universities are under pressure to provide access to greater numbers of students while simultaneously facing economic pressures that make the expansion of face-to-face offerings difficult (Brown et al., 2000; Dave & Danahy, 2000). Online course offerings are recognized as a mechanism to mitigate some of these disadvantages by providing enrollment access to a greater number of people than a physical campus can provide, while also providing the university with an additional source of revenue (Bender & Good, 2003; Radclyffe-Thomas, 2008).

Gaps in the Literature Identified in the Meta-Synthesis

Several important gaps in the literature are identified as a result of this meta-synthesis. First, little work has focused on the holistic impact that DDE has on design instruction. Many studies examine separate elements of design education, such as collaboration or critiquing, but there is not a thorough evaluation of how DDE impacts how students learn, think, and create. Additionally, there are no longitudinal studies determining the impacts of DDE on a cohort of students over time, as all of the reported projects in the literature were conducted over only a portion or whole of a single semester, although some compare results of the same course over multiple semesters.

This type of research, while contributing valuable knowledge about details of implementation, does not adequately address the overall impacts DDE has on a student's entire educational experience. Research such as this could help to identify particular subjects, or cohorts of students, that are better or ill-suited for participation in DDE.

On a similar vein, there is insufficient research on the pedagogical implications of DDE. The most comprehensive analysis to date is that by Kvan (2001), although it is dated in the methods and technology available at the time, who suggests that DDE introduces significant alterations to traditional design studio pedagogy in nearly every aspect of design education, all of which needed to be considered and mitigated. Chen and You (2003) propose a theoretical framework describing the role of the learner, instructor, course, and internet in creating a successful distributed design environment, but they only consider pedagogy to be a small element within the broader framework, on par with considerations such as cost and learner motivation. Other authors refer to the need to address DDE pedagogy, but beyond Kvan (2001) there appears to be no serious attempt to do so.

Finally, the literature review reveals trends in research methodologies that need to be addressed in future research. As mentioned previously, nearly two-thirds of the research published on DDE has little to no description of the methodology used to conduct the research, and little rigor in the methods employed. The majority of articles are show-and-tell pieces that, while good for sharing initial ideas and perhaps inspiring future exploration, do not provide enough evidence of success or critical evaluation of the method to provide sufficient motivation for instructors to adopt DDE. Basic information such as sample size, sample characteristics, and length of the intervention are often

omitted from the description of projects. The sparse amount of information provided also makes it difficult for other educators to effectively replicate and evaluate the DDE projects being described.

Also of concern is the short-term focus prevalent in DDE research. While a couple of articles report on projects that are repeated over multiple years, there appears to be no longitudinal studies that evaluate the long term impact of DDE on a student's learning and performance (Brown et al., 2000; Brown & Cruickshank, 2003; Cheng, 1998). This last omission from the body of literature is particularly worrisome, as it suggests that many researchers may have approached research on DDE as self-contained projects occurring in an educational vacuum, and have not been considering the holistic impacts of DDE on student learning and its place in a broader design curriculum. Because landscape architecture education requires a high degree of skills mastery from students, if students fail to master a skill in a DDE course the ramifications may be compounded over the course of the student's academic career. Thus it is critical that DDE researchers carefully consider the manner in which they both construct and report their studies in the future in order to accelerate DDE research.

Identification of Critical Barriers in the Delphi Study

Participants

There were 43 individuals who agreed to participate in the study. Participation rates for panelists who responded to at least one question in each round of the survey are presented in Table 5.

Table 5
Participation Rates in the Delphi Study

<i>Round</i>	<i>Round N-size</i>	<i>Round Response N-size</i>	<i>Round Participation %</i>	<i>Total Participation %</i>
Round 1	43	33	77%	77%
Round 2	33	28	85%	65%
Round 3	28	23	82%	53%

Panel Demographics

Of the original 43 subjects who registered to participate in the study, 34 completed the first round of the study (79%). Thirty-three panelists completed the demographic survey included in the first round of the Delphi (See Table 6). Approximately 61% ($n = 20$) of the panel was composed of men. The panel is nearly equally distributed by age, with the least represented age bracket (41-50) representing 21% of the panel ($n = 7$), while the age groups of 31-40 and 51-60 each composed 27% of the panel ($n = 9$).

The panel has a diverse cross section of education and work experience. The most prominent position amongst panelists is professor, with nearly 74% holding this position ($n = 25$), the remaining panelists are either department heads or associate deans. Associate professor is the most common rank, with 44 % of panelists holding this rank ($n = 15$). The large majority of panelists had worked in private practice (85%, $n = 28$), though most were removed by 7 or more years from their last work in private practice (57%, $n = 16$).

Table 6
Panel Demographic Data

Gender	Male	20	Studio courses taught per year	0	1
	Female	13		1	7
Age				2	13
	< 30	0		3	7
	31-40	9		4+	5
	41-50	7	Online teaching experience	Yes	9
	51-60	9		No	24
	60 <	8			
Teaching Experience	< 5 years	4	Private practice experience	Yes	28
	6-10 years	8		No	5
	11-15 years	7	Last time in private practice	Current	1
	16-20 years	6		Last 5 years	11
	21-25 years	5		6-10	5
	25 < years	3		More than 10 years	10
Degree Held	MLA	16	Position	Professor	25
	PhD	16		Department Head	6
Rank	Assistant Professor	13		Dean	3
	Associate Professor	15			
	Professor	6			

Nearly 60% ($n = 19$) taught at the university-level for 15 years or less, only three panelists have more than 25 years of teaching experience. The highest degree held is equally split amongst the panel, with 16 holding a PhD, and 16 holding an MLA. Approximately 60% of panelists teach either one or two studio courses a semester ($n = 20$). Only nine panelists have experience teaching an online course (27%).

Results and Rankings of Barriers

The barriers are ranked via their mean score at the end the third round. The barrier rankings are shown in Table 7. When the mean scores are graphed, four distinct divisions appear, which are used to organize the barriers into four categories: critical, important, less important, not important. The seventh-ranked barrier was not initially included amongst the critical barriers, but is included because it shares a close thematic relationship to the barrier ranked 4-6 (see Figure 4). In this section, the critical barriers are examined first, according to their ranking, and then the remaining barriers are reported in numerical order.

Table 7
Delphi results for barriers to adoption.

<i>Barrier</i>	<i>Mean</i>	<i>Mode</i>	<i>SD</i>	<i>IQ R</i>	<i>Category</i>
Instructors believe the studio method cannot be replicated using DDE	5.61	6	1.033	0	Critical
Faculty do not receive adequate compensation during the development phase	5.30	6	1.105	1	Critical
A lack of precedent in DDE	5.05	5 & 6	0.999	2	Critical
Building rapport with others is difficult	4.96	5	1.364	1	Critical
Students feel socially isolated from their peers	4.91	6	1.443	1	Critical
Lack of face-to-face interaction	4.91	5	1.379	1	Critical
Critiquing student work is difficult	4.78	5	1.506	1	Critical
Designs produced solely on a computer are inferior	4.70	6	1.941	4	Important
Upfront costs may deter development	4.70	5	1.329	1	Important
DDE constrains a student's creative process	4.65	6	1.722	3	Important
Only motivated and organized student can succeed	4.61	5	1.196	1	Important
Faculty have theoretical or pedagogical opposition	4.57	5	1.376	2	Important
Faculty struggle to adopt necessary technology	4.52	4 & 5	1.41	1	Important
Students spend less time and energy on DDE projects	4.52	4	1.123	1	Important
It is difficult for students to collaborate	4.48	5	1.675	2	Important
Teaching consumes unacceptable amounts of faculty time	4.32	4 & 5	1.323	2	Less Imp
Faculty concern that DDE will decrease tenured positions	4.30	4	1.579	2	Less Imp
Internet resources may be unreliable	4.14	4 & 5	1.699	3	Less Imp
Private concern DDE will threaten personal job security	4.09	4	1.505	1	Less Imp
Faculty are unwilling to adopt necessary technology	4.04	4 & 5	1.397	2	Less Imp
Ongoing costs deter continued offering	4.04	4	1.147	1	Less Imp
Necessary technology is too expensive for students	3.70	4	1.329	2	Not Imp
Necessary technology is too expensive for programs	3.61	4	1.27	1	Not Imp
Required technology proficiency is unreasonable for students	3.22	3	1.347	1	Not Imp

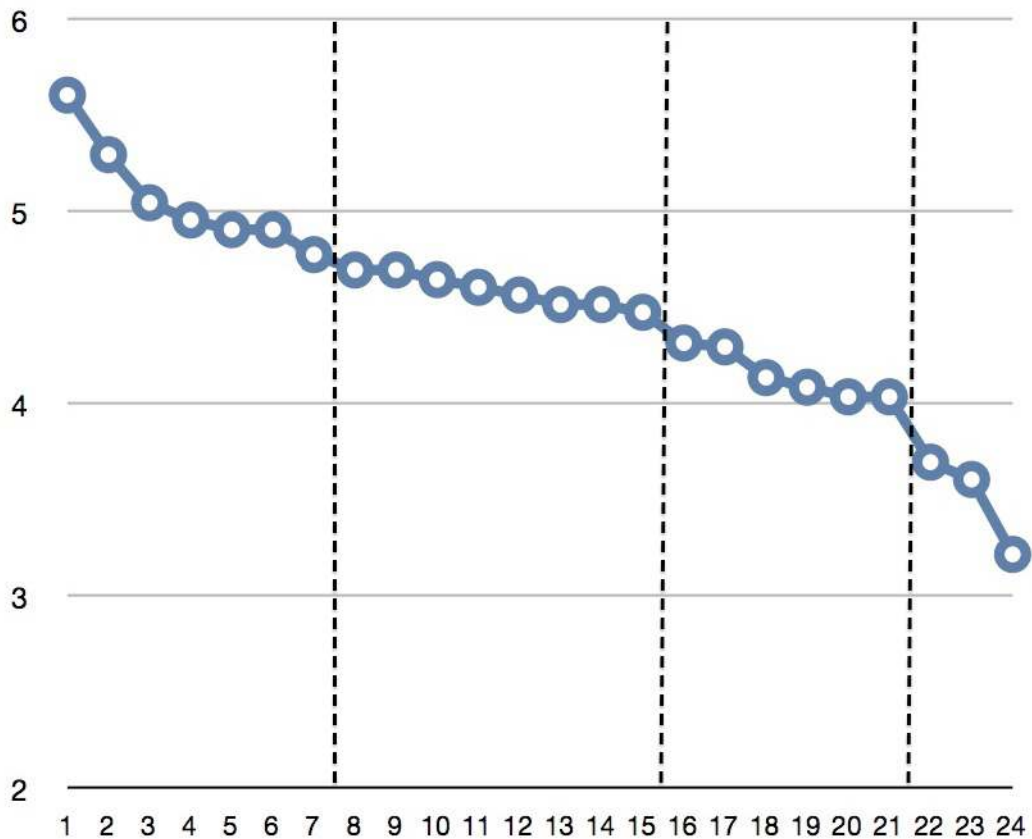


Figure 4: Mean rankings of the barriers. The boundaries of the four categories are indicated by the dashed lines.

Question 1

Panelists were asked to respond to the statement: Instructors **believe the studio method cannot be replicated using a distributed design environment**. There are 33 responses in the first round, 28 in the second round, and 23 in the third round (see Figure 5). The mean score decreases with each successive round, moving from 5.94 in the first round to 5.61 in the third round. The standard deviation of the third round distribution is 1.033 and the IQR is 0. This represents a substantial tightening of the consensus from the

first round (SD = 1.2, IQR = 1). The percent of change in the distribution was .20. This barely remains within the range of stability for the study (.20 was the measure of stability), and suggests that the distribution may have been becoming increasingly unstable, as the percent of change at the end of round 2 was .15.

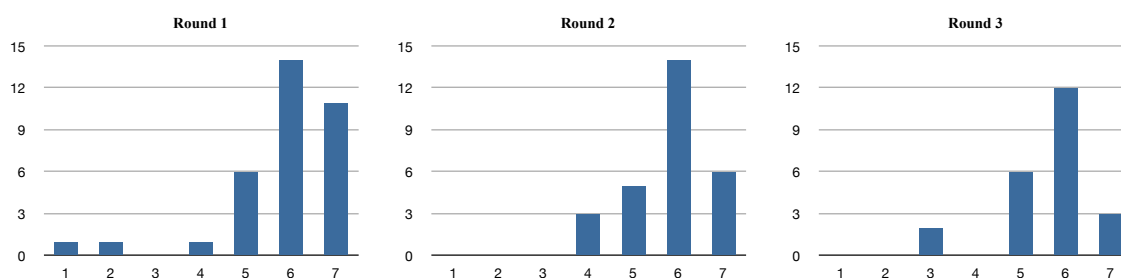


Figure 5. Distribution of responses to question 1.

There are 34 declarative statements for question 1 across all three rounds (see Table 8). Coding these statements produces seven discussion themes. The most common theme is concern about translating the physicality of the studio space, and the social interactions it permits, to an online format. It is clear there is concern about the loss of physical interaction as a means of conveying and converging on information and design ideas, as well as comments related to face-to-face interaction simplifying the process. Several comments refer to an intangible quality of the studio, a “something” that isn’t replicable outside of the physical confines of the studio. These initial comments are best summarized by a panelists response: “There is something lost when students can’t look across to others desks and see their works and/or iterations, overhear conversations, or participate in impromptu pop-up discussions and topics.”

Over the course of the second and third rounds, the comments in this theme largely shift from near total rejection of DDE, to acknowledging that learning goals might be achieved, but that design results would be substantially different. There is discussion about the ability of technology to facilitate many of the types of in-situ communication that occurs in the studio, but that elements of the learning process are either lost or degraded. The following comment best summarizes what several in the panel seemed to feel: “I think that it could be done technically and logistically, but I think that the process and the experience would lose something important.”

Initially, there are several comments concerned about technical constraints or difficulties, and how these impact communication and learning. The comments question whether the technology exists to properly facilitate DDE, specifically the graphic intensive elements of design. However, this theme quickly tapers off in the subsequent rounds. The comments also reveal that some of the panel are not familiar with successful examples, or do not know if the available technology could support DDE. This ignorance of the tools necessary for DDE and the available precedents, suggests broader concerns related to the dissemination of research related to DDE, and is explored more thoroughly in the discussion of question 9.

In the second and third round, a deeper level of analysis amongst the panel emerges in the form of a discussion on the role of DDE and the tradition of studio teaching in landscape architecture. In the second round, panelists begin exploring a role for DDE within the broader curriculum of design education. One panelist comments: “I think a DDE complements the studio method more than replicate it.” In the third round this discussion is expanded on further, suggesting DDE has a place in design curriculum, but

that that role still needs to be more clearly defined.

Finally, a new theme emerges in the third round discussing the role of tradition in design education. These comments question whether opposition to DDE is based on rational pedagogical reasons, or simply represents an emotional defense of a teaching tradition. These comments seem to suggest that the successful implementation of DDE may not be possible until after a generational shift occurs amongst the current faculty nationwide.

Table 8
Number of Comments Per Round by Theme for Question 1

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Physical Interaction	5	3	4	12
Technology gap	4	1		5
Lack of precedent	4			4
Suggestions of success	3			3
General characterization	2			2
Role		2	1	3
Tradition			3	3

Question 24

Panelists were asked to respond to the statement: **Faculty do not receive adequate compensation during the development phase** of online courses. This barrier was added to the second round after being suggested by more than 5% of the panel during the first round. There are a total of 27 responses in the second round and 23 responses in the third round (see Figure 6). The mean is 5.56 in the first round, and 5.30 in the second round. The standard deviation in the third round is 1.105 and the IQR was 1. The measure of stability is .10, well within the range of stability.

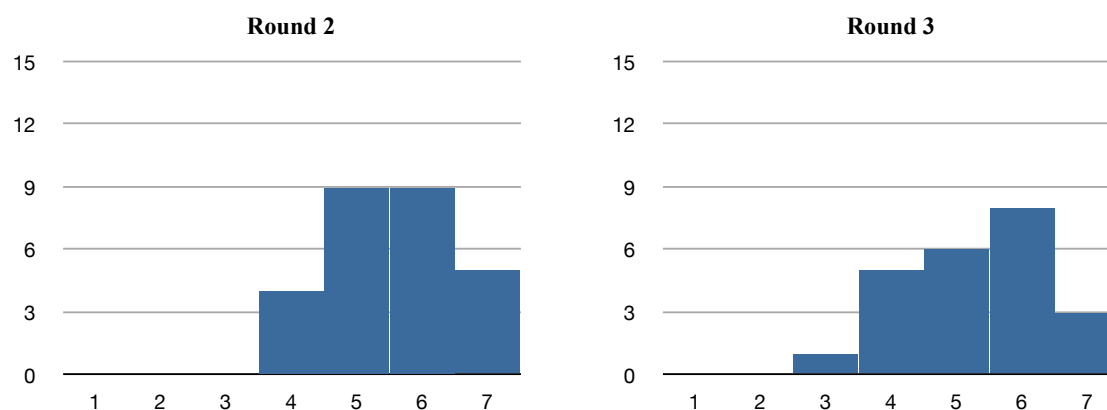


Figure 6. Distribution of responses to question 24.

There are 11 declarative statements provided for question 24 between the two rounds (see Table 9). Coding these statements produced four themes, of which the dominant topic of discussion revolved around issues relating to monetary compensation to faculty members during the development of online courses. The majority of the comments about compensation express the opinion that faculty do not receive adequate compensation for development of courses. One panelist said: “My university encourage [sic] faculty to develop online courses but fail to provide adequate compensation.” Another expressed similar frustration over administrators lobbying for course development, but providing no monetary backing.

The lack of additional compensation appears to be critical to faculty because of the time commitment required to develop an online course. Even a panelist unaware of the required commitment to develop a course recognized the potential problems such a project presents to faculty: “Don’t know for sure, but if time off from studio/lectures are not given for developing then, YES.” It may also relate to a general feeling of increased

demands being put on faculty without additional compensation to offset these. One panelist summed up this position with their comment: “Faculty do not receive adequate compensation for anything today.”

In response to the comments expressing frustration over a lack of additional funding, one panelist provided feedback regarding potential external funding sources that faculty might use to supplement their course development work. Another comment concerns the ongoing cost of maintaining a course after the development stage. A final comment broaches concerns regarding intellectual property rights, noting that “who owns the intellectual content (and controls the long term use) remains an opaque issue.”

Table 9
Number of Comments Per Round by Theme for Question 24

<i>Themes</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Monetary development compensation	4	4	8
Continuing development compensation	1		1
Intellectual property rights	1		1
Available funding sources		1	1

Question 9

Panelists were asked to respond to the statement: **A lack of precedent** in distributed design education deters programs from committing to developing such courses. A total of 33 responses were received in the first round, 28 in the second round, and 22 in the third round (see Figure 7). The mean score shifted lower before finishing at its highest point in the third round. It was 4.97 in the first round, 4.75 in the second round, and is 5.05 in the third round. The distribution in the third round is flat, with

nearly all respondents answering 4, 5, or 6. The standard deviation was .999 with an IQR of 2. The measure of stability strengthened over each round, with a final stability score of .11.

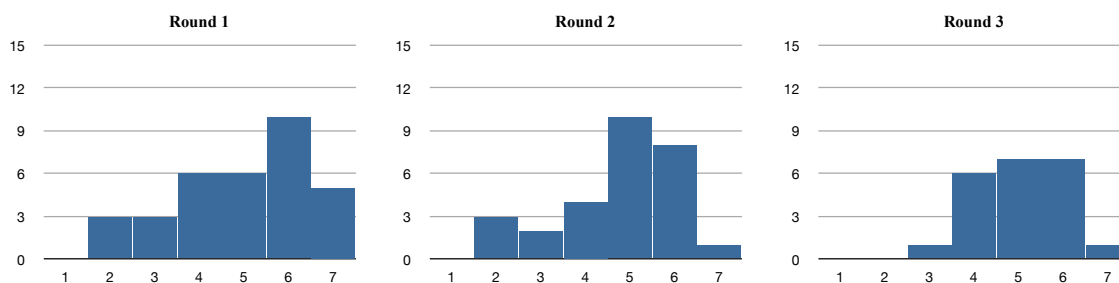


Figure 7. Distribution of responses to question 9.

Eighteen declarative statements are provided across the three rounds (see Table 10). These comments are coded into six categories, with most comments in the category of “little precedent.” In all three rounds, panelists comment on a lack of precedent for DDE. Several comments express a desire to “see successful examples of studio design being taught online.” Beyond seeing examples, panelists also want to see studies documenting the impacts of DDE on “intellectual growth and creativity” and longitudinal results tracing these impacts over several years. These comments suggest that panelists are not only concerned about the existence of described DDE cases, but also the rigor of the assessment of those cases.

A couple of comments indicate that panelists do not know which journals DDE precedents and studies would be published in, suggesting that the discussion on precedent also includes an critique of the dissemination of the existing precedent. This is

unsurprising, as the meta-synthesis found the majority of DDE literature is published in journals and conference proceedings related to technology and education, and not the design fields. Furthermore, the panel cites precedent for the expanding use of the studio model in other education fields, raising the question as to why an instructor would abandon the traditional studio environment at a time when it is receiving so much attention for its merits.

Panelists also point out that university administrations are promoting the development of online courses regardless of whether successful precedent for these types of delivery exists or not. By their reasoning, precedent is not necessary because pressure from administrations is “aimed at increasing quantity rather than quality.” Other comments from the panel suggest that precedent is not a barrier, and that precedent exists in similar education fields. One comment muses: “lack of precedents have not deterred other explorations in design pedagogy.” One panelist states that precedent is not the problem, but a “lack of an understandable and motivating push to [adopt DDE].”

Table 10
Number of Comments Per Round by Theme for Question 9

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Lack of precedent	5	2	3	10
Studio precedent	2			2
Administration pressure	1	1		2
Precedent not needed	1		1	2
Precedent exists	1			1
Lack of desire	1			1

Question 13

Panelists were asked to respond to the statement: **Building rapport with others is difficult** in a distributed environment. A total of 33 responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 8). The mean score decreased during each successive round, from 5.33 in the first round to 4.96 in the third round. The standard deviation of the third round is 1.364 with an IQR of 1. The stability of the distribution increased through all the rounds, and measured as stable at .10 after the third round.

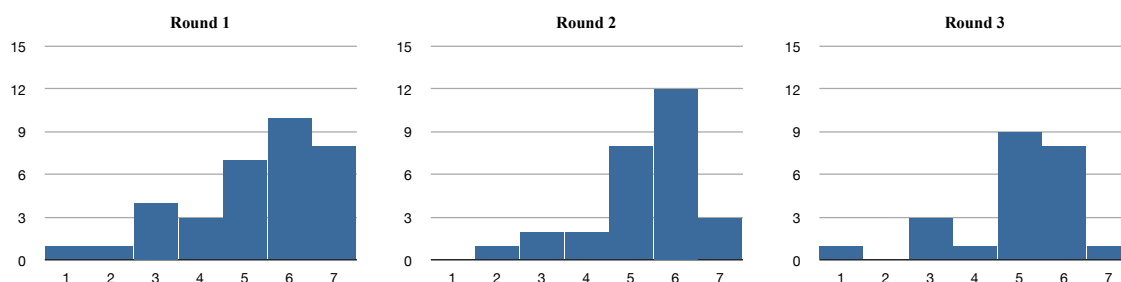


Figure 8. Distribution of responses to question 13.

There are 19 declarative statements for question 13 over the course of the three rounds (see Table 11). The most common theme is concern about the ability of technological tools to support the rich forms of communication necessary for building rapport. Although panelists discuss many common forms of computer-mediated communication and social media, they express the view that “there is a disconnect between [people]” when using these technologies, and that they are unable to develop the “deeper and more meaningful connections” that can be made face-to-face. The concern

about the impacts of technology-mediated communication is not limited to building rapport between students or between students and teachers, but there is also concern about how students would learn to communicate with their future clients and the public. One panelist sums up this concern: “What I worry about is if they will continue to be able to design for REAL PEOPLE. Especially if they don’t get outside and away from their electronic devices long enough.” The comments in this theme are consistent in their tenor through all three rounds, indicating that a segment of the panel was unswayed by comments from opposing viewpoints.

Countering the technology gap theme is discussion on the nature of how modern students collaborate. Some panelists feel that students are digital natives, and that they find it as easy (some suggest easier) to communicate and build rapport in an online setting as in a face-to-face setting. One panelist describes building rapport online as being the “preferred method” of modern youth and, with the heavy involvement students have in social media, it is possible that “rapport of this kind has come into its own in education.”

In between these two sides of the debate are comments that building rapport is no more or less difficult online as it is face-to-face, and that building good rapport in a face-to-face environment is not a foregone conclusion. Comments in this theme suggest that it is more about the characteristics of the individual students and the scaffolding of the course to encourage communication and rapport. Comments in the theme ‘teaching related’ mention that the learning styles of some students may favor building rapport in an online environment, and that a blended model might be employed whereby students initially meet face-to-face before later collaborating online.

Table 11
Number of Comments Per Round by Theme for Question 13

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Technology gap	4	2	3	9
Digital natives	2	1	1	4
Similar to F2F	1	1	1	3
Teaching related	1		1	2
More information needed			1	1

Question 20

Panelists were asked to respond to the statement: **Students feel socially isolated from their peers** and may suffer from a lack of social interaction with their peers in a distributed learning environment. A total of 33 responses were received in the first round, 27 responses in the second round, and 23 in the third round (see Figure 9). The mean score of the first round was 5.27. It rose slightly to 5.30 in the second round before declining to 4.91 in the third round. The standard deviation of the third round is 1.443 with an IQR of 1. After the second round, the distribution was still unstable (.25), but within the range of stability after the third round (.15).

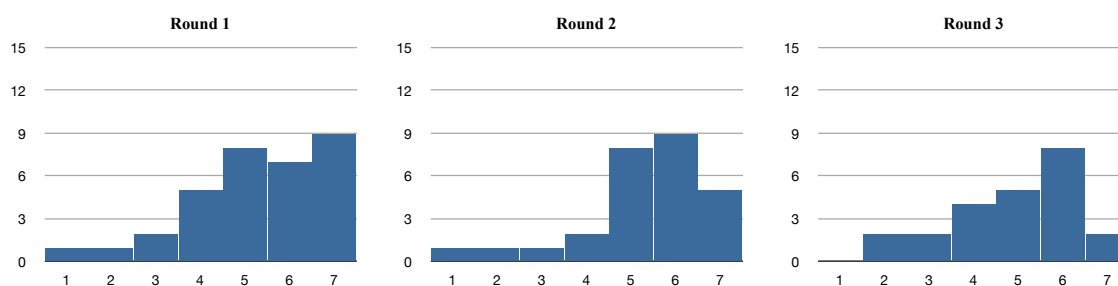


Figure 9. Distribution of responses to question 20.

There are a total of 18 declarative statements for question 20 over the course of all three rounds (see Table 12). These comments are fairly evenly distributed between six different themes. The most common theme (student reality) revolves around modern students and how they socialize. In the first two rounds, comments in this theme are dismissive of this barrier, stating that “students don’t care” about being isolated and that the large majority of modern students regularly communicate and socialize online via social media. However, in the third round these comments are tempered somewhat, with caveats included, such as the demographics of the students involved or whether students are also able to communicate face-to-face.

In the first round, the most common comments are about the social characteristics of studio culture. These comments stated that some of the most important learning that happens in the studio happens organically between peers, and that students in a DDE environment are not be able to enjoy a similar type of social experience. These concerns echo comments made in several other questions regarding social barriers, but are not repeated in the second or third round of the discussion of this question.

Panelists are also concerned that DDE would exacerbate bad behavior in students. They cite personal experience with students socially isolating themselves by choice and declining work quality amongst students with this mentality. One panelist re-emphasized their worry that students would become more isolated in DDE in the third round, perhaps in response to comments that societal trends are already leading to less physical contact and communication between people and more digital interaction. While a student might appear to be more connected than ever via digital devices, DDE “may really isolate them further.”

In the third round, another theme emerges that represents a blending of the discussion of modern students and studio culture, but instead of focusing on the social interaction of the studio environment, these comments focus on the development of broader social skills. “Students need to learn to interact with their peers” and “effective and social interaction and communication is critical” for designers. These comments take a more global look at the issues of isolation and communication, criticizing computer-mediated discussions as insufficient to teach the social skills required in the landscape architecture profession.

Table 12
Number of Comments Per Round by Theme for Question 20

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Student reality	2	1	2	5
Societal trends	1	1		2
Implementation	1	1		2
Exacerbates bad behavior	2		1	3
Studio culture	3			3
Social skills			3	3

Question 2

Panelists were asked to respond to the statement: **Lack of face-to-face interaction** prevents verbal and non-verbal communication in a distributed design. A total of 33 responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 10). The mean score of the first round was 5.24 with a mode of 6. The median rose slightly to 5.36 in the second round, and then dropped to 4.91 in the third round, with the mode shifting to 5. The standard deviation of the third round is 1.379

with an IQR of 1. The distribution was barely stable in both the second and third rounds (.20).

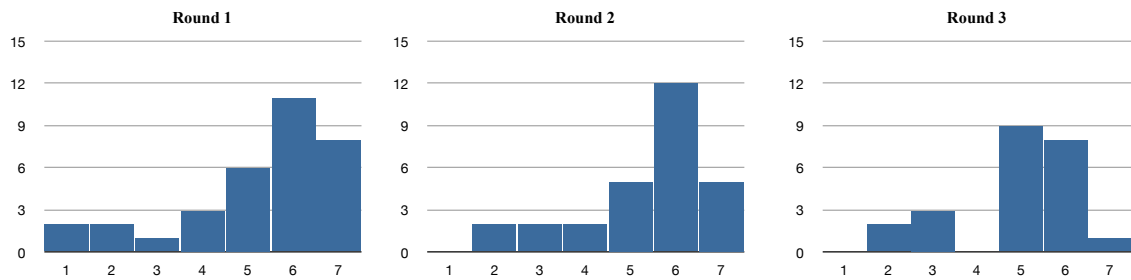


Figure 10. Distribution of responses to question 2.

There are 20 declarative statements for question 2 across all three rounds of the survey (see Table 13). The most common theme through all three rounds is concern about constraints that technology places on the communication process. While some panelists acknowledge that verbal and non-verbal communication can be facilitated online, they are concerned about the “limitations of technology to replicate all of the factors involved in communication.” These limitations impact how students communicate, and therefore what type of culture they form amongst themselves. The idea of culture is discussed in the theme about the studio environment, in which the panel expresses a belief that students benefit immensely from the culture that exists in the studio environment. Panelists also believe that the studio environment is invaluable for providing an embodied experience that “replicates real world situations of design practice.”

Several panelists shared personal success stories of having students communicate

effectively without face-to-face interaction, and also point out that new technologies permit many forms of face-to-face communication. These comments are quite specific, citing hardware and software packages that can be used to successfully overcome shortcomings. These panelists also believe that the latest technologies facilitate face-to-face communication, thereby negating this barrier.

Beginning in the second round, panelists discuss the pedagogical implications of DDE in regards to this question. They recognize that “DDE could facilitate effective communication but may be [sic] not the same type of communication that happens [in the studio].” Out of this there is a discussion of the pros and cons of any potential changes, such as impacts to the time it takes to communicate, the ability to include more stakeholders in the communication process, and the ability to record and revisit conversations later.

Table 13
Number of Comments Per Round by Theme for Question 2

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Technical constraints	3	2	2	7
Suggestions of success	1	1	2	4
Studio environment	1	2	1	4
Questioning value of F2F	1			1
Pedagogical impact		1	3	4

Question 19

Panelists were asked to respond to the statement: **Critiquing student work is difficult** in a distributed environment. Thirty-three responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 11). The mean score

of the first round was 4.85. The mean score rose to 5.04 in the second round, before declining to 4.78 in the third round, with a mode of 5. The standard deviation of the third round is 1.506 with an IQR of 1. The distribution is stable (.10) at the end of the third round.

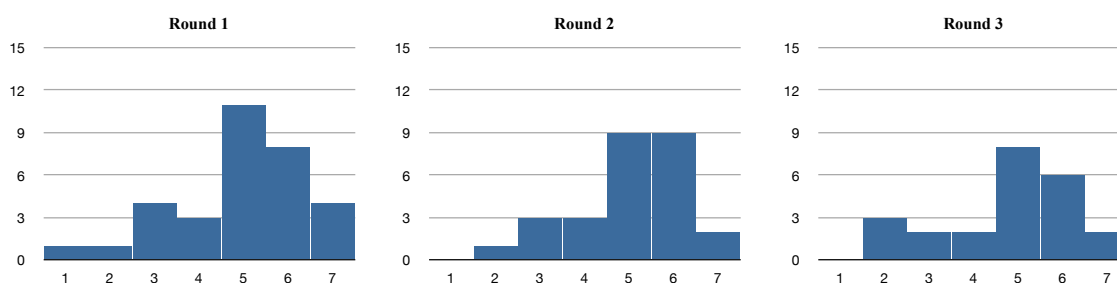


Figure 11. Distribution of responses to question 19.

There are 19 declarative statements for question 19 over the course of all three rounds. These statements are coded into five themes (see Table 14). In the initial round, the major concern is related to the technical constraints of technology in facilitating critiques. Panelists worry that what is already “a difficult process in a face-to-face environment” would become more difficult in a distributed one, and that often “technology complicates simple communication.” The concern appears to be not that technology is unable to facilitate a critique, but rather that it would become more difficult to do so. Although this theme carries throughout all three rounds, in the second and third rounds several panelists share personal experiences of successfully critiquing students in a distributed environment. These comments swayed at least one panelist who indicated in their comment that they had changed their mind and no longer viewed this barrier to be

as critical.

There are also several comments that can loosely be tied together into the broad theme of implementation. All of these comments focus on specific factors related to implementation (issues of scale, system variables, assessment, and workload). Panelists worry that one-on-one critiquing might be possible, but that group critiques would be difficult. They also felt that there are many different variables that would impact how effective DDE critiques might be, and how well student progress can be assessed during the critique process.

In the second and third round there are a couple of comments that express concern about the ability to effectively convey emotion during a critique in DDE. Critiquing students “is always a dicey proposition fraught with risks when students have fragile egos, insecurities, and lack emotional resilience.” Will this process become even more difficult if there is no adequate way to express “voice inflection, facial expressions, and other non-verbal techniques to communicate feedback” in a kind and considered manner?

Table 14
Number of comments per round by theme for question 19

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Technical constraints	3	1	1	5
More information needed	2	1		3
Implementation	3		1	4
Suggestions of success		2	3	5
Expressions of emotion		1	1	2

Non-critical barriers

The remaining barriers are classified in the categories of important, less important, or not important, and are organized by numeric order according to their question number. Only the quantitative data and the numerical count of the coded declarative statements are included for these questions.

Question 3

Panelists were asked to respond to the statement: **Only motivated and organized students are able to succeed** in a distributed design environment. A total of 33 responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 12). The mean score of the third round was 4.94 with a mode of 5. The standard deviation of the third round is 1.196 with an IQR of 1. The distribution was not stable after the second round (.25), but is stable after the third round (.15).

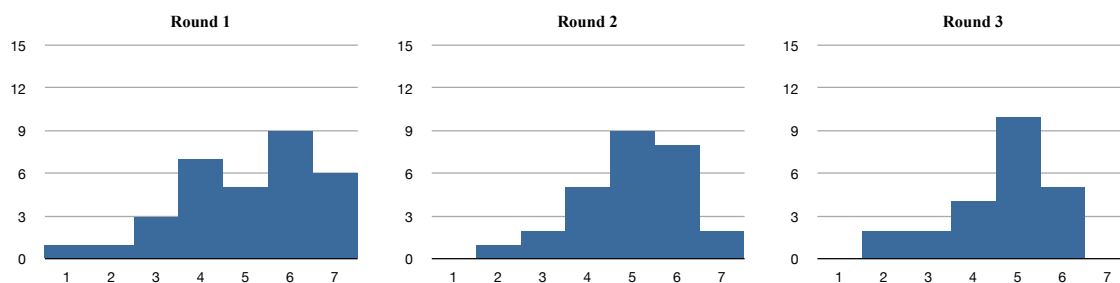


Figure 12. Distribution of responses to question 3.

There are 22 declarative statements for question 3 over the course of all three rounds. These statements are coded into seven themes (see Table 15).

Table 15

Number of Comments Per Round by Theme for Question 3.

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Same as F2F	6	2	3	11
Can be overcome	2	1		3
Issues of scale	3			3
Motivation critical	2			1
Detrimental multitasking	1	1		1
Teacher has less power to motivate	1	0	1	2
Student responsibility			1	1

Question 4

Panelists were asked to respond to the statement: **Faculty members are unwilling to adopt technology** necessary for distributed design education. Thirty-three responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 13). The mean score of third round is 4.04, with shared modes (4 & 5). The standard deviation of the third round is 1.397 with an IQR of 2. The distribution is very stable by the end of the third round (.05).

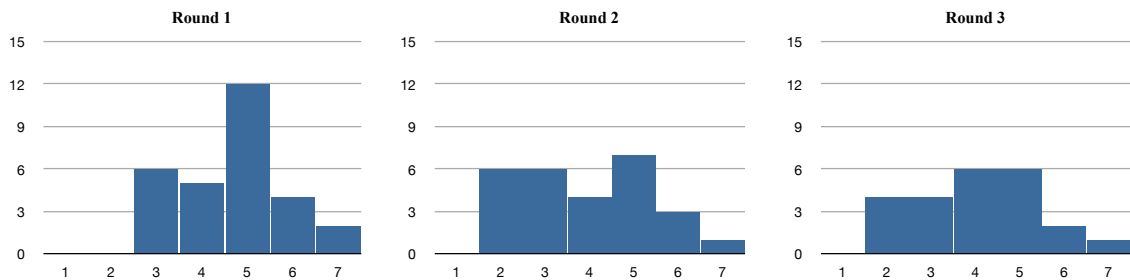


Figure 13. Distribution of responses to question 4.

There are 28 declarative statements for question 4 over the course of all three rounds. These statements are coded into eight themes (see Table 16).

Table 16

Number of Comments Per Round by Theme for Question 4.

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Faculty adopt effective technology	4	1		5
Faculty lack resources/support	3	1	4	8
Faculty unwilling to adopt	2	1	1	4
Learning curve impact	2	1		3
Generational differences	1	1	2	4
Lack of successful precedent	1			1
Faculty not tech literate	1			1
Pedagogical issues		1	1	2

Question 5

Panelists were asked to respond to the statement: **Faculty members struggle to adopt technology** necessary for distributed design education. Thirty-three responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 14). The mean score of the third round is 4.48 and the distribution had shared modes (4 & 5). The standard deviation of third round is 1.41 with an IQR of 1. The distribution is stable at the end of the third round (.11).

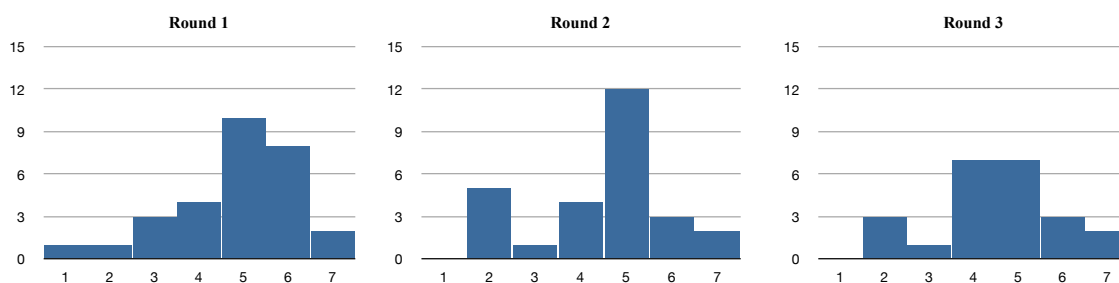


Figure 14. Distribution of responses to question 5.

There are 25 declarative statements for question 5 over the course of all three rounds. These statements are coded into seven themes (see Table 17).

Table 17

Number of Comments Per Round by Theme for Question 5

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Faculty lack needed time	3	1	1	5
Pedagogical issues to adopt	3	1	2	6
Faculty lack resources/support	2	2	3	7
Faculty do not struggle	2	1		3
Case by case	1		1	2
Generational difference	1			1
Poor prior experience	1			1

Question 6

Panelists were asked to respond to the statement: Faculty members oppose the use of distributed design education because of **theoretical or pedagogical disagreements with online education**. A total of 33 responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 15). The mean score of the third round is 4.57 with a mode of 5. The standard deviation of the third round is 1.376 with

an IQR of 2. The distribution is very stable (.05) at the end of the third round.

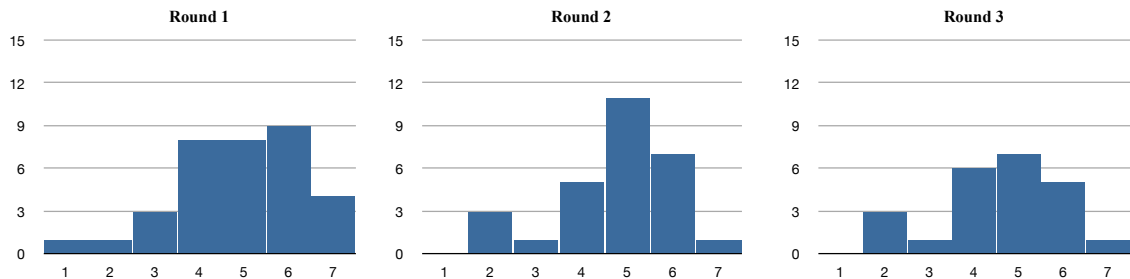


Figure 15. Distribution of responses to question 6.

There are a total of 15 declarative statements for question 6 over the course of all three rounds. These statements are coded into seven themes (see Table 18).

Table 18
Number of Comments Per Round by Theme for Question 6

Themes	Rd 1	Rd 2	Rd 3	Total
Case by case	2		1	3
Believe DDE degrades quality	2		1	3
Faculty overly critical	1		1	2
Only oppose DDE in studio	1			1
Need more information	1			1
Faculty lack pedagogical training		1	2	3
Change adverse		1	1	2

Question 7

Panelists were asked to respond to the statement: **Upfront costs may deter development** of design courses for distributed delivery. Thirty-three responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure

16). The mean score of the third round is 4.70 and the mode s 5. The standard deviation of the third round is 1.329 with an IQR of 1. The distribution is stable at the end of the third round (.15).

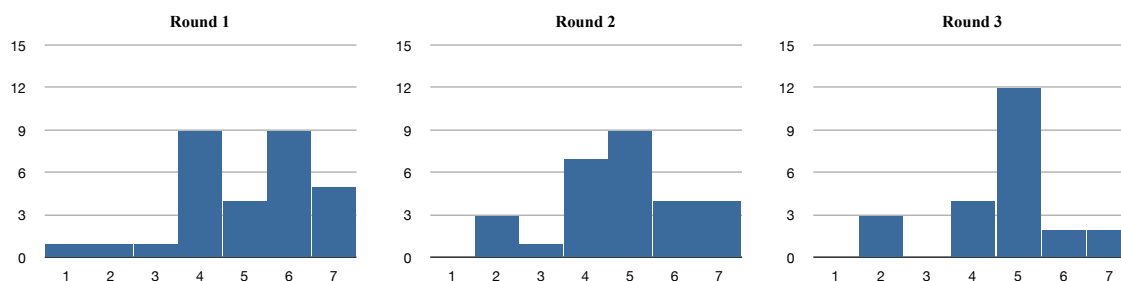


Figure 16. Distribution of responses to question 7.

There are a total of 26 declarative statements for question 7 over the course of all three rounds. These statements are coded into seven themes (see Table 19).

Table 19

Number of Comments Per Round by Theme for Question 7

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Costs are prohibitive	7	3	1	11
Unrealistic administration expectations	4			4
Online education is cost effective	2	1		3
Administration will cover cost	1			1
Need more information		4		4
Demonstration of need		1	1	2
Cost declining			1	1

Question 8

Panelists were asked to respond to the statement: **Ongoing costs may deter the**

continued offering of a distributed design course. Thirty-two responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 17). The mean score of the third round is 4.04 with a mode of 4. The standard deviation is 1.473 with an IQR of 1. The distribution is not stable at the end of the third round (.21).

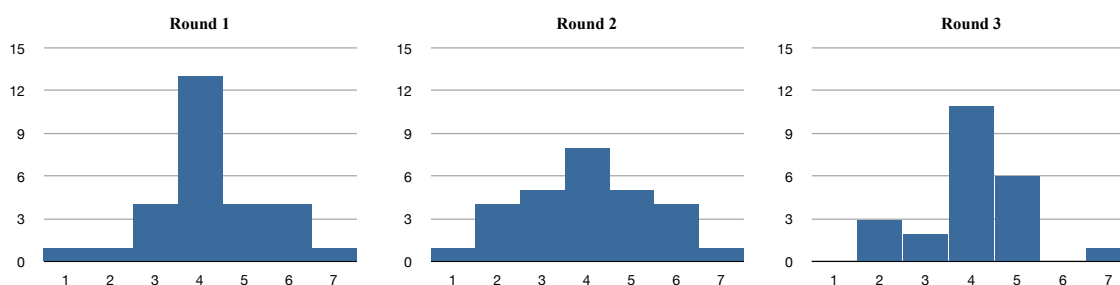


Figure 17. Distribution of responses to question 8.

There are a total of 22 declarative statements for question 8 over the course of all three rounds. These statements are coded into four themes (see Table 20).

Table 20
Number of Comments Per Round by Theme for Question 8

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Ongoing costs less than F2F	6	1	2	9
Costs are prohibitive	3	2	1	6
Need more information	3		3	6
Demonstration of need		1		1

Question 10

Panelists were asked to respond to the statement: **Faculty are concerned that distributed design courses will lead to a decrease in tenured faculty positions.**

Thirty-three responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 18). The mean score of the third round is 4.30 with a mode of 4. The standard deviation of the third round is 1.579 with an IQR of 2. The distribution is stable after the third round (.10).

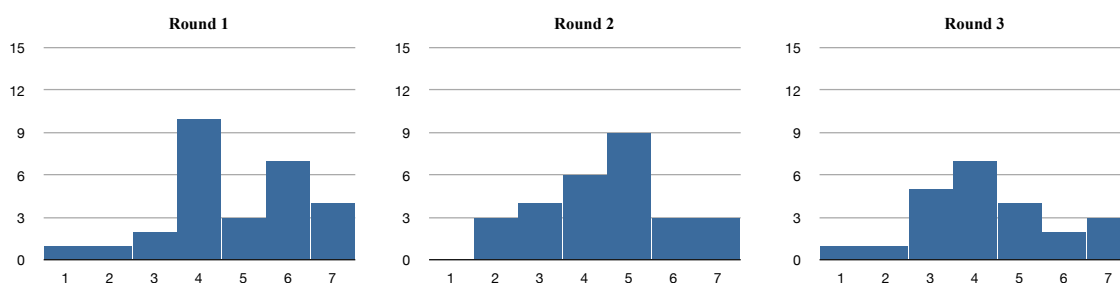


Figure 18. Distribution of responses to question 10.

There are 18 declarative statements for question 10 over the course of all three rounds. These statements are coded into seven themes (see Table 21).

Table 21

Number of Comments Per Round by Theme for Question 10

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Need more information	4		1	5
Positions remain constant	3	1		4
Broader tenure changes	2			2
Disapproval of tenure system	2			2
Faculty don't believe DDE will work	1			1
No correlation		2	1	3
Threat to status quo		1		1

Question 11

Panelists were asked to respond to the statement: **Private concern that distributed design courses will threaten personal job security.** Thirty-three responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 19). The mean score of the third round is 4.09 with a mode of 4. The standard deviation of the third round is 1.505 with an IQR of 1. The distribution is very stable after the third round (.00).

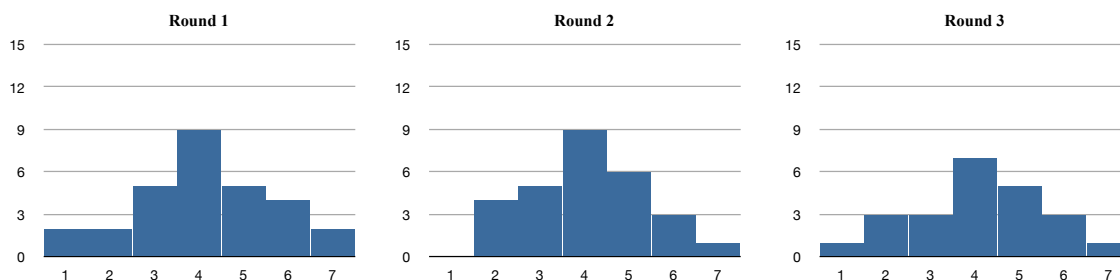


Figure 19. Distribution of responses to question 11.

There are a total of 13 declarative statements for question 11 over the course of all three rounds. These statements are coded into seven themes (see Table 22).

Table 22
Number of Comments Per Round by Theme for Question 11

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Need more information	2			2
Change inevitable	1		1	2
Increased competition	1			1
DDE requires same teaching numbers	1			1
Faculty feel threatened	1			1
Faculty dislike changes to status quo		1	2	3
Faculty don't feel threatened		1	2	3

Question 12

Panelists were asked to respond to the statement: **It is difficult for students to collaborate** in a distributed design course. Thirty-three responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 20). The mean score of the third round is 4.48 with a mode of 5. The standard deviation of the third round is 1.675 with an IQR of 2. The distribution is stable after the third round (.16).

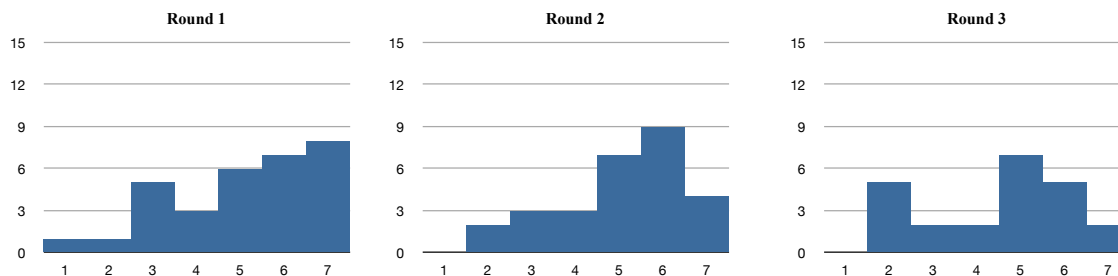


Figure 20. Distribution of responses to question 12.

There are a total of 27 declarative statements for question 12 over the course of all three rounds. These statements are coded into nine themes (see Table 23).

Table 23
Number of Comments Per Round by Theme for Question 12

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Students prefer F2F interaction	3			5
Dependent upon methods	2			4
Difficult to coordinate	1	1		2
Should supplement F2F	1	1	1	3
Technical constraints	1		1	2
Needs more research	1		1	2
Faculty must be competent in tech	1			3
Changing reality			4	4
Digital natives			2	2

Question 14

Panelists were asked to respond to the statement: **Technologies necessary for distributed delivery are too expensive for programs to purchase.** Thirty-three responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 21). The mean score of the third round is 3.61 with a mode of 4. The standard deviation of the third round is 1.27 with an IQR of 1. The distribution is stable after the third round (.10).

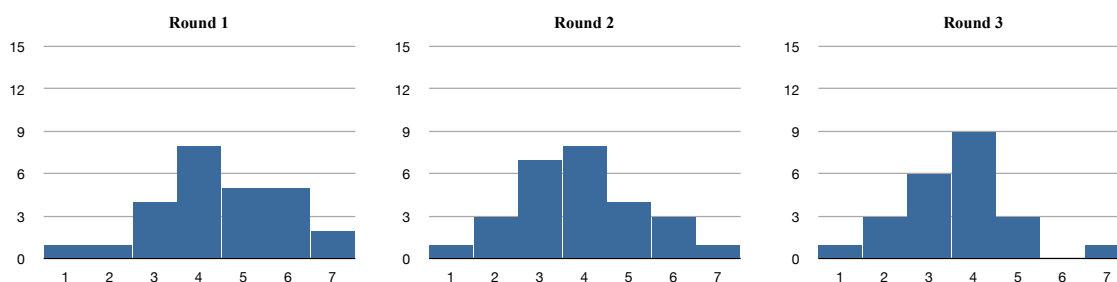


Figure 21. Distribution of responses to question 14.

There are a total of 19 declarative statements for question 14 over the course of all three rounds. These statements are coded into six themes (see Table 24).

Table 24
Number of Comments Per Round by Theme for Question 14

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Need more information	3	1	3	7
DDE is a cost savings	3	1		4
Administration will cover cost	2	1	2	5
Costs are prohibitive	1			1
Continuing costs		1		1
Case by case			1	1

Question 15

Panelists were asked to respond to the statement: **Technologies necessary for distributed learning are too expensive for students to purchase**. Thirty-three responses were received in the first round, 28 in the second round, and 23 in the third round (see Figure 22). The mean score of the third round is 3.70 with a mode of 4. The standard deviation of the third round is 1.33 with an IQR of 2. The distribution is stable after the third round (.05).

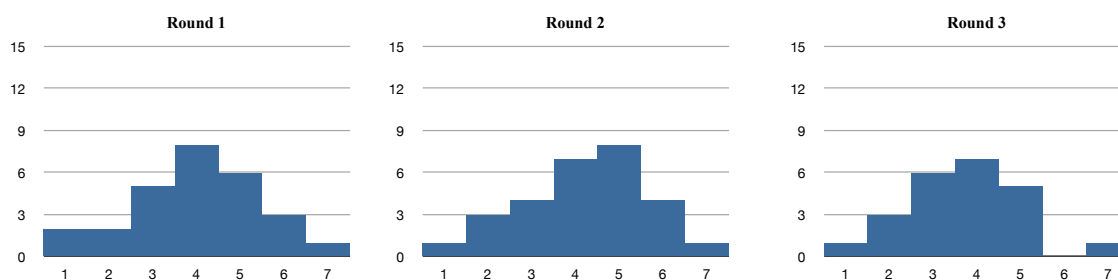


Figure 22. Distribution of responses to question 15.

There are a total of 14 declarative statements for question 15 over the course of all three rounds. These statements are coded into three themes (see Table 25).

Table 25
Number of Comments Per Round by Theme for Question 15

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Costs are prohibitive	4			4
Need more information	3	2	3	8
University should cover cost	1	1		2

Question 16

Panelists were asked to respond to the statement: The **technological proficiency required of students** in a distributed design course is unreasonable. Thirty-three responses were received in the first round, 27 in the second round, and 23 in the third round (see Figure 23). The mean score of the third round is 3.22 with a mode of 3. The standard deviation of the third round is 1.347 with an IQR of 1. The distribution is stable after the third round (.10).

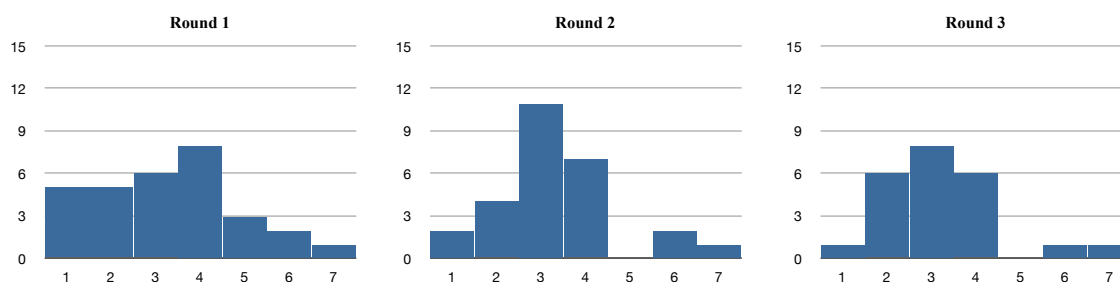


Figure 23. Distribution of responses to question 16.

There are a total of 14 declarative statements for question 16 over the course of all three rounds. These statements are coded into five themes (see Table 26).

Table 26
Number of Comments Per Round by Theme for Question 16

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
No added difficulty	3	2	2	7
Impacts of technology use	2	1		3
Case by case	1	1		2
Technology overload	1			1
Loss of focus on design learning	1			1

Question 17

Panelists were asked to respond to the statement: **Internet resources may be unreliable** due to disruption of an internet connection or the moving of a web link or web content. Thirty-three responses were received in the first round, 27 in the second round, and 22 in the third round (see Figure 24). The mean score of the third round is 4.14 with shared modes (4 & 5). The standard deviation of the third round is 1.699 with an IQR of 3. The distribution is stable after the third round (.11).

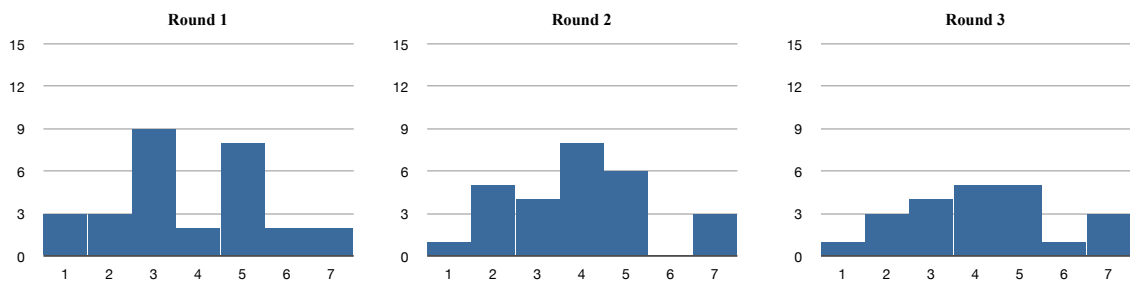


Figure 24. Distribution of responses to question 17.

There are eight declarative statements were submitted for question 17 over the course of all three rounds. These statements are coded into five themes (see Table 27).

Table 27
Number of Comments Per Round by Theme for Question 17

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
No concern	1	1	1	3
Planning for interruption	1			1
Case by case	1	1		1
Similar disruptions in F2F	1			1
Many potential disruptions			2	2

Question 18

Panelists were asked to respond to the statement: Teaching/managing a distributed course **consumes unacceptable amounts of faculty time**. Thirty-three responses were received in the first round, 27 in the second round, and 22 in the third round (see Figure 25). The mean score of the third round is 4.32 with shared modes (4 & 5). The standard deviation of the third round is 1.323 with an IQR of 2. The distribution is stable after the third round (.16).

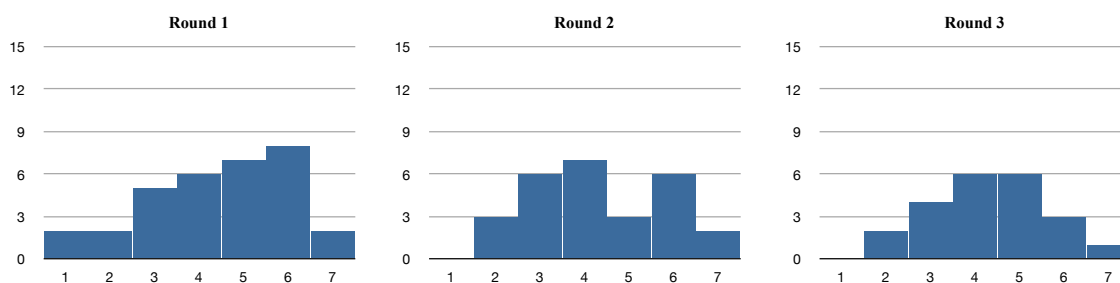


Figure 25. Distribution of responses to question 18.

There are 17 declarative statements submitted for question 18 over the course of all three rounds. These statements are coded into four themes (see Table 28).

Table 28

Number of Comments Per Round by Theme for Question 18

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
During development	7	1	1	9
Demands too much time	2	1		3
Time balance	1	1	2	4
Need more information		1		1

Question 21

Panelists were asked to respond to the statement: **Designs produced solely using computers are inferior.** Thirty-three responses were received in the first round, 26 in the second round, and 23 in the third round (see Figure 26). The mean score of the third round is 4.70 with a mode of 6. The standard deviation of the third round is 1.941 with an IQR of 4. The distribution is stable after the third round (.15).

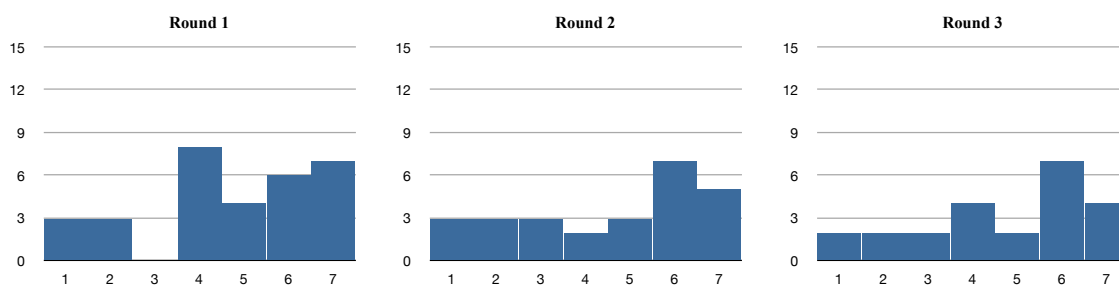


Figure 26. Distribution of responses to question 21.

There are 23 declarative statements for question 21 over the course of all three rounds. These statements are coded into five themes (see Table 29).

Table 29

Number of Comments Per Round by Theme for Question 21

<i>Themes</i>	<i>Rd 1</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Negatively impacts design learning	4	3	1	8
Negatively impacts design process	3			3
Computers are tools	2	1	1	4
DDE not 100% digital	2	1	1	4
Is the perception	2		2	4

Question 22

Panelists were asked to respond to the statement: Characteristics of the distributed environment **constrain a design student's creative process**. Thirty-three responses were received in the first round, 26 in the second round, and 23 in the third round (see Figure 27). The mean score of the third round is 4.65 with a mode of 6. The standard deviation of the third round is 1.722 with an IQR of 3. The distribution is stable after the third round (.11).

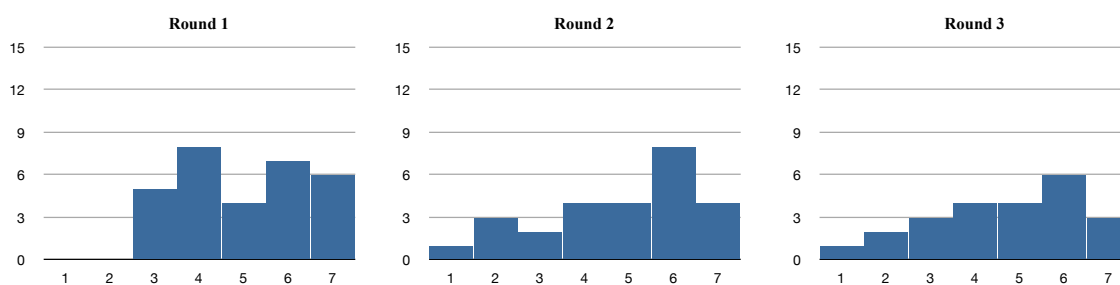


Figure 27. Distribution of responses to question 22.

There are 15 declarative statements for question 22 over the course of all three rounds. These statements are coded into five themes (see Table 30).

Table 30
Number of Comments Per Round by Theme for Question 22

Themes	Rd 1	Rd 2	Rd 3	Total
Constrains creative development	4	1	2	7
Depends on pedagogy	1	1	1	3
Need more information	1	2		3
Can occur in F2F studio	1			1
Case by case			1	1

Additional Barriers

At the end of the first round, panelists were asked to submit other barriers to the adoption of DDE that they felt should be considered by the panel. If barriers were suggested by more than 5% of the panel original panel ($n = 43$, $5\% = 3$ or more panelists), they were included in the second round. The following barriers were suggested by the panel. Suggestions marked with an asterisk were included in the second

and third rounds as questions 23 and 24. Question 24 is a critical barrier and is discussed at the beginning of this section.

Question 23

Panelists were asked to respond to the statement: There is a perception that **students spend less time and energy on projects in online courses**. Twenty-seven responses were received in the second round and 23 in the third round (see Figure 28). The mean score of the third round is 4.52 with a mode of 4. The standard deviation of the third round is 1.123 with an IQR of 1. The distribution is stable after the third round (.10).

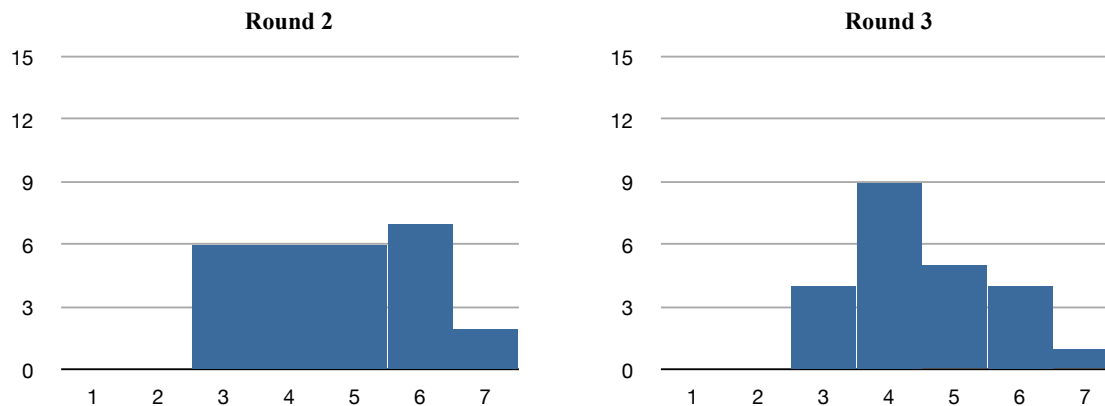


Figure 28. Distribution of responses to question 23.

There are 11 declarative statements for question 21 over the course of the final two rounds. These statements are coded into five themes (see Table 31).

Table 31
Number of Comments Per Round by Theme for Question 23

<i>Themes</i>	<i>Rd 2</i>	<i>Rd 3</i>	<i>Total</i>
Need more information	2	2	4
Students perceive online to be easier	2		2
Instructional design mitigation	1	2	3
Problems with student engagement	1		1
Lack of social pressure	1		1

Correlations

Correlation tests for each potential barrier were performed using the data collected in the demographic survey. There are seven significant moderate or strong correlations found. Kendall's tau is used to calculate correlation coefficients. In instances where one of the variables is dichotomous, a point-biserial correlation is calculated.

Length of Time in Private Practice x Barrier 1

There is a strong, positive correlation between the length of time a panelist had spent in private practice and barrier 1 (faculty believe the studio method cannot replicated by DDE). Kendall's tau is $r_t = .585$ ($n = 17, p = .006$). The longer a panelist spent in private practice, the more likely they are to agree that this was a barrier to adoption.

Degree Held x Barrier 9

There is a strong, negative correlation between the highest degree held by a panelist and barrier 9 (a lack of precedent). The point-biserial coefficient is $r_{pb} = -.533$ (n

= 20, $p = .015$). Panelists who hold a PhD are less likely to agree that this is a critical barrier to adoption.

Gender x Barrier 11

There is a strong correlation between panelist's gender and barrier 11 (private concern that DDE threatened job security). The point-biserial coefficient is $r_{pb} = .557$ ($n = 22$, $p = .007$). Men are more likely to agree that DDE represents a personal threat to their job security.

Online Teaching Experience x Barrier 19

There is a moderate correlation between panelist experience teaching online courses and barrier 19 (critiquing student work is difficult). The point-biserial coefficient is $r_{pb} = .450$ ($n = 22$, $p = .035$). Panelists without online teaching experience are more likely to agree that this is a critical barrier to adoption.

Last Time in Private Practice x Barrier 20

There is a moderate, negative correlation between the last time a panelist was in private practice and barrier 20 (students feel socially isolated). Kendall tau's is $r_t = -.448$ ($n = 17$, $p = .032$). The more recently a panelist has worked in private practice, the more likely they are to agree that this is a critical barrier to adoption.

Number of Studio Courses Taught Per Year x Barrier 22

There is a moderate, positive correlation between the number of studio courses a panelist taught each year and barrier 22 (DDE constrains student's creative process). Kendall tau's is $r_t = .429$ ($n = 22, p = .015$). The more studio courses that a panelist teaches each year, the more likely they are to agree that this is a critical barrier to adoption.

Online Teaching Experience x Barrier 22

There is a moderate correlation between panelist experience teaching online courses and barrier 22 (DDE constrains student's creative process). The point-biserial coefficient is $r_{pb} = .430$ ($n = 22, p = .046$). Panelists without online teaching experience are more likely to agree that this is a critical barrier to adoption.

Summary of Results

This study utilized a meta-synthesis of the literature to identify the constraints of DDE and a Delphi study to identify the critical barriers to the adoption of DDE by landscape architecture educators. The meta-synthesis identified 26 constraints of DDE. These were subsequently consolidated into 22 potential barriers, which were submitted to the study panel. The study panel suggested an additional two barriers. Of the 24 barriers the panel considered, 7 barriers are considered to be critical.

CHAPTER V

DISCUSSION

Summary of Study and Results

For convenience in reading, this chapter presents a brief summary of the overall study before discussing the implications of the results, the limitations of the research, and suggestions for future avenues of research. The purpose of this study is to answer the following research questions:

1. What are the reported constraints to the use of DDE in the literature, how might these be categorized, and what areas need additional research?
2. What are the perceived barriers to the adoption of DDE by landscape architecture faculty?

Conclusions

In general, the results of the meta-synthesis found the majority of published work in DDE focuses on issues related to the institutional and structural concerns and ramifications of DDE, such as program costs, time requirements, and specifics of technology. In contrast, the results of the Delphi study suggest that educators are most concerned about social barriers, and least concerned about structural barriers (see Table 32). This suggests that the focus of DDE researchers and the concerns of educators may not be well aligned, and that future research should place greater emphasis on the social

aspects of DDE. The remainder of this section first discusses the results of the Delphi study in more detail, then discusses how the findings of the Delphi compare with the results of the meta-synthesis, explicitly discussing the implications of the findings and how this dissertation lays a foundation for future research in DDE.

Table 32

The Seven Most Common Constraints and Barriers Compared

	<i>Constraints/Barriers</i>	<i>Theme</i>
Meta-synthesis	Lack of face-to-face interaction	Social
	Upfront costs may deter development	Institutional
	Ongoing costs may deter continued offerings	Institutional
	Building rapport with others is difficult	Social
	Faculty members struggle to adopt technology	Structural
	Faculty members are unwilling to adopt technology	Structural
	Technological proficiency required of students	Structural
Delphi	Instructors believe the studio method cannot be replicated using DDE	Pedagogical
	Faculty do not receive adequate compensation during development	Institutional
	Lack of precedent	Institutional
	Building rapport with others is difficult	Social
	Lack of face-to-face interaction	Social
	Students feel socially isolated from their peers	Social
	Critiquing student work is difficult	Social

Implications

The Delphi study identifies seven barriers as critical barriers to the adoption of DDE in landscape architecture (see Table 7). The implications of each of these barriers are discussed here, presented in order by their final ranking from the panel. Mitigations are suggested for each barrier. In general, these mitigations are drawn from social learning theories (DisCog, AfS, LPP), media-synchronicity theory, the findings of

previous DDE and online education research, and personal experience with teaching DDE.

Barrier 1: Instructors believe the studio method cannot be replicated using a distributed design environment.

This barrier is clearly of most concern to the panel. Other than the bottom tier of barriers, it has the highest amount of separation from the next closest barrier as measured by mean (.31). It also enjoys a high degree of consensus, with the second-lowest standard deviation score (1.033) amongst all the barriers. The barrier also generated the most comments from the panelists, with many of the comments revolving around social and pedagogical issues. Comments suggest that students would be unable to interact with each other, and therefore learn from each other through observation and impromptu learning sessions. There is also a belief that an online education platform that could support all of the communication and design tools necessary simply does not yet exist.

However, there is some dissent in the panel and, by the third round, there is clearly a group of panelists that are unconvinced that DDE is incompatible with the studio method, particularly from the standpoint of F2F communication. Issues were raised regarding generational familiarity with traditional teaching practices and the absolute necessity for students and faculty to interact F2F. Overall, the comments suggest an overall softening of attitudes towards DDE within the panel with a recognition that DDE presented a different method to studio teaching, and that if educators are concerned about achieving learning objectives, and not recreating the studio environment in minutiae, then perhaps DDE would work. This softening in the comments is also born

out in the statistical analysis, as the mean decreased with each round and the distribution became increasingly unstable. Despite these shifts, it remains the most critical barrier at the end of the survey.

This barrier presents a unique challenge when compared to most of the remaining barriers, because it is concerned more with an overarching concept (the entire studio method) than a specific facet of DDE or studio teaching, such as critiques, social rapport, or technology access. It is telling that this barrier was selected as the most critical, and suggests that there may be an underlying bias or misunderstanding of online education amongst landscape architecture educators. If this is the case, there are two methods that may be proposed to address this barrier.

The first is to assume that this barrier can only be addressed by mitigating for the remaining critical barriers, which are more focused in their scope and provide greater clarity on specific aspects of DDE. The second is to assume that this barrier represents an underlying bias or misunderstanding of DDE, in which case the proper approach to mitigating for this barrier is through improved education about the affordances, constraints, and potential uses of DDE. Similar conclusions that substantial faculty education on DDE may be necessary have previously been noted by Bender and Good (2003). Logically, because it is already necessary to develop methods of mitigating for the other critical barriers, the second strategy should be applied to help mitigate for this barrier. Educators need to be better informed about all aspects of DDE and they need opportunities to both observe and experiment with DDE.

Barrier 24: Faculty do not receive adequate compensation during the development phase

This barrier is one of two suggested by the panel and included in the second and third rounds. It was not identified as a potential barrier from the analysis of the constraints identified in the meta-synthesis. There is strong consensus on this barrier, with the third-lowest standard deviation score (1.105) and a high degree of stability (.095). The comments suggest that this barrier taps into larger frustrations from faculty about an increasing number of expectations without commensurate compensation being provided by institutions. Faculty do not believe they receive adequate monetary compensation, or adjustments to other responsibilities, to accommodate the time and work needed to develop a DDE course. Concern is also expressed about the intellectual rights associated with course content, and a lack of clarity at some institutions as to who retains ownership of course content.

There are several methods that may be utilized to mitigate for this barrier. The first is increased investment in development costs by university administrators to make DDE course development more attractive to faculty. Several comments from the panelists indicated that universities often seem more willing to invest in programs and infrastructure, than in the manpower to develop online courses. With all of the other demands placed on faculty, especially pre-tenure faculty, the lack of financial commitment is a serious disincentive to develop DDE courses. While increased investment appears necessary, how this investment is distributed could vary. Faculty need to be adequately compensated for their investment of time and energy, but efforts can also be made to reduce the amount of time and energy required by a faculty member

(Lawhon, 2003). Offloading some of the work from faculty members to other individuals, such as instructional designers, is a method that can be used to reduce the burden placed on faculty during the development phase. Modest increases in compensation, combined with offloading of some development responsibilities, can make DDE course development much more attractive to faculty.

The problem of a lack of investment is compounded by concerns over intellectual property rights. Many faculty are protective of their course material, as it often represents a substantial investment of their time and research efforts. Being asked to share this information online without assurances of retaining control and ownership can understandably make faculty nervous. Many may fear that their work will be taken from them and freely distributed without credit or compensation. Guarantees of intellectual property rights need to be clearly defined at all levels of a university, and done so in a clear and transparent manner in order to provide faculty with proper assurances (Godschalk & Lacey, 2001). Returning to the topic of compensation, faculty members may be less concerned if adequate compensation is being provided, if there is a clear provision on how a professor would receive ongoing compensation with regards to the use of their course content. In this model, faculty would essentially be paid a royalty fee for use of their content.

Barrier 9: A lack of precedent in distributed design education

This barrier has the highest degree of consensus, with a standard deviation of .999. The distribution has shared modes (5 & 6) and is highly stable (.105), suggesting that panelists are in close agreement and with a high degree of consensus. The high ranking

of this barrier suggests both a concern over a perceived lack of precedent, but also a desire amongst panelists to see and examine precedents. However, the literature review demonstrates that there are numerous examples of successful DDE precedents, yet ten comments on this barrier say more precedent is needed (or precedent did not exist), while only one comment mentions the existence of existing precedent (and not directly related to DDE). The strong belief by the panel that there is a lack of precedent appears to be more indicative of a lack of dissemination of the existing research, rather than a lack of precedent itself.

It would appear that dissemination of DDE precedent through traditional methods (journals and conferences) has been less effective in reaching landscape architecture faculty. This might partially be explained by the training of many landscape architecture faculty. There is a strong negative correlation between degree held and belief that lack of precedent is a barrier ($r_{pb} = -.533$). It may be that the large number of landscape architecture educators holding an MLA means that landscape architecture faculty are less likely to utilize traditional dissemination methods. These individuals are less likely to have received as rigorous training, or made a habit, in regularly consulting journals and conference proceedings, and are therefore more likely to be unaware of existing precedents.

If this is the case, steps need to be taken to disseminate DDE work in non-traditional methods. Experts in the field may offer direct dissemination to departments in the form of a guest lecture or brief training, and departments should encourage the exploration of DDE practices through conducting distance collaborations between universities (Bender & Good, 2003). As was discussed under barrier 1, there is also a

need to integrate faculty more closely with DDE than has been the case in the past. Instead of only one or two faculty members pursuing DDE, department administrators need to ensure a concerted effort, involving many faculty members, in order to ensure broad exposure and understanding of DDE across the faculty.

Comments from the panel also make it clear that there is a desire to see increased rigor in research. Several comments express a desire to see long-term longitudinal studies to better assess DDE's impact on the educational development of students and the achievement of teaching objectives. This study's evaluation of the literature also reveals that much of the current research on DDE is deficient in research methods. Therefore, efforts need to be undertaken to conduct more rigorous and targeted research in order to instill greater confidence in the precedent that does exist.

Finally, the subject of precedent needs to be considered in the context of a willingness to adopt. One comment is particularly telling on this subject: "Design educators are fans of innovation and would love to be the first to employ a successful method. It is the desire to advance successful students and the assumption that conventional studio teaching is the most effective method that deters commitment to new technologies." This comment suggests that while there is a desire to innovate and adopt new methods, there is also a strong underlying bias and tradition that runs counter to that desire. Comments such as this suggests that there may need to be a preponderance of successful precedents before many landscape architecture educators would be willing to adopt DDE.

Barrier 13: Building rapport with others is difficult

This barrier is the first of four critical barriers that deal with social factors and, taken together, these barriers suggest there is significant concern about the ability to translate the various social dynamics endemic to design education into a DDE environment. This suggests that there needs to be greater emphasis placed on studying how students interact with each other in DDE, and how those interactions might be improved. With this specific barrier, there is clearly a concern about the ability of students to build the relationships necessary to facilitate the rich sharing of ideas that should happen in the studio environment.

This barrier might be addressed via two primary methods, systematic and pedagogical. Systematically, the technology and software used to facilitate interactions between students should foster rapport building, and not just information transmission. Pedagogically, the instructor should introduce course activities that provide scaffolding for rapport building in a DDE course that may not have been necessary in a F2F course. Otherwise, it is conceivable that a student could complete a DDE course without ever communicating with their fellow students unless the instructor takes steps to facilitate interaction.

Despite the critical ranking of the barrier, some of the comments suggest that this may be a more important barrier for faculty than for students. Many panelists point out that modern students have grown up using social media, and that they share and collaborate freely in an online environment. They concede that there may be some factors that will not translate as well to a DDE course, or that communicating may not be as easy, but that it is generally possible and effective. While this is a concern, it is likely

that as technology continues to advance, the facilitation of rapport building will most likely become less and less of a technological issue and more of a pedagogical one.

Barrier 20: Students feel socially isolated from their peers

This barrier, and barrier 2 (see below), share the same mean score. However, this barrier has a higher mode (6 vs. 5), and is therefore listed earlier in the rankings. Once again, this barrier suggests that panelists are concerned about the social ramifications of DDE. Concerns stemming from this barrier are best understood in the context of the physical environment of the studio, where students are free to observe and interact with their peers. Social isolation, in design pedagogy, is worse than simply reducing the amount of social exchanges between students, it represents the reduction in the quantity of ideas that are shared, and, by extension, the quality of designs that are subsequently produced (Dutton, 1987; Schön, 1983).

As Hutchins (1995) theorized in the horizon of observation model, it is critical that learners are able to observe each other, especially their more advanced peers, in order to facilitate learning and mastery of more advanced skills. Lave and Wenger (1991) also demonstrate that observation of others is critical to learning and enculturation. In the studio, this observation often takes the form of socialization between students, as they move between each other's desks to talk about their designs and other topics. Mitigating for social and creative isolation is therefore clearly supported theoretically and by the results of the survey.

The comments from the panel are fairly polarized, as many panelists hold the view that modern students are adept at socializing in virtual environments because of their

familiarity with social media and other communication technologies. Other panelists do not believe that these social tools are an adequate replacement for the type of socialization that occurs within the studio, and that mastering the social environment and communication skills of the studio are important learning objectives in their own right. However, using the same rationale, a similar argument can be made that students need to be able to master and communicate via new media such as social media, as these technologies become increasingly prominent in practice and broader society (Boyd & Ellison, 2007; Vanderkaay, 2010).

Mitigation for this barrier seems to be closely tied to those for building rapport. Solutions need to be both systematic, through improved communication tools, and pedagogic, through the introduction of course activities that encourage students to regularly socialize. Researchers might look to the work done by Luther, Fiesler, and Bruckman (2012) on the open source project management system Pipeline, and existing commercial social networks for inspiration on addressing both the systematic and pedagogical facets.

Barrier 2: Lack of face-to-face interaction

This barrier is the most commonly cited constraint of DDE identified in the meta-synthesis, and is also identified by the panel as a critical barrier to adoption. Although a critical barrier, there is quite a lot of oscillation in the distribution stability, and at the end of the third round it is barely stable (.20), while the mean dropped .45 between the second and third rounds. This is the third barrier in the critical tier that is concerned with a social theme.

Many of the comments suggest it is possible to use various communication technologies (Voice Thread, Video chat, etc.) to overcome this barrier, but that these tools will still not produce as rich of a communication medium as F2F. For instance, assuming the technical aspects can be mastered, DDE may still only produce a communication experience that is 70% as rich of what might occur F2F. This issue of depth and quality is a prominent point of discussion among the panelists, and the overall feeling is that this barrier could be overcome to a degree – but not to the full extent of what occurs in a F2F studio. However, the suggestion is that even though physical face-to-face communication is preferable, not having it is not insurmountable. It is likely this barrier will become less of a concern as technology improves and students have the ability to communicate in a manner ever-closer to F2F interactions.

Other criticisms deal with the learning and pedagogy implications of F2F versus DDE. For instance, students and faculty may not experience the serendipitous conversations (or overhear peer's conversations) that occur in a PDS. With communication being more prescribed, it seems less likely that the rich, indirect learning environment of the studio can be fully replicated online. Also, the issue of authenticity in communication is raised – will students and instructors be less forthright and honest if they know that a discussion is being recorded or shared beyond what is happening at a desk? While issues of privacy might be a concern, it should be remembered that students in a PDS are already asked to share a great deal about their design process and product, and therefore a request to record a critique or design conversation does not seem to push boundaries of privacy much further.

Barrier 19: Critiquing student work is difficult

This is the final critical barrier. Although there is a noticeable drop between the mean of this barrier and the one immediately above it, this barrier is included with the critical barriers because it is closely tied to the barriers ranked 4-6, which are also social in nature. The distribution had a negative skew with a fair amount of disagreement, with a SD of 1.506, the highest amongst the critical barriers. Interestingly, it is also largely ignored by the literature, with only one article identifying difficulty critiquing student work as a constraint of DDE. This is not unsurprising, as most of the DDE projects reported in the literature reported on student-student collaboration, and few reported on details of the teacher-student relationship. Taken with the previous three barriers, it is apparent that a primary concern of landscape architecture faculty is how well DDE can meet the social and communicative needs of design education.

There is a moderately strong correlation on this barrier in that panelists who have experience with online teaching were less likely to consider this a critical barrier ($r_{pb} = .450$). Amongst those with online education experience, the mean was 4, while the mean for those without online experience it was 5.33. It is interesting that this, of all the social barriers in the study, is the only instance where online teaching experience is significantly correlated. It is also the only social barrier that is specifically concerned with the teacher-student relationship. It is possible that panelists who have experience with online education are more apt to trust their own ability to engage in legitimate communication with a student using DDE than they are to trust students to do so with their peers.

Despite this barrier ranking high, there are fewer comments compared to some of the other critical barriers. While there are clear concerns about the impact of DDE on the

critiquing process, as described above, there is also clear support for DDE critiques amongst the panel. Several panelists believe that one-to-one critiquing is not a problem, as long as the communication system supports multiple representations and enables a view of the development process. A couple panelists even provide examples of how they are already facilitating online critiques using Voice Thread or other technologies. One panelist even said they prefer to critique a digital file in detail and return it to the student later. Other panelists point out that these tools, and the practice of distance critique and collaboration, are already being used extensively in private practice, so it is appropriate that design education should also train students to design and critique in a distributed environment.

Commonalities

When considering the critical barriers as a body, there are several commonalities that appear. Four of the seven barriers are social barriers, suggesting that panelists are very concerned about the impact of DDE on the social aspect of learning that occurs in the PDS. The meta-synthesis somewhat agrees with the importance placed on social barriers by the panelists, as the first and fourth most frequently cited barriers in the literature were also social barriers (Barriers 13 and 2). However, there is a substantial disconnect between the constraints identified in the meta-synthesis and the barrier rankings developed from the Delphi, which is discussed in more detail below.

When considering the comments for all of the critical barriers in aggregate, the most commonly discussed theme has to do with technical constraints and the gap between what was possible in a PDS and what is possible through DDE (see Table 33).

Panelists are most frequently concerned about the impact that technology would have on the communication process. Panelists commonly note that technological tools could enable many aspects of communication, but often in a limited fashion. There is also concern over the facilitation of communication, and how DDE impacts the manner in which communication occurs. Many panelists made observations similar to Kvan (2001), who noted there is concern that the structured communication that occurs within DDE may limit the organic development of conversations and ideas.

Table 33
Proposed Mitigations for the Identified Critical Barriers

<i>Barrier</i>	<i>Proposed Mitigations</i>
Barrier 1: Studio method cannot be replicated using DDE	<ul style="list-style-type: none"> • Mitigate for remaining critical barriers • Improved education on affordances, constraints, and potential uses of DDE
Barrier 24: Inadequate faculty compensation during development	<ul style="list-style-type: none"> • Increased compensation and support for faculty • Clearly define issues related to intellectual copyrights • Provide for ongoing 'royalty' payments for use of faculty's intellectual property.
Barrier 9: Lack of precedent	<ul style="list-style-type: none"> • On-site presentations and demonstrations of DDE • Involve more department-level faculty in DDE efforts • Improve rigor of research being conducted in DDE
Barrier 13: Building rapport is difficult	<ul style="list-style-type: none"> • Select communication technologies to encourage rapport building in addition to information sharing • Scaffold social interactions into course curriculum • Improvements in communication and collaboration technologies.
Barrier 20: Students feel social isolation	<ul style="list-style-type: none"> • Select communication technologies to encourage rapport building • Scaffold social interactions into course curriculum • Improvements in communication and collaboration technologies.
Barrier 2: Lack of face-to-face interaction	<ul style="list-style-type: none"> • Utilize medium-rich communication tools such as VoiceThread or video chat.
Barrier 19: Difficulties critiquing student work	<ul style="list-style-type: none"> • Utilize medium-rich communication tools such as VoiceThread or video chat. • Mimic distance-critiques from professional practice

That the panel members focus the largest portion of their comments on technical issues is not surprising. This is similar to what many DDE researchers focus on, and demonstrates the appeal and fascination of the technology used. However, it is important to move the focus beyond the technology and discuss the underlying concerns that drive much of the technology discussion.

Table 34

The Common Themes from the Comments of the Critical Barriers

<i>Theme</i>	<i>Count</i>
Technical constraints / Technology Gap	26
Studio culture and social environment	19
Lack of precedent	14
Suggestions of success	12
Faculty compensation	9
Digital natives / student reality	9

The next most common topic was the studio culture and social environment of the studio. Panelists are very concerned about how the social culture of the PDS is replicated in a VDS. Comments concerning peer learning, rapport, mechanics of communication, and authenticity of communication are particularly prominent. In the PDS, students are free to observe and interact with each other, producing a social environment that is ideal for the development of mentoring relationships between students. How this F2F interaction can be replicated in a VDS is particularly perplexing to many panelists. The literature notes the difficulties associated with communication and rapport building, but fails to provide much in the way of innovative solutions (Niculae, 2011; Saghafi et al., 2012b). Some specific suggestions to emerge are from Matthew and Weigand (2001),

who noted that students who physically meet prior to collaborating online improve their collaboration. Cheng (1998) identified the need to scaffold social interactions in DDE, but later research does not report on the implementation of these suggestions.

How deficiencies in computer-mediated communication impact the sharing and development of ideas and knowledge is also important to the panel. This is true of both student-student and teacher-student interactions, although this research speculated that the impact on student-student interaction is of greater concern to the panel. There is a strong sense that learning design is an interactive process that occurs in a social and creative environment. This milieu appears to be one of the elements of the PDS that panelists are most concerned about replicating in DDE.

Panelists also frequently comment on the potential loss of an intangible quality of the studio, a “something” that permeates the studio. It is not possible to define this something from the scope of this study, but it is possible that these comments are a reference to a nostalgia or attachment to the traditional studio. It is likely that faculty have a romantic attachment, not necessarily to the performance of the studio, but to the idea of the studio. If this is the case, it is unlikely that DDE will ever be able to replicate the PDS, in the same way that a new item can never fully replace an old item with emotional attachment. The appropriate action is to focus the conversation on the measurable qualities of the studio and the achievement of learning outcomes, while acknowledging the cultural and historical value of the PDS.

Lack of precedent is the next most commonly mentioned topic in the comments. This is discussed in detail above, but it is worth noting again that the results of this research have demonstrated that DDE research has not been sufficiently disseminated,

nor is it of sufficient rigor. There are also many panelists who provide examples of how DDE principles have been used successfully. These specific examples provide an interesting counterpoint to the belief that there is insufficient precedent. However, none of the panelists appear to have published or presented on the use of DDE, and so these successful examples that were shared remain isolated from the larger academic community.

The next most discussed topic is insufficient compensation for the development of DDE courses. However, comments about this concern are limited to the discussion of Barrier 24, which is discussed above. The final frequent topic of discussion is the changing characteristics of the student population. Several panelists feel that today's students are digital natives who already regularly socialize and collaborate online. These panelists appear to share Prensky's (2001) opinion that modern design students differ significantly from previous generations who learned technology later in their life, instead of growing up under its constant influence. These panelists suggest that concerns about students' abilities to collaborate in a similar manner to the PDS are unfounded, and that the increasing prevalence of digital communication reflects broader trends in society. Surprisingly, the correlations did not reveal the existence of any digital natives amongst the younger panelists. Younger panelists did not have significantly different attitudes towards social interaction in DDE when compared to their older peers. While it may be that digital natives have not yet entered academia, it is more likely that even the younger, "digital native" faculty harbor sufficient reservations about the ability of communication technologies to adequately mitigate the impact of removing a student from the social setting of the studio.

Relationship to the Literature

An important finding of this research is the existence of a disconnect between the focus of existing DDE research and the critical barriers identified by the Delphi panel. When the rankings of the most common constraints from the meta-synthesis and the barriers from the Delphi are statistically compared, there is no significant correlation between them. A simple comparison of the rank means of the constraints, based off of the barrier levels (critical, important, less important, not important), suggests that researchers have spent the majority of their efforts on issues that are of the least concern to the panel (see Table 34).

Figure 29 shows a comparison between the final rankings of the barriers, shown on the left, and a ranking of the corresponding constraint identified in the literature (calculated through instance count). It should be noted that two barriers were not even identified from the meta-synthesis, but were drawn from panel suggestions. The critical barriers are especially misaligned with the findings of the meta-synthesis, with the top seven barriers having respective constraint rankings of 9, unranked, 20 (tie), 4, 14, 1, 20 (tie). Only two of the critical barriers were in the upper quartile of the list of most commonly identified constraints from the meta-synthesis. Conversely, three of the critical barriers were in the lower quartile of the meta-synthesis. The commonly identified constraints from the meta-synthesis were also generally of least concern to the panel, with respective final barrier rankings of 5, 8, 20, 4, 20, 24.

Table 35
Comparison of the Mean Rank From the Meta-Synthesis to Panel Results

<i>Barrier level</i>	<i>Mean Rank of Meta-Synthesis</i>
Critical (1-7)	13
Important (8-15)	11.625
Less Important (16-21)	10.667
Not Important (22-24)	9.667

At first glance, these findings should be an expected result. A frequently researched topic should produce less concern, as it is more likely that detailed study of the factors involved has led to the development of viable solutions. However, it is important to remember that the third-ranked barrier is a lack of precedent in DDE research, suggesting that panelists are largely unaware of the existing body of work on DDE, and therefore their conclusions can be assumed to have been reached independent of substantial influence from a knowledge of existing DDE research. Consequently, the findings support the existence of a disconnection between the research and the barriers. While this does not suggest that the existing work conducted on DDE has been a wasted exercise, it does indicate that DDE researchers need to re-evaluate their research agendas to more closely align with the concerns of faculty. Much of the current research focuses on structural and institutional topics, and several social factors have been under researched. Especial priority should be given to the evaluation of the social impacts of DDE and how the social benefits of the studio might be achieved through DDE. Without

aligning the research agenda, it is unlikely that DDE will experience widespread adoption as the most critical faculty concerns will remain unaddressed.

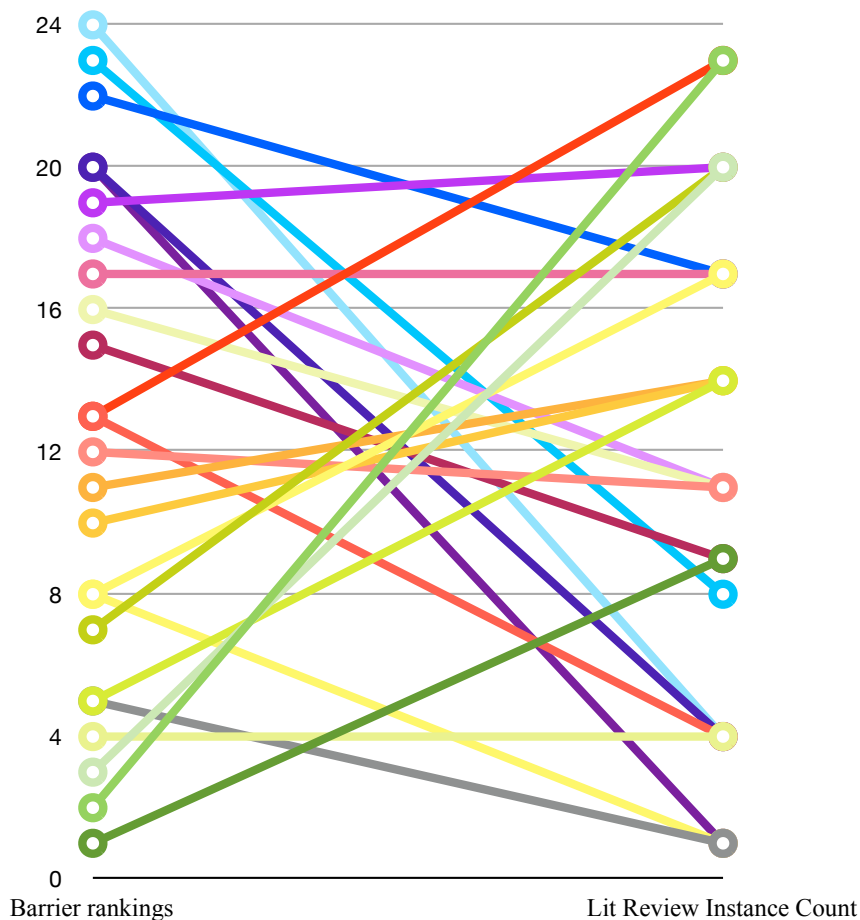


Figure 29. A comparison of the final barrier rankings and most common constraints. The barriers are ranked on the left with the instance count of the constraints from the meta-synthesis on the right. The highest ranked barriers begin at the bottom of the chart.

Recommendations for Future Research

An important part of this work is to help create a foundation on which future research in DDE can be constructed. This is accomplished through an analysis of the

trends identified in the meta-synthesis, the identification of the critical barriers to adoption of DDE, and an analysis of the declarative statements provided by the panel. As a result of this work, several general and specific recommendations for future research can be made.

General Recommendations

The literature review reveals that there needs to be an improvement in the rigor of the studies being conducted on DDE. Studies need to be pre-planned with clear measures and objectives identified prior to the start of the study. Descriptions of study methods also need to be described in greater clarity and detail to improve the repeatability and assessment of the studies. The panel comments suggest a need for long-term longitudinal studies over a multi-year period to assess the broader impact of DDE on design and learning objectives. Studies also need to be undertaken to better assess the impact of DDE on different demographics and experience levels of students.

Dissemination of DDE research also needs to be a top priority. Effort should be made to place articles in the top design-related journals and conferences, instead of more technical or educational journals. Alternative types of dissemination should also be considered, such as workshops, trainings, and demonstrations in order to raise familiarity and experience with DDE methods.

Specific Recommendations

Based on the findings of the Delphi study, several specific recommendations can be suggested for future research work in DDE. First, there needs to be greater emphasis

placed on researching social interactions in DDE. It is important to better quantify the impact that DDE has on social interactions, how potentially negative impacts can be mitigated for, and how positive aspects and behaviors of communication can be modeled and scaffolded for. Researchers would do well to draw on the work being done on online collaboration by researchers in other fields, such as social media and distributed cognition and collaboration in developing models of social interaction in DDE (e.g., Greenhow, Robelia, & Hughes, 2009; Hutchins, 1995; Luther et al., 2012). Luther's work (Luther et al., 2012; Luther et al., 2010) offers particularly useful models for digital collaborations involving graphic-heavy subjects, similar in principle to what DDE needs to achieve within a VDS. This social research should pay particular attention to the creation of social design networks, similar to what occur in a PDS, where the focus is not on the design product or the tools being used, but on the design process, design conversation, and the interactions between students and teachers that impact the course of the design process.

Secondly, more research needs to occur on closing the technology gap, that is the gap in effectiveness between digital and F2F communication. Rather than focus research on the development of new digital tools, it is more advisable that DDE researchers focus on systematically identifying existing (and future) tools that are particularly suited for learning and collaboration tasks within DDE. Media-synchronicity theory can provide a valuable model on which to begin this evaluation, and provide a theoretical foundation for identifying ideal technology tools based on the communication objectives and learning goals of design education (Dennis, Fuller, & Valacich, 2008; Kahai, Carroll, &

Jestice, 2007). This includes facilitating more organic discussion, authentic conversation involving a design during a critique, and an iterative development process.

Third, greater focus needs to be placed on the pedagogical implications of DDE. It is insufficient to recognize that DDE presents specific challenges to teaching design in the traditional manner. These challenges need to be clearly identified, their impacts measured, and solutions suggested. These solutions should not constrain themselves to the traditional studio paradigm, but should focus on the achievement of learning objectives. If, as Kvan (2001) has noted, DDE significantly alters traditional design pedagogy, than it stands to reason that a successful DDE pedagogy might not closely resemble that of the PDS. Rather, researchers should look to research on mentoring, enculturation, and collaboration for insights into the learning theories that underlie studio learning and studio culture. The incorporation of social and collaborative concepts such as the fluid horizontal social networks in affinity space theory, the horizon of observation in distributed cognition theory, and the mentoring relationships and enculturation process theorized in legitimate peripheral participation can provide DDE researchers with valuable knowledge and theoretical foundation around which to construct a new pedagogy specifically tailored to the strengths and weaknesses of DDE (Black, 2008; Hutchins, 1995; Lave & Wenger, 1991).

Fourth, there needs to be a conversation, backed by research, about the role that DDE can play in landscape architecture education. Several comments from the panel indicate a belief that DDE can play a valuable role in landscape architecture education, but more work needs to be done to define that role. As mentioned at the beginning of this work, DDE can potentially provide several benefits to programs, such as enrollment

expansion, geographic reach, and increased flexibility, but there may be many ways a program could implement DDE to achieve these results. Research in this area needs to incorporate the opinions of faculty, students, and administrators in an attempt to obtain a degree of consensus and buy-in. There are several current studies on DDE that have begun to explore this subject, such as Li's (2007) and Saghafi and colleagues' (2012b) evaluation of student opinions on DDE use and its potential role, yet more comprehensive research needs to be conducted on both the role and implementation of DDE in landscape architecture education.

Limitations

This dissertation examines the body of research on DDE and describes a study of the barriers to the adoption of DDE by landscape architecture faculty. There are several limitations of this work that should be considered in both its evaluation and its generalizability.

With any Delphi study, the panel of experts is an important factor to consider in discussing limitations. The panel in this study does not represent a randomized sample of landscape architecture faculty, and it is more likely to include participants who have a potential interest in DDE, for any variety of reasons. The panel was selected using a method to potentially include a very broad spectrum of landscape architecture faculty in order to avoid constructing a panel biased in knowledge, experience, or opinion of DDE. The results of the demographic survey suggest that the panel did represent a diverse spectrum of landscape architecture faculty. However, as is the case with any sample, care should be taken when generalizing findings to the entire population. Furthermore,

subtle differences between the design fields may make generalizing the results of this work to fields such as architecture and interior design less reliable.

Measurement error is also a limitation of the Delphi study. As is noted in the Methods Chapter, there is a continuing debate on the viability of the Delphi method in creating consensus, and to what degree the results represent the actual opinions of the panelists, versus panelists conforming towards the mean as a matter of convenience. Although the declarative statements were collected as a method for trying to mitigate for this, it is likely that a small number of panelists may have responded out of convenience during the rounds of the Delphi. Furthermore, the impact of panelists dropping out of the study is difficult to measure. The decision was made to include the data of panelists who dropped out of the study because it was deemed that their contribution during the conversational process of the Delphi had an impact on shaping panel opinions.

Finally, the frame of reference and personal biases of the researcher also represent a limitation to the research. The researcher holds a master's degree in Landscape Architecture and has experience developing and teaching DDE courses. In order to mitigate for researcher bias as, steps were taken to ensure the work was carried out in as unbiased a manner as possible. This included the use of a second researcher to validate the coding in the meta-synthesis, having landscape architecture faculty review the Delphi survey prior to distribution to ensure clarity and neutrality in wording, and ensuring the Delphi was conducted in a transparent process.

Final Opinions

This research found a disconnect between the research that has been conducted on DDE and the reported barriers to adoption. In many instances, often discussed constraints within the literature do not correspond with the critical barriers identified by the panel. While researchers largely discuss structural and institutional concerns, social concerns constitute the majority of the critical barriers identified by the faculty panel. While this is somewhat disconcerting, it also suggests that there is still much research that needs to be done on DDE before there is sufficient information to determine DDE's effectiveness and adaptability to the unique demands of design education.

Overall, the study does not suggest any insurmountable barriers to the successful implementation and adoption of DDE. The focus on the development of social technologies, both in research and industry, bodes well for the development of the technological tools and skillsets necessary to overcome the social constraints and barriers of DDE, which appear to include some of the more difficult concerns to address. While future technology may promise a more polished final product and process, programs and faculty should not adopt a wait-and-see attitude towards DDE. There is ample research that still needs to be done, especially in the areas of role and pedagogy.

There needs to be a discussion about the role of DDE in design education curriculum. Although the potential exists for DDE to be used to create entire course or program offerings in an online format, this is certainly not the only model that could be adopted. DDE can also provide opportunities to supplement existing face-to-face instruction or provide more flexibility or precision in course offerings. What role DDE

might play in design education is a conversation that should be taking place in individual departments.

Finally, a top priority for DDE researchers should be the creation of a DDE pedagogy that is uniquely designed to utilize the affordances of DDE and mitigate for the constraints and barriers. Brown and Cruickshank (2003) and Kvan (2001) have both noted the need for such an evaluation, but this has not been done. There is already some discussion amongst educators and theorists about the need to reevaluate design pedagogy, even in traditional studios (Dutton, 1987; Hokanson, 2012; Webster, 2009). It would seem that DDE offers an opportunity for such a reevaluation, at least in applying design pedagogy to an online setting.

REFERENCES

- Alexander, C. (1964). *Synthesis of form*. Cambridge, MA: Harvard University Press.
- Anderson, J. Q., Boyles, J. L., & Rainie, L. (2012). The future impact of the internet on higher education: Experts expect more efficient collaborative environments and new grading schemes; they worry about massive online courses, the shift away from on-campus life. *Pew Internet & American Life Project*. Retrieved from: http://www.pewinternet.org/files/old-media/Files/Reports/2012/PIP_Future_of_Higher_Ed.pdf
- Anthony, K. H. (1991). *Design juries on trial: The renaissance of the design studio*. New York, NY: Van Nostrand Reinhold.
- Baker, J., Lovell, K., & Harris, N. (2006). How expert are the experts? An exploration of the concept of “expert” within Delphi panel techniques. *Nurse Researcher*, 14(1), 59–70.
- Barnett-Page, E., & Thomas, J. (2009). Methods for the synthesis of qualitative research: a critical review. *BMC Medical Research Methodology*, 9(1), 59.
- Bender, D. M. (2005). Developing a collaborative multidisciplinary online design course. *The Journal of Educators Online*, 2(2), 1-12.
- Bender, D. M., & Good, L. (2003). Interior design faculty intentions to adopt distance education. *Journal of Interior Design*, 29(1&2), 66–80.
- Bender, D. M., & Vredevoogd, J. D. (2006). Using online education technologies to support studio instruction. *Journal of Educational Technology & Society*, 9(4), 114–122.
- Bender, D. M., Wood, B. J., & Vredevoogd, J. D. (2004). Teaching time: Distance education versus classroom instruction. *The American Journal of Distance Education*, 18(2), 103–114.
- Bennett, S., Maton, K., & Kervin, L. (2008). The “digital natives” debate: A critical review of the evidence. *British Journal of Educational Technology*, 39(5), 775–786.
- Black, R. W. (2008). *Adolescents and online fan fiction*. New York, Peter Lang.
- Blumenfeld, P.C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26(3-4), 369–398.

- Boyd, D. M., & Ellison, N. B. (2007). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210–230.
- Brancheau, J. C., Janz, B. D., & Wetherbe, J. C. (1996). Key issues in information systems: 1994-95 SIM Delphi results. *MIS Quarterly*, June 1996, 225–242.
- Broadfoot, O., & Bennett, R. (2003). *Design studios: Online? Comparing traditional face-to-face Design Studio education with modern internet-based design studios* (pp. 1–13). Presented at the Apple University Consortium.
- Brown, J. S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42
- Brown, S., & Cruickshank, I. (2003). The virtual studio. *International Journal of Architectural Research*, 22(3), 281–288.
- Brown, S., Hardaker, C. H. M., & Higgett, N. P. (2000). Designs on the web: A case study of online learning for design students. *Association for Learning Technology Journal*, 8(1), 30–40.
- Budd, J., Vanka, S., & Runton, A. (1999). The ID-Online Asynchronous Learning Network: A “Virtual Studio” for interdisciplinary design collaboration. *Digital Creativity*, 10(4), 205–214.
- Chen, W., & You, M. (2003). A framework for the development of online design learning environment (pp. 14–17). *Proceedings of the 6th Asian Design Conference*. Tsukuba, Japan.
- Cheng, N. Y.-W. (1998). Digital identity in the virtual design studio (pp. 1–13). *Proceedings of the 86th Associated Collegiate Schools of Architecture's (ACSA)*. Cleveland, OH.
- Christensen, C., & Eyring, H. J. (2011). *The Innovative university: Changing the DNA of higher education*. New York, NY: John Wiley.
- Commission for Architecture and the Built Environment. (2010). *Green space skills 2009: National employer survey findings* (pp. 1–67). London: Commission for Architecture and the Built Environment.
- Crowther, P. (2010). Assessing architectural design processes of diverse learners. *Proceedings of the ATTN Assessment Conference 2010: Sustainability, Diversity and Innovation*. Sydney, Australia: ATTN.
- Dale, J. S. (2006). A technology-based online design curriculum. In TCC, 2-11. Retrieved from: http://www.researchgate.net/publication/228611136_A_technology-

based_online_design_curriculum

- Dave, B., & Danahy, J. (2000). Virtual study abroad and exchange studio. *Automation in Construction*, 9, 57–71.
- Dennis, A. R., Fuller, R. M., & Valacich, J. S. (2008). Media, tasks, and communication processes: a theory of media synchronicity. *MIS Quarterly*, 32(3), 575–600.
- Dill, W. R. (1998). Specialized accreditation: an idea whose time has come? or gone? *Change*, 30(4), 18–25.
- Dorst, K. (2003). The problem of design problems. In *Expertise in design* (pp. 135–147).
- Dutton, T. A. (1987). Design and studio pedagogy. *Journal of Architectural Education*, 41(1), 16–25.
- Elger, D., & Russel, P. (2001). Net-based architectural design: The difficult path from the presentation of architectural design in the World Wide Web to teamwork in virtual planning offices: A field report. *Proceedings of the 19th eCAADe*. Helsinki, Finland: eCAADe.
- Fischer, R. G. (1978). The Delphi method: A description, review and criticism. *Journal of Academic Librarianship*, 4(2), 64–70.
- Gee, J. (2004). *Situated language and learning: A critique of traditional schooling*. New York, NY: Routledge.
- Godschalk, D. R., & Lacey, L. (2001). Learning at a distance: Technology impacts on planning education. *Journal of Planning Education and Research*, 20, 476–489.
- Grantham, E. (2011). *NEA, 2011* (No. Research Note #103) (pp. 1–14). Washington, DC: Office of Research & Analysis, National Endowment for the Arts.
- Greenhow, C., Robelia, B., & Hughes, J. E. (2009). Web 2.0 and classroom research: What path should we take now? *Educational Researcher*, 38(4), 246–259.
- Group, T. U. A. E. R. (2013). *Pathways and gateways: The structure and regulation of architectural education*. London, England: The UK Architectural Education Review Group.
- Gül, L. F., Williams, A., & Gu, N. (2012). Constructivist learning theory in virtual design studios. In N. Gu & X. Wang, *Computational design methods and technologies: applications in CAD, CAM, and CAE education* (pp. 139–162). Hershey, PA: IGI Global.

- Ham, J. J., & Schnable, M. A. (2011). Web 2.0 virtual design studio: Social networking as facilitator of design education. *Architectural Science Review*, 54(2), 108–116.
- Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, 32(4), 1008–1015.
- Herring, M. C. (2004). Development of constructivist-based distance learning environments. *The Quarterly Review of Distance Education*, 5(4), 231–242.
- Hill, K. Q., & Fowles, J. (1975). The methodological worth of the Delphi forecasting technique. *Technological Forecasting and Social Change*, 7, 179–192.
- Hokanson, B. (2012). The design critique as a model for distributed learning. In L. Moller & J. B. Huett (Eds.), *The Next Generation of Distance Education*, (pp. 71–83). Boston, MA: Springer US.
- Hubbard, H. V., & Kimball, T. (1917). *An introduction to the study of landscape design*. New York, NY: MacMillan.
- Hunter, W. (2012, September 28). Alternative routes for architecture. *Architectural Review*. Retrieved from: <http://www.architectural-review.com/academia/alternative-routes-for-architecture/8636207.article>
- Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.
- Itten, J. (1975). *Design and form: The basic course at the bauhaus and later*. London, England: John Wiley.
- Kahai, S. S., Carroll, E., & Jestice, R. (2007). Team collaboration in virtual worlds. *The DATA BASE for Advances in Information Systems*, 38(4), 1–8.
- Keeney, S., Hasson, F., & McKenna, H. P. (2001). A critical review of the Delphi technique as a research methodology for nursing. *International Journal of Nursing Studies*, 38, 195–200.
- Kramer, B. S., Walker, A. E., & Brill, J. M. (2007). The underutilization of information and communication technology-assisted collaborative project-based learning among international educators: A Delphi study. *Educational Technology Research and Development*, 55(5), 527–543.
- Kvan, T. (2001). The pedagogy of virtual design studios. *Automation in Construction*, 10, 345–353.
- Landscape Architecture CEO Roundtable. (2007). *Landscape Architecture CEO Roundtable*. Logan, UT.

- Lawhon, L. L. (2003). Do distance learning efforts in urban planning education cut short the educational experience? *Journal of Planning Education and Research*, 23, 202-205.
- Lave, J., & Wenger, E. (1991). *Situated learning and legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.
- Levine, S. L., & Wake, W. K. (2000). Hybrid teaching: Design studios in virtual space (Vol. 1). *Proceedings of the National conference on liberal arts and the education of artists*. New York City, NY.
- Li, M.-H. (2007). Lessons learned from web-enhanced teaching in landscape architecture studios. *International Journal on E-Learning*, 6(2), 205–212.
- Li, M.-H., & Murphy, M. D. (2004). Assessing the effect of supplemental web-based learning in two landscape construction courses. *Landscape Review*, 9(1), 157–161.
- Linstone, H. A., & Turoff, M. (Eds.). (1979). *The Delphi method: Techniques and applications*. Reading, MA: Addison-Wesley.
- Lokken, F., & Mullins, C. (2014). *2013 Distance education survey results*. Washington, DC: Instructional Technology Council.
- Luther, K., Caine, K., Ziegler, K., & Bruckman, A. (2010). Why it works (when it works): Success factors in online creative collaboration. *Proceedings of the 16th ACM international conference on supporting group work*. Sanibel Island, FL: ACM.
- Luther, K., Fiesler, C., & Bruckman, A. (2012). Redistributing leadership in online creative collaboration. *Proceedings of the 2013 Conference on computer supported cooperative work*. San Antonio, TX: ACM.
- Maher, M. L., & Simoff, S. (1999). Variations on the virtual design studio. *Proceedings of Fourth International Workshop on CSCW in Design*. Compiègne, France.
- Maher, M. L., Bilda, Z., & Gül, L. F. (2006). Impact of collaborative virtual environments on design behavior. *Proceedings of Design computing and cognition '06*. Springer Netherlands.
- Maher, M. L., Simoff, S., & Cicognani, A. (1996). *The potential and current limitations in a virtual design studio*. Sydney, Australia. Key Centre of Design Computing, Department of Architecture and Design Science. Retrieved from: <http://web.arch.usyd.edu.au/~mary/VDSjournal/>
- Matthews, D., & Weigand, J. (2001). Collaborative design using the internet: A case

- study. *Journal of Interior Design*, 27(1), 45–53.
- McHarg, I. L. (1969). *Design with nature*. New York, NY: American Museum of Natural History.
- Niculae, R. L. (2011). The virtual architectural studio - an experiment of online cooperation. *Review of Applied Socio-Economic Research*, 1(1), 38–46.
- Noblit, G. W., & Hare, R. D. (1988). *Meta-ethnography: Synthesizing qualitative studies*. Newbury Park, CA: SAGE.
- Ono, R., & Wedemeyer, D. J. (1994). Assessing the validity of the Delphi technique. *Futures*, 26(3), 289–304.
- Ozturk, E., & Ünlü, C. E. (2014). Online design education: Its availability, viability, advantages, and disadvantage. *Proceedings of the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, Montreal, Canada.
- Park, J. Y. (2011). Design education online: Learning delivery and evaluation. *The International Journal of Art & Design Education*, 30(2), 176–187.
- Pollard, C., & Pollard, R. (2004). Research priorities in educational technology: A Delphi study. *Journal of Research on Technology in Education*, 37(2), 145–160.
- Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, 9(5), 1–6.
- Radclyffe-Thomas, N. (2008). White heat or blue screen? Digital technology in art & design education. *The International Journal of Art & Design Education*, 27(2), 158–167.
- Rogers, E. B. (2001). *Landscape design: A cultural and architectural history*. New York, NY: Harry N. Abrams.
- Saghafi, M. R., Franz, J., & Crowther, P. (2012a). A holistic blended design studio model: A basis for exploring and expanding learning opportunities. *Proceedings of the Society for Information Technology and Teacher Education International Conference (SITE 2012)*. Austin, TX.
- Saghafi, M. R., Franz, J., & Crowther, P. (2012b). Perceptions of physical versus virtual design studio education. *International Journal of Architectural Research*, 6(1), 6–22.
- Sagun, A., Demirkan, H., & Goktepe, M. (2001). A framework for the design studio in web-based education. *The International Journal of Art & Design Education*, 20(3), 332–342.

- Scheibe, M., Skutsch, M., & Schofer, J. (1975). Experiments in Delphi methodology. In H. A. Linstone & M. Turoff, *The Delphi method: Techniques and applications* (pp. 257–281). London, England: Addison-Wesley.
- Schmidt, R. (1997). Managing Delphi surveys using nonparametric statistical techniques. *Decision Sciences*, 28(3), 763–774.
- Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001). Identifying software project risks: An international Delphi study. *Journal of Management Information Systems*, 17(4), 5–36.
- Schnable, M. A., Kvan, T., Kruiff, E., & Donath, D. (2001). The first virtual environment design studio. *Proceedings of the the 19th Conference on Education in Computer Aided Architectural Design in Europe*. Helsinki, Finland.
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Schön, D. A. (1985). *The design studio: An exploration of its traditions and potentials*. London, England: Royal Institute of British Architects.
- Shannon, S. J. (2002). Authentic digital design learning. *Proceedings of the 36th conference of the Australian and New Zealand Architectural Science Association* (pp. 461–468). Geelong, Australia.
- Silva, N. F., & Lima, E. M. (2008). Distance learning in architectural design studio: Two comparative studies with one onsite teaching. In M. Iskander (Ed.), *Innovative techniques in instruction technology, e-learning, e-assessment, and education* (pp. 381–386). Houten, Netherlands: Springer.
- Simoff, S., & Maher, M. L. (1997). Design education via web-based virtual environments. *Proceedings of the Fourth Congress of Computing in Civil Engineering*. New York, NY: ASCE.
- Simon, H. A. (1996). *Administrative behavior* (4th ed.). New York, NY: The Free Press.
- Smulian, M. (2010). Greening our cities. *Planning Resource*. Retrieved from <http://www.planningresource.co.uk/article/986028/greening-cities>
- So, H.-J., & Bonk, C. J. (2010). Examining the roles of blended learning approaches in computer-supported collaborative learning (CSCL) environments: A Delphi study. *Educational Technology & Society*, 13(3), 189–200.
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(1), 45.

- Vanderkaay, S. (2010). The social media evolution. *Canadian Architect*, 4(10), 39-40.
- Walsh, D., & Downe, S. (2005). Meta-synthesis method for qualitative research: A literature review. *Journal of Advanced Nursing*, 50(2), 204–211.
- Wang, T. (2011). Designing for designing: Information and communication technologies (ICTs) and professional education. *The International Journal of Art & Design Education*, 30(2), 188–199.
- Webster, H. (2009). Architectural education after Schön: Cracks, blurs, boundaries and beyond. *Journal for Education in the Built Environment*, 3(2), 63–74.
- Wood, J. (2004). *A report on the use of information and communication technology (ICT) in art and design*. Coventry, UK: British Educational Communications and Technology Agency.

APPENDICES

Appendix A

Additional Theoretical Frameworks

Distributed cognition

The theory of distributed cognition (DisCog) was developed by Hutchins (1995) as a way of understanding the cognitive processes, task sharing, and management that occurs within a collaborative group. In DisCog, the social structure of the group is a critical variable in how the group functions, determining how individuals interact and share information. Usually the social structure described by DisCog is vertically organized with experienced members of the group acting as mentors to less experienced members of the group. Another defining element of DisCog is the importance of the physical setting in which collaboration occurs. Individuals use the objects around them as open tools with which to communicate ideas and work through problems collaboratively. Through the use of these tools, members of the group can come to a shared understanding of the task and develop viable outcomes. Group members can also learn from each other through observation. The ability of group members to observe each other is theorized as a horizon of observation, which is a measure of an individual's ability to observe his peers. When the horizon of observation is constricted, learners will be unable to learn through observing their peers and may find their learning experience compromised. Conversely, individuals with an expansive horizon of observation are readily able to observe more advanced peers and learn from watching their actions.

Legitimate peripheral participation

The theory of legitimate peripheral participation (LPP) was advanced by Lave & Wenger (1991) and theorizes the learning and social characteristics of the master-apprentice relationship. In LPP, the master-apprentice relationship serves the important

role of not only providing the apprentice with instruction, but also with the opportunity to participate in legitimate social activities within the larger community of practice, thereby enabling the apprentice to gradually gain social acceptance within the community. In LPP theory a successful apprenticeship involves more than the structural establishment of a master-apprentice duality. The master must provide the learner with contextual and social opportunities for legitimate peripheral participation in the community of practice. The social nature of the tasks set for the apprentice are critical for the enculturation of the learner into the community of practice and its associated norms. Learning largely occurs through the physical observation of both masters and other apprentices, whether this is through intentional demonstration or unintentional observation. While Lave and Wenger (1991) note that it is common for apprentices to learn from each other, the most successful apprenticeships described by Lave and Wenger included frequent and intimate contact between the teacher and student.

Affinity spaces

Affinity spaces (AfS) were theorized by Gee (2004) to understand the learning that occurs in modern virtual spaces amongst users. These spaces are organized around a shared interest, or affinity, and the social structure is loose and fluid. Individuals regularly assume different identities, and may shift from being an expert to a novice dependent upon a particular area of interest. This social structure allows individuals to apprentice themselves to the entire group in an open and collaborative environment where members of all levels of expertise may contribute to a task and help mentor each other.

Appendix B

Institutional Review Board Letter of Information for Participants

As an IRB-exempt study, participants were not required to sign an informed letter of consent, however, at the beginning of the solicitation survey a letter of information was provided to potential participants detailing the purpose, methods, panelist responsibilities, and timeframe of the study.

Due to the nature of the Delphi method, participants were not strictly anonymous to the researcher. This is due to the need to provide a participant with their response information from previous rounds and to track how a participant's responses change over time. Safeguards were put in place to protect participant's data from any third party sources. All data was stored digitally on a password-protected computer in a locked room, and the folder containing the data was encrypted. Only the researcher knew the passwords used. The online response data is protected on Qualtrics' servers via password access and additional security measures, as put in place by Qualtrics. To protect the identity of the participants, all personal identifying information was stripped from downloaded data sets and each participant was given a unique identifier number. A separate spreadsheet contained a list pairing the identifier numbers with the email addresses of participants, which was used for distributing the survey and results from previous rounds to the participants. All of the declarative statements were edited to remove any personal information that might have led to the identification of a participant to other members of the panel. Finally, all of the data shared in the rounds of the survey and reported in this manuscript has been aggregated to prevent any individual responses from being identified or traced to a participant.

LETTER OF INFORMATION

Barriers to the adoption of distributed design education in landscape architecture

Introduction/ Purpose Professor Andrew Walker and Benjamin George in the Department of Instructional Technology & Learning Sciences at Utah State University is conducting research to study faculty barriers to adoption of distributed design education. You have been asked to take part because of your participation in the design education and pedagogy track at CELA in either 2011, 2012, or 2013; or your position as a department head of an accredited landscape architecture program. It is anticipated that approximately 90 individuals from across the country will be participating in this study.

Procedures This study will use a Delphi format. A Delphi study is composed of a series of moderated surveys distributed to a panel of experts. This Delphi study will have, at most, four rounds of surveys. If you agree to be in this research study, in each round you will be asked to answer a series of questions in an effort to develop consensus amongst panel members. In the first round you will be asked to consider individual barriers and rate their importance, as well as provide any written justification for your response. In subsequent rounds, panelists will be shown their previous response on a particular barrier as well as the current group statistical measures for that item, and any submitted feedback. Upon considering the new statistical and qualitative feedback, each panelist is asked to reconsider his or her response to each barrier and alter their answer accordingly, or provide additional feedback justifying the maintenance of their position.

Risks Participation in this research study may involve some added risks or discomforts. These include feelings of anxiety which may occur from taking the questionnaire.

Benefits The results of this survey will provide important information to enable the assessment of the barriers to the adoption of distributed design education among landscape architecture faculty. This information will provide researchers and educators with valuable knowledge which can be used to make distributed design education both more effective and more accessible.

Explanation & offer to answer questions Benjamin George has explained this research study to you and answered your questions. If you have other questions or research-related problems, you may reach Benjamin George at (435) 512-7847 or benjamin.george@usu.edu.

Extra Cost(s) *Specify if there will be any additional costs for participating. Clearly state what costs the participant is responsible for. If there is no cost to the participant, it should be stated here. If there would be no reasonable expectation of a cost, this section can be eliminated.*

Voluntary nature of participation and right to withdraw without consequence

Participation in research is entirely voluntary. You may refuse to participate without consequence or loss of benefits.

Confidentiality Research records will be kept confidential, consistent with federal and state regulations. Only the investigator will have access to the data which will be kept on a password protected computer in a locked room. To protect your privacy, personal, identifiable information will be removed from study documents and replaced with a study identifier. Identifying information will be stored separately from data and will be kept.

IRB Approval Statement The Institutional Review Board for the protection of human participants at Utah State University has approved this research study. If you have any questions or concerns about your rights or a research-related injury and would like to contact someone other than the research team, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu to obtain information or to offer input.

Investigator Statement “I certify that the research study has been explained to the individual, by me or my research staff, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered.”

Signature of Researcher(s)

Andrew Walker, PhD
Principal Investigator
435-797-2614
andrew.walker@usu.edu



Benjamin George, MLA
Student Researcher
435-512-7847
benjamin.george@usu.edu

Appendix C
Delphi Survey

Delphi study on distributed design education in landscape architecture

About this study

Thank you for participating in this study to assess barriers to the adoption of distributed design education (on-line education) in landscape architecture. Your experience and knowledge of design education is invaluable and your participation will help to improve online design education.

Study format

This study is designed to promote consensus through a series of no more than four survey rounds. In these surveys, you will be given a list of potential barriers to the adoption of distributed design education. Rate the degree to which you agree or disagree that a statement is a barrier to the adoption of distributed design education. Please answer every question as honestly as possible. You will have the opportunity to change your responses in future rounds.

Barriers to adoption of distributed design education in landscape architecture

Instructions

In each question you will be given a statement describing a potential barrier to the adoption of distributed design education. The barrier to consider is shown in bold and is contextualized in a sentence. Please mark on the Likert-scale to the extent you degree or disagree the statement described a barrier to adoption of distributed design education.

A space is provided with each question to contribute written feedback about a statement, such as why you answered in the manner you did, or if you wish to qualify your choice. You will have an opportunity to suggest additional barriers at the end of the survey.

2.1 -

Instructors **believe the studio method cannot be replicated using a distributed design environment.**

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.2

Lack of face-to-face interaction prevents verbal and non-verbal communication in a distributed design environment.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.3

Only motivated and organized students are able to succeed in a distributed design environment.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.4

Faculty members are unwilling to adopt technology necessary for distributed design education.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.5

Faculty members struggle to adopt technology necessary for distributed design education.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.6

Faculty members oppose the use of distributed design education because of **theoretical or pedagogical disagreements with online education.**

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.7

Upfront costs may deter development of design courses for distributed delivery.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.8

Ongoing costs may deter the continued offering of a distributed design course.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.9

A lack of precedent in distributed design education deters programs from committing to developing such courses.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

Additional Comments:

2.17

Internet resources may be unreliable due to disruption of an internet connection or the moving of a web link or web content.

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.18

Teaching/managing a distributed course **consumes unacceptable amounts of faculty time.**

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.19

Critiquing student work is difficult in a distributed environment. [this is not a design course specific question—should it be?]

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.20

Students feel socially isolated from their peers and suffer from a lack of social interaction with their peers in a distributed learning environment.

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.21

Designs produced solely using computers are inferior.

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.22

Characteristics of the distributed environment **constrain a design student's creative process.**

	1	2	3	4	5	6	7
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Strongly Agree

Additional Comments:

2.23

There is a perception that **students spend less time and energy on projects in online courses.**

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

2.24

Faculty do not receive adequate compensation during the development phase of online courses.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

Additional barriers:

Below you have the option to describe additional barriers to adoption that you believe should be considered by the group. Items suggested by at least 5% of participants will be added to later rounds of the survey. Please describe the challenge and provide a rating for it.

Barrier:

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

Barrier:

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

Barrier:

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Additional Comments:

Appendix D
Demographic Survey

1. Are you:
 - A) Male
 - B) Female

2. What is your age:
 - A) >30
 - B) 31-40
 - C) 41-50
 - D) 51-60
 - E) 60 <

3. How long have you taught at the university level?
 - A) < 5 years
 - B) 6-10 years
 - C) 11-15 years
 - D) 16-20 years
 - E) 21-25 years
 - D) 25 years <

4. What is your highest degree held?
 - A) Bachelor degree
 - B) Masters degree
 - C) Doctoral degree

5. On average, how many studio courses do you teach in an academic year?
 - A) 0
 - B) 1
 - C) 2
 - D) 3
 - E) 3<

6. Have you ever taught an online course in a design field? (architecture, landscape architecture, urban planning, or interior design)
 - A) Yes
 - B) No

7. Please rate your self-perceived overall computer literacy
 - A) Very confident
 - B) Somewhat confident
 - C) Neither confident nor unconfident
 - D) Somewhat unconfident
 - E) Very unconfident

8. Have you worked in private design practice?

- A) Yes
- B) No

9. For how long?

- A) < 3 years
- B) 4-6 years
- C) 7-9 years
- D) 9 < years

10. When did you last work in private practice?

- A) I am currently working in private practice
- B) Within the last 5 years
- C) Within the last 10 years
- D) Longer than 10 years ago

Appendix E

Comments from Panel on Critical Barriers

Q1: Instructors believe the studio method cannot be replicated using a distributed design environment.

Round 1:

- There is something lost when students can't look across to others desks and see their works and/or iterations, overhear conversations, or participate in impromptu pop-up discussions and topics. An online course could likely only foster one-on-one mentorship with some pseudo-formal milestone critique sessions if the faculty was able to post notes and mark-ups with each project, and make them available to the class as a whole.
- And I agree strongly!! Something happens between the hand, eye, and ears when drawing/thinking about design. It requires interaction.
- face to face interaction is essential to design studio. 1 reason: replicates real world situations of design practice.
- Some demonstrations of techniques, idea generation, or feedback on student work is more easily and or accurately done in a face-to-face environment.
- much of studio learning is gained by one-on-one interaction between the student and the instructor assessing the tangible aspects of design development through rapid iterative testing of design elements.
- A powerful online studio platform, which allows the instant sharing and exchange of all types of design output, e.g., drawing, models, layouts not yet available.
- The goal is to have interaction among students--working on the same drawings, models, etc. at the same time. This requires more technology (including bandwidth) than many schools or individuals have.
- I've never experienced technical difficulties when communicating face to face with a student at their desk. I cannot say the same for conference calls, video conferencing, etc.
- If the studio method is a simulation of practice, remote review of design between the principal and employee is not convention. Part of the studio experience is understanding and being accountable for workplace behaviors. Technological limitations to understanding and expressing design intent also exist in that the pen on paper experience has not been replaced adequately by pen and tablet.
- partly because they have never experienced it
- There is a lack of examples, or mistrust of the few that are out there.
- May also be in response to know knowing the full capability of such a system
- I don't believe the studio method absolutely cannot be replicated, but I am at this time unaware of an effective means of doing so.
- I am on the fence with this one ... the European model of design education has a lot less faculty-student interaction, and look at the exciting designs coming out of Europe.
- I believe that there are aspects of distributed design environments that do replicate the studio method. It takes a lot of finesse with technology to do. I've been doing a combined model on design thesis for 8 years+ and find advantages and

disadvantages.

- We have begun using a pilot virtual environment, so faculty are starting to see its potential.
- I agree most instructors believe this.
- This is my characterization of instructors, not necessarily my personal opinion

Rd 2:

- I wonder if the respondents have not experienced the "next generation" virtual environments, where real time video and voice, with many in a "room," is possible.
- I think a DDE complements the studio method more than replicate it.
- I think there is potential, but it has not been worked out yet ... sadly, design education is becoming an exercise in talk-a-lecture, so the need for active, on the boards type of design education is losing its interests with the new generation of non-practice design educators.
- I think that it could be done technically and logistically, but I think that the process and the experience would lose something important
- While a distributed design environment offers benefits for the creative design process, its practice would result in something different than the traditional studio method. Consequently, while it has benefits (as its own unique method), I still do NOT believe it can successfully REPLICATE the traditional studio method.
- Personal contact is essential to design education. Learning is interactive and requires a physical presence in a milieu together.

Rd 3:

- Personal contact is essential for quality teaching in a design studio. If the virtual environment can produce this, it may have a chance, but as things are now, I can't see it happening. Immediate, rather than deliberate, consideration and cooperative, inspired response from both student and professor are things that cannot be made remotely in my estimation.
- I agree with the comments that a studio could be taught virtually but in no way can it replicate the experience.
- Using Skype etc. might appear to substitute for the studio method but I don't feel would ever replace the dynamic of face to face one on one studio teaching. It also lacks the flexibility of the current model where a prof. can make a decision to do a new exercise with the class today based on what they are seeing
- With enough technology and a bit of practice, I think it could be done. Another issue is the "vicarious" learning that takes place when a group spend a lot of time in the same space. Many students are on-line much of the day, but it is not clear to me that they are focused in the way that people in the same space are.
- I think most faculty teach in the same methodology (environment) in which they were taught and/or practiced. Until there is a generational shift in faculty that have experienced and utilized a different methodology, most faculty will continue to agree with the statement.
- I think there is possibly a generational difference among faculty that affects

whether faculty view distributed education as comparable as that delivered traditionally.

- I agree that DDE is to supplement but not to replicate the traditional studio method.
- There needs to be some explanation of what is the "studio method"? If you are trying to recreate the traditional studio method, then of course you will NOT be able to recreate it. On the other hand if you are trying to achieve some specific learning outcomes, I think that you can.
- As with any teaching and learning environment, the pedagogy must be developed so that the learning objectives are obtainable. Just because we've been doing something a certain way in the past doesn't mean it's the only way to move forward. Think of how digital communication is used in practice to develop and critique design during the design process. New tools means new and/or evolving methods, not the same methods.
- I want to be clear that the studio environment with students and instructor in physical proximity of each other is different than a virtual environment. We simply cannot assume that the results of the two modes of learning will produce the same results. To be sure, the results will be different. But that doesn't mean that one is better than the other: they're just different. Those with practice and experience in one mode will likely prefer it over another. But I don't think we can categorical state that one is better than the other. They're just different.

Q2: Lack of face-to-face interaction prevents verbal and non-verbal communication in a distributed design

Rd 1:

- Sometimes talking through an issue is all a student needs to reach an "ah-ha!" moment and the physical barrier of typing or talking through a computer can interrupt that rapport.
- The problem is the limitations of technology to replicate all of the factors involved in communication. Camera quality, microphone quality, speed of connection, limitation of peripheral vision all play into the inability to fully interact.
- Personal interaction, discussion and motivation is hard to fully realized through a cyber environment.
- Again, I don't know if one-on-one interaction is that important.
- use of video/camera technology addresses this
- Through video cameras and applications such as VoiceThread, face-to-face verbal and non-verbal are possible. (I prefer "in person" instead of "face-to-face" since you can have face-to-face in virtual world))
- face to face interaction is essential to design studio. 1 reason: replicates real world situations of design practice.

Rd 2:

- Again this presents barriers with impromptu and overheard learning opportunities.

It also lacks a shared culture feeling inherent in the life of a student designer...

- While verbal and non-verbal communication can take place via a distributed environment, I think the key difference is the type of communication that is likely to occur. Just as people are much more guarded in their speech if they know it is being recorded (or archived in written format ie email) than in informal discussion, I believe the quality of interaction would differ in a distributed environment.
- again, because the mode is changing from active designing to talking about designing, the issue is moot.
- The next generation virtual environments can provide the real time, verbal and non-verbal that is needed.
- A lack of face-to-face interactions hinders traditional studio education - so much more for a distributed model.
- Digital communication is one dimension, true learning is embodied.

Rd 3:

- Personal contact is essential for quality teaching in a design studio. If the virtual environment can produce this, it may have a chance, but as things are now, I can't see it happening. Immediate, rather than deliberate, consideration and cooperative, inspired response from both student and professor are things that cannot be made remotely in my estimation.
- Maybe the question isn't black and white, yes you can communicate verbally and non-verbally in a virtual environment but to what level? I think the depth of virtual communication is limited.
- Today's students communicate continuously with their best friends and social circle via texting and freely post their lives on facebook. I don't think being recorded bothers any of them, perhaps the faculty would be bothered more.
- As I said in earlier rounds, the newer forms of virtual environments do allow face-to-face (voice and video) and others can hear/ participate in the conversation. I read statement #2 as my thoughts on this, so I still disagree.
- People today are using internet technologies for all sort of communication. DDE could facilitate effective communication but may be not the same type of communication that happens in face-to-face studio environment.
- Yes, some verbal and non-verbal communication will be compromised. On the other hand this might allow talking to stakeholders that might not have been at the table in the first place.
- the continually evolving digital face-to-face (Skype or other closeup digital conversations) offer verbal and non-verbal cues. It also can demand more of each student and faculty. Also takes more time as everything is individual.
- I can not help but agree with the previously provided written feedback that students in a DDE are at a disadvantage against those in a traditional studio environment. There can be a far richer experience of learning in a traditional studio by being able to see and hear and participate in what others are doing in an informal but proximal setting.

Q9: A lack of precedent in distributed design education deters programs from committing to developing such courses.

Rd 1:

- If it works, it works, regardless of precedent. Someone has to start the ball rolling...
- If it makes money for a university--never fear--administration will find the money for it.
- I suspect its more a lack of an understandable and motivating push to do so more than lack of precedent
- Other programs like entrepreneurship are adopting the studio model for a reason: IT WORKS.
- Design educators are fans of innovation and would love to be the first to employ a successful method. It is the desire to advance successful students and the assumption that conventional studio teaching is the most effective method that deters commitment to new technologies.
- Through Penn State's World Campus we are fortunate to have similar, though not identical, precedents to draw from.
- Not many successful cases out there.
- educators need objective education about this type of teaching/learning and need to see longitudinal results!
- like to see successful examples of studio design being taught online
- also lack of the research that demonstrates the impact on intellectual growth and creativity
- without seeing an effective example I would strongly agree.

Rd 2:

- lack of precedents have not deterred other explorations in design pedagogy...
- I've not seen enough information or studies--that is, there aren't precedents out there to convince me (to adopt or not).
- I'm not aware of many precedents here. Where would precedent for this work be published?
- In my experience the push for distributed education is aimed at increasing quantity rather than quality.

Rd 3:

- Where are the precedents? How can we know what we are talking about in this whole survey. It is a theory as of yet.
- Until faculty experience something they are unwilling to risk change.
- I have changed my thoughts on this, without precedent or some momentum, we are unaware of which technology to adopt. It reminds me of the VCR/Beta or Blu-ray/HDDVD conversation. Nobody wants to be stuck with the BetaMax.
- Some schools will be leaders in this and others will follow-- just as in many other areas of academia.

Q13: Building rapport with others is difficult in a distributed environment.

Rd 1:

- Students today are involved in social media very heavily. Maybe rapport of this kind has come into its own in education
- students MAY be quite comfortable building rapport and collaborating in this information given that they have "grown up online"
- If both sides are motivated, this is not difficult. If there is a lack of motivation it is definitely difficult. But so is the face-to-face time
- I have found from my experience with FaceTime, Skype, telephone, etc. that there is a disconnect between the people I am communicating with. Potentially with improved technology this could change, for now it is a challenge.
- People (both faculty and students) need to interact face to face to develop a trust and believe in each other through face to face interaction.
- again it depends of the system
- not sure, but face-to-face engagement is very important, especially during team exercises.
- Best option is students getting to know each other face to face and then online collaboration works.

Rd 2:

- students now have more virtual friends than real friends
- Even in-person courses rapport can and should be fostered-- no different for virtual world. Also, if virtual is only way to engage, one gets more accustomed to it.
- I don't have enough information here, but think that students have to be very motivated and organized to do this in an effective way. i am skeptical.
- Deeper and more meaningful connections can be made face-to-face. I think this partially stems from the fact that people are more candid with each other when they do not believe they are being recorded, transcribed, etc. They feel more comfortable being real with each other and less concerned with saying something unintelligent, offensive, or overly obvious- and having that statement publicized or immortalized via the web.

Rd 3:

- The role face-to-face for building rapport is hard to be replaced in a distributed environment.
- The socialization thing is alive and well. What I worry about is if they will continue to be able to design for REAL PEOPLE. Especially if they don't get outside and away from their electronic devices long enough.
- Rapport can be difficult, trust is more difficult (and might be the greater concern).
- My children have never had a problem developing rapport in a distributed environment, in some ways it's their preferred method.
- Teaching and learning studies already show that some students are much more involved when in a virtual environment. Those quiet students in the back of the

room can become engaged in ways not imaginable in person. Learning styles and personality respond to different situations.

- We need studies to help us understand = to be better informed
- Experience at our university shows that students really look forward to meeting their faculty and peers at professional events, which says to me that they did indeed build rapport

Q19: Critiquing student work is difficult in a distributed environment.

Rd 1:

- It is easy for one on one situations, but as a shared class experience, it is very difficult.
- How could it be? Perhaps I just don't know enough to answer this definitively
- Not enough info
- We are limited by resolution and focus.
- Often times technology complicates simple communication, I can only imagine legitimate critiquing.
- It's difficult in a face to face environment let alone a distributed one.
- depends on the system
- unless process work is included it is difficult to evaluate progress.

Rd 2:

- We have found that technology such as Voice Thread enables thoughtful comments and reflection by all; something that is not always assured with in-person courses.
- I often prefer to get a file, mark it up then send it back. I don't need to hear my own voice drone on and on.
- ditto: "It's difficult in a face to face environment let alone a distributed one"
- again, we need more information. I'm not averse to DDE but think that there is probably a pretty steep learning curve and one has to have very good time management skills.
- I find critiquing student work is easier in person because I can use voice inflection, facial expressions, and other non-verbal techniques to communicate feedback more kindly than via a distributed method.

Rd 3:

- We already do this. No problems, but face to face feedback will ensure they listen (whereas only letting them read results is faulty thinking.)
- I've changed my mind on this one as well. A web cam, touch screen and Teamviewer allows critiques of a students work remotely in a way that isn't any different from sitting in front of a computer screen, but perhaps most don't like that either.
- It may not be as fluid depending upon whether voiced (Skype or other) or written. I do think it's important to remember that these communications are being used in

practice and perhaps we should acknowledge that in our own practices.

- I was recently asked to give a video review for a number of projects as a guest reviewer for a studio. I spent about 2 hours per project, recording, marking on screen shots, speaking to the student, editing, etc. I was able to get through 4 projects in an 8 hour day. I could have reviewed the entire 15 student class in that amount of time in person.
- face-to-face communication is often very necessary in critiquing student work
- Critiquing students - whether face-to-face or in a DDE - is always a dicey proposition fraught with risks when students have fragile egos, insecurities, and lack emotional resilience.

Q20: Students feel socially isolated from their peers and may suffer from a lack of social interaction with their peers in a distributed learning environment.

Rd 1:

- We already struggle with students not spending time in the studio when they can take their computers home with them and work from the couch.
- Quality of work has suffered with this mentality.
- Research shows that students in Landscape Architecture are more introverted than extroverted!
- students today don't care about this ...
- NOT only true of online classes but in society in general. Seems they can't communicate without a keyboard.
- It is possible but not a given
- A lot of student learning is from their peers in the studio itself.
- studio is not just teaching an individual it is also helping them learn how to be a productive part of a group
- So much peer instruction occurs in the studio outside of class hours as students informally interact - I fear that spontaneous interaction would be inhibited in a distributed learning environment.

Rd 2:

- the person who wrote this question are not in touch with today's students
- but, today's students tend to operate / socialize / communicate virtually = see Sherry Turkle's work -- and this is disconcerting. How will it change the profession?
- If every course was like this, then yes I could foresee this.

Rd 3:

- Students are savvy but ONLY ON Social Media. Therefore, removing them from a face-to-face environment may really isolate them further.
- Effective social interaction and communication is critical for environmental designers. Students often feel they are not well prepared enough even in a face-to-face environment.

- I continue to agree with this statement, my students use social media but still interact in person, still go out to lunch, goof off in the studio after class, etc. We know that social interaction is critical for mental and physical health. If they don't have peers to interact with in person, I feel they will be isolated.
- students need to learn to interact with their peers in design classes/studios--it is an essential aspect of our work
- Most, but not all students, are deeply engaged in virtual social environments, so I will modify my previous stance on this question to some degree.
- The profile (particularly urban/suburban vs. rural) of the student may affect whether this is true. This may be an appropriate issue to explore in a followup study.

Q24: Faculty do not receive adequate compensation during the development phase of online courses.

Rd 2:

- faculty do not receive adequate compensation for anything today
- I have been asked to develop online courses with funding promised. Still waiting for funding.
- My university encourage faculty to develop online courses but fail to provide adequate compensation mainly due to budget deficiency.
- probably in the beginning stages, re: steep learning curve.
- Course development independant of digital technologies takes time to do well. Add in the ever changing nature of digital software and hardware, and it's a never ending climb to remain relevant.
- With regard to adequate compensation, it depends what is included in the original package. Who owns the intellectual content (and controls the long term use) remains an opaque issue.

Rd 3:

- Don't know for sure, but if time off from studio/lectures are not given for developing then, YES
- I'm STILL waiting on funding...
- It depends on the institution, whether DDE is an initiative of the program, and administrative support.
- This depends on individual cases/circumstances/
- I suspect this varies from institution to institution. There are a number of external and internal grants available. Whether faculty pursue these or not depends on their knowledge of available resources and interest in pursuing them. It also may offer additional collaborative research opportunities with folks in educational technologies and in the area of SoTL (Scholarship of Teaching and Learning)

Benjamin H. George, MLA **Curriculum Vitae**

Department of Landscape Architecture & Environmental Planning
Utah State University
benjamin.george@usu.edu
<http://www.gardentaining.com/dililah/>

Education

- 2009- Ph.D. - Instructional Technology and Learning Sciences
2014 Utah State University
Dissertation: Barriers to the implementation of distributed design education and their mitigation. Anticipated completion: August 2014.
- 2009 MLA - Landscape Architecture & Environmental Planning
Utah State University
Thesis: Indoor Outdoor Relationships at the Residential Scale
- 2007 Postgraduate Diploma in Irish Studies
The Queen's University of Belfast
- 2006 BS - Political Science
Utah State University
Minor: History

Professional Positions

- Jan 2012 - present Adjunct Faculty
Department of Landscape Architecture and Environmental Planning
Utah State University
- Aug 2010 - present Instructor
Department of Plants, Soils, and Climate
Utah State University
- Aug 2008 - Dec 2011 Instructor
Department of Landscape Architecture and Environmental Planning
Utah State University
- June 2009 - Dec 2010 Horticultural Manager
Tony's Grove Inc.

Peer-Reviewed Articles

Published

- 2014 **George, B. H.** An Analysis of the Spatial Structure of the National Palace of Queluz.
Landscape Research Record, 1, 129-139.

In revision

George, B. H. Contextualized History: The Use of Virtual Tours to Teach Landscape Architecture History. *Landscape Journal*.

Peer-Reviewed Published Abstracts

- 2014 **George, B. H.** Engaging with history: An experiential pedagogy for teaching landscape architecture history. Proceedings from *2014 Council of Educators in Landscape Architecture Annual Conference*. Baltimore, MD.
- 2014 **George, B. H.**, James, M. Pinterest and Pedagogy: Fostering beginning design students with cloud collaboration. Proceedings from *2014 Council of Educators in Landscape Architecture Annual Conference*. Baltimore, MD.
- 2013 **George, B. H.** Likes, tweets, and pins: A best-practice method for integrating social media into the classroom. Proceedings from *e-Volution: Innovations in Learning Environments & Agricultural and Natural Resources Western Region Teaching Symposium*. Laramie, WY, September 13, 2013.
- 2013 **George, B. H.** *Landscape Architecture 2.0*. Proceedings from *2013 Council of Educators in Landscape Architecture Annual Conference*. Austin, TX.
- 2012 **George, B. H.**, Michael, S. E. Take me there: Situated cognition and virtual tours in landscape architecture history curricula. Proceedings from *2012 Council of Educators in Landscape Architecture Annual Conference*. Champagne, IL.
- 2009 Bell, D., **George, B. H.**, Winkler, L. Zion Canyon Corridor Futures Study. Proceedings from *2009 National Extension Tourism Conference*. Park City, UT. 2009.

Non-Refereed Publications

- 2009 **George, B. H.**, Nelson, S., Winkler, L., et al. *Zion Canyon Corridor Futures Study*. Prepared for Five County Association of Governments, March 2009.
- 2009 **George, B. H.** *Indoor Outdoor Relationships at the Residential Scale*. Master's thesis. Utah State University, Logan, UT.
- 2008 Timmons, M., Brabec, E., **George, B. H.**, Winkler, L. *International Klondike Gold Rush Trail, Final Report and Technical Appendices*. Prepared for the National Park Service, Rivers, Trails and Conservation Assistance Program, Alaska Region, September 1, 2008.

Non-Refereed Presentations

- 2011 **George, B. H.** Visualization technologies for teaching plant identification. Proceedings from *Intermountain Graduate Research Symposium*. Logan, UT.

- 2007 Rycewicz-Borecki, M., **George, B. H.** Determining the trends in northern Utah's on-site stormwater BMP use and their perceived effectiveness. Proceedings from *USU Spring Runoff Conference*. Logan, UT.

Research in Progress (working titles)

George, B. H. Queluz: A baroque garden built on Moorish principles. Anticipated journal article submittal May 1, 2014 to *Gardens and Landscape of Portugal*.

George, B. H. Best practices for selecting social media based off communication needs. Anticipated journal article submittal July, 2014.

George, B. H., James, M. Distance design collaboration using social media. Manuscript in preparation for submittal to International Journal of Technology and Design Education.

George, B. H., Bussiere, S. Factors impacting student use of design studios. National survey planned for March, 2014.

Funding

- 2014 **George, B. H.**, Christensen, K. M., Michael, S. E. Course development grant: LAEP 2300. Regional Campuses and Distance Education, Utah State University, Dollar amount TBD.
- 2014 **George, B. H.**, Anderson, D. T., Michael, S. E. Course development grant: LAEP 2300. Regional Campuses and Distance Education, Utah State University, Dollar amount TBD.
- 2013 **George, B. H.** Graduate Student Travel Award. Utah State University, \$300.
- 2012 **George, B. H.**, Kvarfordt, K., Michael, S. E. Course development grant: LAEP 2300. Regional Campuses and Distance Education, Utah State University, \$2,500.
- 2011 **George, B. H.**, Michael, S. E. Course development grant: LAEP 2300. Regional Campuses and Distance Education, Utah State University, \$2,500.
- 2011 **George, B. H.** Travel Grant for the creation of Virtual Tours in Europe. Regional Campuses and Distance Education, Utah State University, \$4,500.
- 2011 **George, B. H.** Travel Grant for the creation of Virtual Tours in Europe. Office for Global Engagement, Utah State University, \$1,000.
- 2010 Michael, S. E., **George, B. H.** Course development grant: PSC 2620. Regional Campuses and Distance Education, Utah State University, \$4,000.

Course development

- 2013 Course development: LAEP 1200, Basic Graphics distance education course. Development of course pedagogy, planning, and video content.
Course content and curriculum: Kvarfordt, K. 95%, George, B.H. 5%
Instructional development: George, B. H. 85%, Kvarfordt, K. 15%

- 2012 Course Development: LAEP 2300, History of Landscape Architecture distance education course. Principal course developer and instructional designer.
Course content and curriculum: Timmons, M. 90%, George, B.H. 10%
Instructional development: George, B. H. 100%
- 2010 Course Development: PSC 2620, Woody Plant Materials distance education course. Principal course developer, instructional designer and content expert.
Course content and curriculum: George, B.H. 60%, Aston, C. D. 40%
Instructional development: George, B. H. 100%
- 2008 Course Development: LAEP 1030, Introduction to Landscape Architecture distance education course. Principal course developer, instructional designer and content expert.
Course content and curriculum: George, B.H. 75%, Salmore, A. 25%
Instructional development: George, B.H. 100%

Creative and Professional Projects

- 2013 Exploratory Physiocartographies of Place and Time. Sketch crawl and gallery exhibit at 2013 Conference of the Council of Educators in Landscape Architecture. Austin, TX. Exhibit participant.
- 2012 Digital Library of Landscape Architecture History (DiLiLAH). Director, developer, and programmer.
- 2009 Semi-finalist. Disney Imaginations Competition. *Kuzcotopia*.

Awards

- 2013 Robins Award for Graduate Instructor of the Year at Utah State University.
- 2013 North American Colleges and Teachers of Agriculture Graduate Student Teaching Award of Merit.
- 2012 College of Agriculture Graduate Student Instructor of the Year, Utah State University.

Teaching Experience

- Spring 2014 LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)
LAEP 2300: History of Landscape Architecture, 3 credits (on-line)
PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
- Fall 2013 USU 1010: University Connections, 1 credits (face-to-face)
LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)
LAEP 2300: History of Landscape Architecture, 3 credits (on-line)
PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
- Summer 2013 LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)

	LAEP 2300: History of Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Spring 2013	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) LAEP 2300: History of Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Fall 2012	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) LAEP 2300: History of Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Summer 2012	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Spring 2012	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) LAEP 2300/6230: History of Landscape Architecture, 3 credits (face-to-face) LAEP 2300: History of Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Fall 2011	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Spring 2011	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Fall 2010	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line) PSC 2620: Introduction to Woody Trees and Shrub, 3 credits (on-line)
Spring 2010	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)
Fall 2009	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)
Spring 2009	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)
Fall 2008	LAEP 1030: Introduction to Landscape Architecture, 3 credits (on-line)

Invited Presentations

- 2014 **George, B. H.** *Utilizing mobile devices in the design process.* Invited presentation as part of LAEP Genius Hour. Logan, UT.
- 2013 **George, B. H.** *Best practices for technology use in the university classroom.* Invited presentation to the Dean and Department Heads of the College of Agriculture & Applied Sciences. Logan, UT.
- 2013 **George, B. H.** *24 Nights in a tent.* Invited presentation at Ignite. Logan, UT.
- 2010 **George, B. H., George, P. L.** *Permaculture in Cache Valley.* Invited presentation to the Wilson Neighborhood Alliance.

Graduate Committees

Present Keni Althouse

Community Service

2012-2014 Chairman, Logan City Neighborhood Council
2012-2013 Past-President, Hillcrest Improvement Committee
2011-2012 President, Hillcrest Improvement Committee
2010 Vice-president, Hillcrest Improvement Committee

Academic Service

2013 LAEP House Committee Member
2013 Faculty Charrette facilitator
2013 CELA Design Education and Pedagogy track abstract reviewer
2012 CELA Design Education and Pedagogy track abstract reviewer