Responding to the Indeterminacy of Doctoral Research in Design

Davis, Meredith; Feast, Luke; Forlizzi, Jodi; Friedman, Ken; Ilhan, Ali; Ju, Wendy; Kortuem, Gerd; Reimer, Maria Hellström; Teixeira, Carlos

DOI
10.1016/j.sheji.2023.05.005

Publication date
2023

Document Version
Final published version

Published in
She Ji

Citation (APA)
Davis, M., Feast, L., Forlizzi, J., Friedman, K., Ilhan, A., Ju, W., Kortuem, G., Reimer, M. H., & Teixeira, C. (2023). Responding to the Indeterminacy of Doctoral Research in Design. *She Ji*, *9*(2), 283-307. https://doi.org/10.1016/j.sheji.2023.05.005

she ji
[ʃə: ʤi:]

Responding to the Indeterminacy of Doctoral Research in Design

Meredith Davis*
Luke Feast
Jodi Forlizzi
Ken Friedman
Ali Ilhan
Wendy Ju
Gerd Kortuem
Maria Hellström Reimer
Carlos Teixeira

Keywords
PhD in Design
Doctor of Design
Design research
Doctoral education
Practice-based research
Design knowledge

Received
January 12, 2023
Accepted
May 16, 2023

Abstract
The Future of Design Education working group on doctoral education included doctoral supervisors from nine programs around the world and addressed the indeterminacy of standards for the PhD in Design. Internationally, "contributions to knowledge" under the PhD degree title range from evidence-based investigations documented in a dissertation to personal reflections on making artifacts. In some programs, quantitative and qualitative research methods are taught; in others, there is no instruction in methods. The working group suggested that reflection on one's own creative production is the role of the professional master's degree and recommended standards for two doctoral programs — the PhD and the Doctor of Design (DDes). The group defined the PhD as addressing unresolved problems with the goal of generalizable knowledge or theory for the field. It described the DDes as a professional practice degree in which research is done in a practice setting to frame a specific opportunity space, guide in-process design decisions, or evaluate outcomes. DDes findings do not claim generalizability and result in "cases." The working group discussed methods, sampling, standards of evidence and claims, ethics, research writing, and program management.

* Authors are listed in alphabetic order.

MEREDITH DAVIS
Emerita Professor, College of Design, North Carolina State University, USA
mjdavis@ncsu.edu

LUKE FEAST
Department of Architecture, Design and Media Technology, Aalborg University, Denmark
leef@create.aau.dk

JODI FORLIZZI
School of Computer Science, Carnegie Mellon University, USA
forlizzi@cs.cmu.edu

KEN FRIEDMAN
College of Design and Innovation, Tongji University, China
ken.friedman.sheji@icloud.com

ALI ILHAN
School of Design/College of Design, Art, Architecture and Planning, University of Cincinnati, USA
ilhanao@ucmail.uc.edu

http://www.sciencedirect.com/journal/she-ji-the-journal-of-design-economics-and-innovation
https://doi.org/10.1016/j.sheji.2023.05.005

Introduction

In most fields, PhD research standards are similar from university to university. While research emphases, theoretical perspectives, and curricular formats may be specific to institutions and vary over time, disciplines rarely equivocate over minimum criteria for the most advanced work in a field. The American Anthropology Association, for example, defines four types of research but makes clear through its publications that researchers must apply theories, employ systematic research methodologies, formulate and test hypotheses, and develop extensive sets of data.[1] On behalf of the field, the association publishes a handbook on research ethics, advice on data treatment, and guidelines for evaluating faculty scholarship.

Likewise, most professions agree on the purposes served by various doctoral degrees. There is a general understanding that the Doctor of Medicine (MD) is a professional degree and the PhD in Medicine is a research degree. The American Psychological Association describes graduates of the PhD in Psychology as "generating new knowledge through scientific research" and the Doctor of Psychology as "providing psychological services."[2] Academic journals, research societies, review panels, and accreditation agencies reinforce accepted standards and support discourse in evolutionary efforts to negotiate emergent definitions. And through academic policies—such as those regarding post-graduate submissions and faculty tenure—universities typically hold student and faculty research accountable to minimal institutional criteria across disciplines.

A relative newcomer to doctoral education, design lacks disciplinary consensus regarding research definitions, evaluative norms, and missions under various degree titles. Because the PhD in Design internationally conflates very different conceptions of research under the same title, colleges and universities must use more than the degree alone to confirm research competencies when hiring faculty. As institutions raise the threshold degree qualifications for faculty and encourage cross-disciplinary research collaboration, evidence and measures of design scholarship attract greater scrutiny. Such standards and output for peer review often appear inconsistent to outsiders—publications (refereed or not) for some and commissions, artifacts, or exhibitions for others. By enlisting only external faculty evaluators and doctoral examiners sympathetic to a candidate's specific form of output, design programs further reinforce parochial views of research rather than situate assessment in a consensus-built intellectual context for the field.

The relationship between design research and practice is equally unresolved under doctoral curricula. Academic research conducted by higher education faculty typically aims to produce new generalizable knowledge or theory, including findings relevant to practice. It is held to high methodological and ethical standards and seeks credible evidence that withstands examination or replication by other researchers. On the other hand, design "practice" generally refers to the application of professional knowledge and methods to changing a practical situation in some positive way. Designers and researchers, including those from other fields, may conduct evidence-based inquiries that inform design decisions under

1 "What Is Anthropology?," American Anthropological Association, 2022, accessed June 21, 2023, https://americananthro.org/learn-teach/what-is-anthropology/.

2 Daniel S. Michalski and Garth Fowler, "Doctoral Degrees in Psychology: How Are They Different, or Not so Different?," American Psychological Association, January 2016, accessed June 21, 2023, retrieved from https://www.apa.org/ed/precollege/psn/2016/01/doctoral-degrees.

WENDY JU
Jacobs Technion-Cornell Institute,
Cornell Tech, Cornell University, USA
wendyju@cornell.edu

GERD KORTUEM
Faculty of Industrial Design Engineering,
Delft University of Technology,
the Netherlands
g.w.kortuem@tudelft.nl

MARIA HELLSTRÖM REIMER
School of Arts and Communication,
Malmö University, Sweden
maria.hellstrom.reimer@mau.se

CARLOS TEIXEIRA
Institute of Design, Illinois Institute of
Technology, USA
carlos@id.iit.edu

specific conditions, just as an MD studies symptoms, performs tests, and makes diagnoses that inform patient treatment. When the purposes of such practice-situated inquiries are simply to suggest general directions designers should take, standards are justifiably lower than in academic research. However, other practice investigations guide decisions with high-stakes outcomes for business strategy, civic policy, or public safety and require more rigorous applications of research methods, standards of evidence, and ethical concern for the breadth of possible consequences. There is value in both approaches to practice, yet the field remains somewhat conflicted regarding the education that prepares design professionals for these various types of inquiry.

Adding to the confusion, some programs use the term "practice-based research" under a PhD in Design title to refer to individual designers' accounts of their experiences as makers. Doctoral students in these programs reflect subjectively on and through their creative production of messages, objects, or spaces. In this case, "research" refers to reflection on one's own exploratory journey and only secondarily (if at all) to the outcomes for others or the environment and systems in which artifacts are located. In fact, practice-based doctoral students may lack any prior professional experience or access to applied settings from which to draw conclusions. There is little documentation of broad professional or disciplinary benefits derived from such personal accounts, at least as a research and theory-building activity distinct from the routinely contemplative work of design. Many of these studies begin and end as post-graduate degree submissions or as speculation on their significance in academic journals.

Such wide-ranging definitions of doctoral intent keep criteria for evaluating research findings and research education largely indeterminate. The increasingly common practice of conjoining very different degree missions under the single PhD title sends mixed messages to the field, the growing number of research partners in other disciplines, and the public regarding the purposes and claims of design research. It places PhD in Design study in a liminal space, simultaneously occupying both sides of a boundary between the self-actualization of practitioners and contributions to the body of knowledge in the field.

The Future of Design Education working group on doctoral education sought curricular distinctions between two kinds of advanced degrees. One degree has the purpose of educating researchers who develop generalizable knowledge and theory to advance the design discipline and other disciplines. The other degree uses inquiry-guided methods and criteria for evidence on researchable questions in a specific practice situation. This interest in practice-located research acknowledges increasing accountability and an expanding domain for design decisions, aiming to understand people, systems, and forces that better characterize a particular case. Under both types of research, institutions may narrow the scope of investigations to reflect their resident expertise and resources.

At the same time, however, the working group challenged reflection on one's creative production of artifacts as a definition of design research and suggested that such work is generally more appropriate to a professional master's or fine arts degree.

A Complicated Context for the Evolution of Doctoral Education in Design

Evolving conditions in higher education contributed to the indeterminacy of research education in design. During recent decades and across disciplines, doctoral education, in general, turned from generating new knowledge to also acting on that knowledge to solve workplace problems.[3] For example, Research and Development (R&D) spending by the United States government increases annually, while allocations to basic research have declined steadily since 2010.[4] In the quest for patents that contribute to institutional status and the bottom line, research in higher education now competes with private industry for funding.

Revenue losses from declining or static undergraduate enrolments—partially due to smaller 18–24-year-old populations in North America, Europe, Latin America, and South Asia—also encourage the development of new master's and doctoral offerings. Since 2000, for example, the United States has countered its undergraduate deficit numbers with a nearly 40% increase in graduate program enrollment, sometimes with little concern for students' industry or university employment after completing their degrees.[5] The OECD projected in 2022 that 2.3% of students in developed countries would enroll in a doctoral program at some point in their lives, up from the 1% with doctorates in 2019.[6] Advanced programs require curricular accommodations for mature students with complicated lives. Low residency requirements, independent study, and limited faculty supervision (sometimes as few as six contact hours per year) are common practices that shift responsibility from departmentally or institutionally negotiated curricular standards to quality control by a few faculty willing to mentor doctoral students. In some cases, this mentorship is on top of full-time teaching loads at lower levels of study.

While financial incentives changed the nature of existing doctoral studies, new research imperatives also encouraged the development of academic programs in applied areas with limited research histories; consequently, the roles of research actors became more fluid. Today it is difficult to distinguish between producers and users of research because the boundaries among disciplinary systems are porous.[7] Many design researchers, for example, rely on social science methods and findings in framing their investigations. The design response to climate change builds on research in technology and the natural sciences. And it is impossible, in many cases, to separate data science from design research in a rapidly accelerating information age. Moreover, as collaborations among fields increase, design plays an important role in making the findings of other fields actionable. Peter Scott, Emeritus Professor of Higher Education at the University Colleges of London, however, argued that this fluidity encourages alternative knowledge traditions to "invade" core disciplines, contributing to varied definitions of "excellence" and debate over forms of quality control in an increasingly regulatory environment.[8]

Scott also described the emphasis on regulation by an "audit society" as having significant implications for research education. For example, to inform the allocation of quality-weighted research funding, a consortium of higher education funding councils in the United Kingdom conducted the 1992 *Research Assessment Exercise* (RAE). Around this time, the United Kingdom

3 Howard Green and Stuart Powell, *Doctoral Study in Contemporary Higher Education* (London: SRHE and Open University Press, 2005), 47.

4 Mark Boroush and Ledia Guci, "Research and Development: U.S. Trends and International Comparisons" (report, National Science Board Science and Engineering Indicators 2022), https://ncses.nsf.gov/pubs/nsb20225.

5 Jon Marcus, "Universities Increasingly Turn to Graduate Programs to Balance Their Books," *Hechinger Report*, April 23, 2019, https://hechingerreport.org/universities-increasingly-turn-to-graduate-programs-to-balance-their-books/.

6 OECD, "What Are the Characteristics and Outcomes of Doctoral Graduates?," in *Education at a Glance 2019: OECD Indicators* (Paris: OECD Publishing, 2019), 246–60, https://doi.org/10.1787/f8d7880d-en.

7 Peter Scott, "Clashing Concepts and Methods: Assessing Excellence in the Humanities and Social Sciences," *Humanities* 4, no. 1 (2015): 120, https://doi.org/10.3390/h4010118.

8 Ibid.

abolished the distinction between universities and the polytechnics which served the needs of industry after World War II. By integrating research and vocational missions and extending doctoral degree-granting authorization to art schools that previously offered three-year diplomas only, the RAE created new responsibilities for institutions. The curricular task for some professional schools was to build new design research cultures under existing intellectual resources and vocational training histories.

In 2014, the *Research Excellence Framework* (REF) replaced the RAE with the goal of securing "a world-class … and responsive research base across the full academic spectrum" and through "reputational yardsticks."[9] The REF currently assesses institutional research outputs, their impact beyond academia, and the supporting environment for research.[10] However, criticism of the REF cites its over-reliance on internal institutional assessment rather than independent research experts, preferences for research novelty, and institutions gaming the system by "coming up with a hypothesis after data is collected."[11]

Defining excellence under new research missions and regulatory measures presented conceptual challenges for institutions developing doctoral programs in design. There was tension between the longstanding internal identity of design as an arts discipline (evident in programs where PhD students reflect on their making) and external expectations to produce knowledge with broad relevance to the field and society (the traditional role of the PhD). With the once-binary system of professional schools and academic universities gone, higher education no longer represented a clear division of intellectual traditions and responsibilities.

Interest in the free movement of degree-seeking students across countries further eroded conventional distinctions among types of study. Through the 1999 *Bologna Declaration*, twenty-nine nations proposed a two-part higher education system: diploma study followed by master's and doctoral degrees, a 3+2+3-year system.[12] The 2010 *Budapest-Vienna Declaration* officially established the European Higher Education Area, expanding voluntary Bologna recommendations to forty-seven signatory countries around the world. The system paired the vocational history of three-year diploma study with an emerging interest in advanced degrees, indirectly reshaping research definitions.

The Curricular Response

The reclassification of institutions as "doctoral granting" often left design programs largely unchanged in their studio orientation, despite new responsibilities for research education. In many cases, design students in Bologna signatory countries today spend five years entirely in art and design study preceding their PhD enrollment. They advance to doctoral programs, having done little or no supervised reading and writing outside of the discipline, expecting to master the intellectual perspectives and competencies of a research degree in three years. Under independent study, many wrestle with new skills on their own, or pursue doctoral investigations that depend less on the quality of academic scholarship than on more familiar studio

9 "What Is the REF?," Research Excellence Framework, accessed June 21, 2023, https://www.ref.ac.uk/about/what-is-the-ref/.
10 Ibid.
11 Alex Jones and Andrew Kemp, "Why Is So Much Research Dodgy: Blame the Research Excellence Framework," *The Guardian*, October 17, 2016, https://www.theguardian.com/higher-education-network/2016/oct/17/why-is-so-much-research-dodgy-blame-the-research-excellence-framework.
12 European Higher Education Area, "The Bologna Declaration of 19 June 1999," last modified April 7, 2023, http://www.ehea.info/media.ehea.info/file/Ministerial_conferences/02/8/1999_Bologna_Declaration_English_553028.pdf.

production. Further, the brief history of doctoral study in design leaves some students in institutions with supervisors who are not qualified by a degree or firsthand research experience in the student's field.[13]

By contrast, most North American students complete four-year bachelor's degrees with general education coursework comprising as much as 50% of the credits required for graduation. Several top-tier undergraduate design programs first screen applicants for admission by academic indicators. These universities either place portfolios in a secondary role or do not review visual evidence, relying instead on intensive first-year studio performance to recommend advancement to a design major. Under regional and disciplinary accreditation standards, universities and freestanding professional art schools in the United States require undergraduate study across the sciences, social sciences, and humanities.

Developing academic skills in ambitious master's programs also prepares graduates for the demands of doctoral work. MFA and MDes accreditation standards — under the National Association of Schools of Art and Design in the United States and other countries under *NASAD Substantial Equivalency*[14] — call for design students in terminal degree studio programs to "engage in human-subject research," "make judgments about the appropriateness of specific research methods," and integrate "knowledge, perspectives, and values gained through … modes of inquiry in other fields" with design practice.[15] Faculty-curated seminar readings and coursework help master's students develop such competencies under a paradigm of practice adopted by the program. Rather than assuming all students will "discover" appropriate modes of inquiry and perspectives through independent studio work, these programs commit to the regular instruction of all students in a body of knowledge and repertoire of methods consistent with the program's stated purpose. Written thesis documents accompany studio investigations and may exceed 25,000 words in length, with a more formal structure than "artists' statements." Such student writing is accountable to research publications' style, citation, and bibliographical protocols.

Therefore, at least two general approaches to design education — one based in instrumental know-how acquired through studio-only experiences and another in which practice is supported by the explicit academic study of theory, methods, and evidence — represent somewhat competing visions of the field in a knowledge economy. The two approaches lay different foundations for doctoral study. Scott described these positions as self-organizing systems that, due to external forces, cannot follow a more natural evolution in reaching an agreement on disciplinary knowledge and standards for doctoral degrees.[16] And the more diffuse the academic community, the greater contestability of their authority to make pronouncements.[17]

The international response at the doctoral level has been diverse missions and curricular structures representing wide-ranging views of design research. Some programs follow the model of the traditional PhD, seeking original contributions to knowledge and theories that are generalizable to the field. In North America, the majority of PhD curricula are "taught"; independent fieldwork and dissertation writing follow the completion

13 David Durling, "Discourses on Research and the PhD in Design," *Quality Assurance in Education* 10, no. 2 (2002): 80, https://doi.org/10.1108/09684880210423564.

14 National Association of Schools of Art and Design, "Substantial Equivalency," NASAD, accessed July 5, 2023, https://nasad.arts-accredit.org/services/review-services/substantial-equivalency/.

15 National Association of Schools of Art and Design, *NASAD Handbook 2021–22* (Reston, VA: NASAD, 2022), 146, https://nasad.arts-accredit.org/wp-content/uploads/sites/3/2022/04/AD-2021-22-Handbook-Final-04-08-2022.pdf.

16 Scott, "Clashing Concepts and Methods," 121.

17 Ibid., 122.

of courses in research paradigms, research methods, and advised cognate study, as well as readings and pilot studies in the student's primary discipline.

Elsewhere, doctoral programs take a more subjective approach to investigations under practice-based or practice-led doctoral degrees, valuing personal reflection on tacit knowledge and individual development that may not be accessible by other scholars.[18] These programs are rarely "taught" and usually include studio investigations, with some institutions accepting exhibitions of artifacts in place of written theses. Internationally, it is possible to find little difference between the submission requirements and duration of study in some practice-based doctoral programs and MFA or MDes programs.

Scott addressed the difficulty in stretching the definition of research outputs to accommodate a field's indecision regarding research evidence. He cited the growing use of "creative and cultural industries" to justify popular forms of scholarly output as research. Whereas previous forms counted as research only if they went through a process of translation (publication of academic monographs, refereed journal articles, or keynote addresses), this new type of intellectual production may never undergo external review.[19] Under such conditions, argued Scott, studies may never be complete; process is presented as product, with the absence of formal acknowledgment as a knowledge contribution undermining its closure as findings.[20]

Conjoining these two doctoral purposes under the same PhD degree title further perpetuates the indeterminacy of research definitions and standards. In the United Kingdom, the 1996 *Harris Review of Post-Graduate Education* and the 1997 *Dearing Report of Higher Education in the Learning Society* affirmed the confusion created by conflating doctoral research and practice-based missions under the PhD degree.[21] Subsequent attempts to fix the problem by tightening explanations of graduation submissions appear to have had limited effect, as diverse requirements continue to make similar claims as knowledge contributions.

Professional Doctorates

American universities largely avoid this confusion by reflecting on one's work under the terminal master's degree, developing generalizable knowledge under the PhD, and conducting case-based work situated in practice settings under the professional doctorate (for example, Doctor of Design and Doctor of Architecture). Many professional fields maintain this distinction between research and professional doctorates: for example, business, healthcare, education, and law. A study of seventy British universities offering professional doctorates described their graduates as "researching professionals" rather than the "professional researchers" produced by the PhD.[22]

Felly Kot and Darwin Hendel of the Post-Secondary Education Research Institute at the University of Minnesota attributed the growth in professional doctorates to employer complaints of narrowing specialization in the PhD study and the need for job-related skills. A 2006 task force report of the Higher Learning Commission, a regional accrediting body for colleges

18 Durling, "Discourses on Research," 80.
19 Scott, "Clashing Concepts and Methods," 122.
20 Ibid., 123.
21 Green and Powell, *Doctoral Study*, 6.
22 Tom Bourner, Rachel Bowder, and David Laing, "Professional Doctorates in England," *Studies in Higher Education* 26, no. 1 (2001): 71, https://doi.org/10.1080/03075070124819.

and universities in the United States, concluded that professional doctorates have a clearly defined place among higher education degrees in the USA but should be viewed as different from and not "substitutes" for research degrees.[23]

Design, therefore, equivocates regarding the general purposes and minimum requirements among doctoral degrees in design. The issue is not in offering doctoral degrees focused on professional practice but in titling them as PhDs under indeterminate research definitions.

Frayling's Definitions

Christopher Frayling, a former rector at the Royal College of Art in London, is often cited as a source for the particular definition of design research an institution adopts. In a 1993 paper titled "Research in Art and Design," Frayling extended Herbert Read's proposition of education through art to three kinds of art and design research. Under Frayling's definitions, research *into* art and design, addresses historical and theoretical issues in the disciplines, including the effects of social, political, and cultural forces.[24] This description is consistent with the domain of the MPhil and PhD study that does not emphasize studio work. Frayling's research *through* art and design includes work with materials, investigations of process, and contextualizing studio experiments in a research report.[25] Research *for* art and design results in an artifact that embodies a principle or theory. Frayling described this last type of research, not as verbal explanation, but as communication through the artifact itself.[26]

Much has changed in design practice since Frayling published his 1993 typology. For example, it is difficult to argue that many of the most pressing issues that drive design research today share much with the purposes, processes, and values of fine art. Neither does the individual creation of physical messages, objects, and spaces define design practice as it once did. The USA Bureau of Labor Statistics projects a decline over the coming decade in traditional, artifact-centered design work and exponential growth in the design of socio-technical systems.[27] Further, design research in employment growth areas is interdisciplinary and done by cross-functional teams, not individual makers. Therefore, which of Frayling's three types of design research addresses the development of a product-service ecology, the system rules that control the behavior of a software platform, or an infrastructure plan for an organization's sustainable design practices? Under which research type are consumers also producers? And how might Frayling classify the new process opportunities in "automated data and insight generation, compiled via remote sensing and delivered through technologies."[28]

In a 2015 interview for the Research Through Design Conference, Frayling stated that he has always disliked the term *practice-based research* as "[it] confus[es] a method of research with an outcome."[29] Further, he said that if he retitled his research classifications today, they would be: "*pure* [basic] *research*, *applied research*, and *action research*," categories with methodological approaches and standards more generally understood across disciplines.[30]

23 Felly Chiteng Kot and Darwin D. Hendel, "Emergence and Growth of Professional Doctorates in the United States, United Kindom, Canada and Australia," *Studies in Higher Education* 37, no. 3 (2012): 345–64, https://doi.org/10.1080/03075079.2010.516356.

24 Christopher Frayling, "Research in Art and Design," *Royal College of Art Research Papers* 1, no. 1 (1993/4): 5, https://researchonline.rca.ac.uk/id/eprint/384.

25 Ibid., 5.

26 Ibid.

27 U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook* (Washington, DC: US Department of Labor, 2019), accessed June 24, 2023, retrieved from: https://www.bls.gov/ooh/.

28 John Brownlee, "5 Design Jobs that Won't Exist in the Future," *Fast Company*, September 1, 2016, https://www.fastcompany.com/3063318/5-design-jobs-that-wont-exist-in-the-future.

29 Abigail Durrant and James Price, "RTD 2015 Provocation by Sir Christopher Frayling Part 1: Research Through Design Evolution," vimeo video, 7:07, posted by RTD Conference Series, accessed June 24, 2023, https://vimeo.com/129775325.

30 Ibid.

Traditional PhD Programs in Design

If degree titles are insufficient in identifying positions on design research and research education, their respective activities and claims may be more revealing. Traditional PhD programs view research training as their goal. While these curricula place a high value on doctoral scholars' specific contributions to knowledge or theory, the ultimate outcome of a traditional PhD study is a research professional who generates knowledge and theory across a lifetime of investigations, interacts with researchers in other fields, extends the influence of research findings through articulate, unambiguous presentations and publications, and trains doctoral students or research colleagues to do the same.

It is important to note that nothing in the understanding of traditional PhD research competencies dictates positivist perspectives on inquiry, a common complaint by those who view doctoral study as overly scientific and antithetical to qualitative decision-making in design. And despite Frayling's exclusion of creative production under his definition of research *into* design, traditional PhD students often engage people with physical objects intended to yield specific kinds of information — for example, cultural probes, prototypes, or graphic representations that seek users' understanding of a situation.

Further, traditional PhD efforts may address issues in practice — for example, forces shaping new practices, how communities of practice conduct their work, and models of recurring situations that define the settings for professional work. Ultimately, the distinguishing characteristics of traditional doctoral research reside in methodological rigor and the scope and credibility of claims — verification through the systematic application of methods that findings reliably represent what they purport to represent, and with some significance to other researchers, the field, or society.

In support of these research purposes and activities, traditional PhD curricula typically address a broadly negotiated inventory of theories and methods, delivered comprehensively to all doctoral students and accountable to shared standards, despite individual applications and reporting. Such theories and methods form a repertoire of approaches through which mature researchers frame studies after the completion of their dissertations and that inform their future students' investigations. In other words, there is a shared understanding within the academic research community regarding a core body of knowledge and procedures that get passed from expert to novice and from generation to generation. The curricular implication is that generally accepted standards of good research (within and outside the primary area of study) are initially acquired and debated through curated programs of reading and moderated discourse around an array of research examples and supervised activities rather than through students' self-discovery. This does not preclude new methods or challenges to standards, but it does suggest that such innovation acknowledges existing approaches. In addition, many traditional PhD programs test broad mastery of methods and standards through oral and written examinations on students' paths to doctoral candidacy.

Also implied under these competencies are general research standards and protocols likely to support claims. Sample size and diversity, for example,

matter when suggesting that results are generalizable to a larger population. The systematic application of methods means not changing study procedures or conditions when maintaining them simply becomes difficult or inconvenient. Accurate reporting reveals any bias and how changes in methods might compromise results.

Although there are debates within traditional PhD programs regarding definitions of knowledge, there have been efforts to narrow the scope. The *Frascati Manual*—developed by the OECD in 1963 as a standard for describing and tracking research expenditures—lists five criteria for classifying activities as research, regardless of field. The work must be novel (aimed at new findings), creative (based on original concepts and exclusive of routine changes to products and processes), uncertain about outcomes (have the possibility of not achieving intended results), systematic (planned and budgeted), and transferable (ensuring the use of knowledge and allowing other researchers to build upon it).[31] Recognizing that there is often a fuzzy boundary between design and R&D, the 2015 edition of the manual argues for the inclusion of experimental development aimed at creating design knowledge in support of new products or processes, with a measurement focus on knowledge production, not on the products themselves.[32] It further states that

> "Some design-related activities may be considered R&D to the extent that they play a role in the product development process, which is aiming at something 'new' (but not necessarily at new knowledge), is creative and original, can be formalized (performed by a dedicated team), and leads to codified output to be passed on to the development team. The main difference with R&D is that no uncertainty is likely to be found when skilled designers are asked to contribute to an innovation project."[33]

In other words, Frascati excludes the application of tacit knowledge in its definition of design research, regardless of innovation intent.

Practice-Based PhD Programs in Design

Practice-based PhD programs often describe their purposes as advancing and improving professional practice through reflection on one's work. Under this perspective, a "contextual view of the field" may replace a conventional literature review.[34] Because practice-based research skills are rarely "taught" through formal classes, students' methodological repertoire may depend more on self-discovery, the requirements of a singular project, or a supervisor's recommendations.

Programs with narrow exposure to seminal work and little peer-to-peer discourse raise questions regarding how practice-based PhD students acquire a comprehensive view of research methods from which to make future research decisions and guide the work of future students whose projects differ from their own. David Durling cited a number of PhD candidates in a well-respected practice-based program who said that they had no research methods training whatsoever.[35] A recent review of several practice-based PhD dissertations showed, for example, limited understanding of "coding"

31 OECD, *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development* (Paris: OECD, 2015), 47–48, https://doi.org/10.1787/9789264239012-en.
32 Ibid., 46, Section 2.16.
33 Ibid., 63–64, Section 2.62.
34 Durling, "Discourses on Research," 82.
35 Ibid.

methods. Under initial, focused, axial, and in vivo coding, good researchers search for recurring themes in interview responses.[36] But in the dissertation examples studied, practice-based doctoral students developed their own categories and selected interviewees' quotes to fit their a priori ideas of practice. In one case, when all practitioners dropped out of the study, the doctoral student continued to report his own survey responses as evidence, even though the student never practiced design himself and therefore had little understanding of design practice. Inquiries from students for long-distance supervision in methods indicate these circumstances continue today.

While practice-based PhD students' subjective reflections on their work often substitute for a more systematic application of established methods and standards of evidence, claims of originality and contributions to knowledge may also depart from the traditional research dissertation. Such work often includes designed artifacts or artifacts in combination with written accounts of some aspect of their creation.

In "The Rhetoric of Research," aesthetics professor Michael Biggs challenged Frayling's notion of research *for* art and design (that is, in which an object communicates) as an "empty set."[37] As a starting point, Biggs parsed the funding criteria of the Arts and Humanities Research Council in the United Kingdom, comparing "symptoms of research" with standards in various research practices.[38] He argued that a research standard requiring publication as evidence of a contribution to knowledge is only relevant under the assumption of influencing some identifiable audience.[39] Unless it can be shown that effects achieved entirely through an artifact represent a new concept or principle that meaningfully applies to the work of others, the artifact embodies a *point of view* rather than an explication.[40] For Biggs, therefore, research is not merely a matter of *intending* to communicate through an object.

Research professor Stephen Scrivener also questioned whether designers could make disciplinary contributions to knowledge through artifacts alone. He argued that artists and designers lose sight of their primary objectives in attempts to define the objects produced in their practices either as knowledge or as servants in a knowledge production process.[41] Scrivener contended that only humans can have knowledge; what is stored in artifacts is *information* that must be extracted to become knowledge. Differentiating *experiencing* from *knowing*, he further claimed that there must be intent by the maker of the artifact to inform an audience, and the audience must be capable of interpreting the practitioner's intent to communicate.[42] "Reading the object" does not mean that any interpretation qualifies. Shared audience understanding and the ability to derive it consistently from the object give interpretation the authority of knowledge.[43]

If Biggs and Scrivener were correct—that objects alone struggle as contributions to knowledge—then required documents have evidentiary responsibility for the explication that supports a claim of advancing knowledge in the field. Donald Schön's *The Reflective Practitioner* is frequently cited as justification for written PhD documents in which designers reflect on their making. It is important, however, to examine what Schön actually said regarding research.

36 Kathy Charmaz, *Constructing Grounded Theory* (London: Sage Publications Ltd., 2006).

37 Michael A. R. Biggs, "The Rhetoric of Research," in *Common Ground: Proceedings of the Design Research Society International Conference at Brunel University*, ed. David Durling and John Shackleton (London: Staffordshire University Press, 2002), 117, https://dl.designresearchsociety.org/conference-volumes/6.

38 Ibid., 114–15.

39 Ibid., 116.

40 Ibid.

41 Stephen Scrivener, "The Art Object Does Not Embody a Form of Knowledge," *Art and Design* 2 (2002): 1–14, available at https://www.herts.ac.uk/_data/assets/pdf_file/0008/12311/WPIAAD_vol2_scrivener.pdf.

42 Ibid.

43 Ibid.

Early in his book, using the interaction between a design student and her professor as an example, Schön compares practice to a kind of science that involves "experiments"—conversations and move-testing between the practitioner and a unique situation he or she hopes to change.[44] Schön's description of this type of activity—affirming moves when results produce intended consequences—differs from the work of a technical rationalist through its integration of means and ends and lack of separation between thinking and doing.[45] In the predetermined, controlled conditions of scientific experiments, systematic changes in specific variables help us to determine the influence they have on other aspects of the experiment. Design practitioner experiments involve exploration to get a feel for things. Move testing reveals the actions that produce effects. Hypothesis testing shows the observations that do or do not fit predicted consequences.[46] Schön described this as *reflection-in-action*. He assigned its relevance to the practitioner's interest in understanding a unique situation as bounded by a subjective interest in changing it rather than by the scientist's goals of objectivity and generalizability.[47] The experiment stops when the practitioner is personally satisfied with the outcomes produced or reframes the situation to begin again under a problem believed to be solvable.[48] *Reflection-on-action* occurs when the practitioner thinks back on something already completed.

In a later discussion of the same text, however, Schön addressed "reflective research"[49] specifically by describing the roles of the practitioner and researcher as collaborative but distinct. Schön talked about four types of research on reflective practice: *frame analysis*, which concerns how practitioners define problems and their roles; *repertoire building*, which analyzes the images, themes, cases, precedents, and exemplars practitioners bring to structuring unique situations; *methods of inquiry and overarching theories*, which account for variations in how different practitioners view situations; and *the process of reflection-in-action* itself.[50] Schön described reflective research as involving task experiments with multiple participants, observations, interviews, and interventions in assessing cognitive, affective, and group dynamic effects—all activities that imply a practitioner and a researcher, not a practitioner *as* a researcher.[51] Further, Schön's topics and examples suggested that the goal of this kind of research is to identify and analyze recurring patterns in and across types of practice rather than the singular project experiences of an individual designer.

Reliance on Schön's first view of move-testing "experiments" that qualify reflection on one's making activity as "research," therefore, opens some doctoral programs to criticism. These comments by Schön concerned the accomplished practitioner's mindset and learned process of inquiry, not the generation of new knowledge. By contrast, Schön's later discussion of research focused on the perspectives or points of entry through which someone studies that mindset or process and discovers patterns characteristic of the larger practice community. This is an important distinction when determining the problems, methods, and evaluative criteria applied by doctoral programs. Schön cautioned that the practitioner's "internal, embodied feel" for work is frequently incongruent with external descriptions

44 Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983), 146.
45 Ibid., 165.
46 Ibid., 145–46.
47 Ibid., 151.
48 Ibid., 151–52.
49 Schön, *Reflective Practitioner,* 309.
50 Ibid., 309–20.
51 Ibid., 322–23.

that others can follow.[52] He also cited difficulty in studying a process interrupted by reflection-on-action rather than the more continuous process of reflection-in-action. Schön's concerns are reasons to question the ways in which doctoral investigations of one's own work are noteworthy or authentically represent the behavior of a larger group of professional peers. Nowhere under his description of research did Schön suggest that the researcher and practitioner were one and the same. He declared that the practitioner might "take time out from practice to become a reflective researcher" during a career.[53]

UCLA professor Dana Cuff identified internal dichotomies in the study and practice of architecture that further challenge definitions of practice-based research in which designers reflect on their own making. First, the architectural education that precedes enrollment in doctoral study depends largely on studio projects that differ from the problems of practice. Assignments are didactic; they simplify complex situations and isolate constraints for investigation, presenting an idealized vision of practice by suppressing competing priorities and the importance of context in professional work.[54] Similar approaches occur across design fields, raising questions about the confusion that professionally inexperienced, recent graduates of master's programs may bring to framing doctoral research.

Second, said Cuff, the dominant image of the professional architect is one of creative visionary when teams guide much of work under a disproportionate emphasis on resolving social, technological, and economic issues, not on form.[55] The distribution of effort across multiple experts undermines the notion that personal reflection on an individual design process actually represents the true nature of contemporary practice.

This mismatch between definitions of design in school and work is especially relevant under the admission and supervision strategies of practice-based PhD programs. While other professional doctorates (for example, the Doctor of Education) presume applicants have experience in practice and a professional context in which to conduct fieldwork, practice-based doctoral students in design may never have worked professionally as designers. A number of practice-based dissertations describe faculty supervisors recommending the topics or artifacts for investigation. Inexperienced students often gain practice information through interviews with professionals only. And reflection on their own production is often limited to individuals' materials and processes, not industry.

Finally, Cuff described a contradiction between espoused theory and theory-in-use. She asserted that architects use the former to explain and justify their decisions and the latter to guide actual actions in practice.[56] This gap compromises the generalizability of personal reflection on one's practice and perpetuates the indeterminacy of performance measures used to evaluate research.[57]

Biggs' perspective is aligned with Cuff's in that there is an inherent dilemma in maintaining indeterminate measures of research performance while actively resisting forms of research that conform to the dominant university culture in which design now finds itself.[58] If practice represents a group of people engaged in a distinctive set of tasks through knowledge

52 Ibid., 276.
53 Ibid., 324.
54 Dana Cuff, *Architecture: The Story of Practice* (Cambridge, MA: MIT Press, 1991), 65.
55 Ibid., 20.
56 Ibid.
57 Ibid.
58 Michael Biggs et al., "The Production of Academic Research and Some Barriers to Academicization in the Creative and Performing Arts," in *Proceedings of ICERI Conference 2010* (Madrid: IATED, 2011), 380, http://hdl.handle.net/2299/7382.

not shared with other professions, what knowledge is genuinely unique to design, and what are the appropriate methods for studying it?

The Recommendations of the Working Group on Doctoral Education

In light of this indeterminacy of doctoral study in design, the Future of Design Education working group on doctoral education began its work under general agreement that reflection on one's practice falls appropriately under the mission of professional master's education, the goal of which should be more ambitious than the continuous refinement of undergraduate skills. At the same time, there was consensus within the group that research developed in support of practice decisions in applied settings—described as "cases"—is both relevant and informative to the field at large. Further, members of the working group concurred that such research could and should conform to standards, some shared with and others different from those of the traditional PhD.

In larger discussions among leaders of the various Future of Design Education working groups, there was also concern regarding the overly casual use of the term "design research" in today's design practices and college programs. For example, simply interviewing someone is not ethnographic research, and designers do not become ethnographers without some education in the concepts and methods of anthropology. Likewise, the complexity of today's design challenges supports the argument that there is a need to understand people through the *interactions* among their individual, group, and cultural experiences. Such insights into user experiences are not revealed simply by the singular application of methods from one social science discipline (psychology, sociology, or anthropology). And the abundance of today's data requires careful consideration of how it is collected, structured, and its statistical significance. Therefore, the *things to know and do* in working group recommendations address standards for both degrees, including when research addresses a professional practice context and where the research question determines the extent of application.

The curricular recommendations (Table 1) that follow juxtapose the recommended research knowledge of a traditional PhD in Design program with the professional Doctor of Design in an effort to separate their respective purposes without suggesting a hierarchy between the two degrees. The working group did not address the specific subject matter of research dissertations, acknowledging content interests as the purview of design specializations and institutions.

In addition to comparing the two degrees, the working group identified things that all doctoral students should know and do, regardless of doctoral degree type. The group formatted these recommendations as student learning outcomes to conform to institutional demands for assessable competencies.

Table 1 **The PhD in Design versus the Doctorate of Design degrees.**

PHD IN DESIGN PROGRAM	DOCTOR OF DESIGN PROGRAM
The PhD in Design is a research degree. A doctoral research project undertakes work on a new or unresolved problem. The goal of PhD research is to generate new knowledge or theory. The scientific and research communities are the primary audience for a doctoral thesis or dissertation. Research outcomes for a PhD in Design should be generalizable explanations of guiding beliefs, principles, or processes. Methods, evidence, and claims are held to rigorous standards, including efforts by others to replicate or extend results. Even so, research findings ultimately may be applied in practice. PhD research may also study the community of practice itself or suggest a new practice through the same research standards applied to all PhD studies.	**The Doctor of Design is a professional practice degree in which research is situated in a particular practice setting as part of an overall design process. The research component and dissertation differentiate the DDes from professional master's degrees. The DDes thesis or dissertation explains research findings and their relevance to the practice situation. Industry and design practitioners are the primary audience for research outcomes presented as cases. As such, investigations respond to the specific conditions of the setting and do not claim to be generalizable. DDes research is used instrumentally to frame the opportunity or problem space, to guide in-process design decisions, or to evaluate design outcomes. Standards of evidence and claims are subject to practical constraints, including time.**
1 PhD design research is an inquiry-driven activity that seeks deeper knowledge or resolution of something. It may: • Arise from personal observation, curiosity, or frustration with a gap in knowledge; • Come to the attention of the researcher through disciplinary discourse or an external challenge for which a course of action is not immediately apparent; or • Respond to the research of others.	**1 DDes research begins with a need to understand something in a specific practice setting or industry. It may:** • Arise from the identification of an "opportunity space" for new or more responsive products, services, systems, or organizations; • Come to the researcher's attention through some misfit or friction in a particular practice situation; or • Build on the recurring need to support and justify design decisions.
2 PhD design research serves different purposes. **The *end goals* of design research might include:** • Generating new knowledge or theory in the field; • Studying patterns or models of emergent conditions to elicit new principles or phenomena; and • Understanding existing and preferred future states produces insights for the field at large concerning a recurring problem. **Relevant studies that serve as means for advancing knowledge might include:** • Applying design knowledge, theories, and methods to interpretation in other fields; • Interpreting design through knowledge, theories, and methods from other fields; and • Confirming, expanding, or reconsidering other design researchers' findings.	**2 DDes research serves a variety of purposes in practice settings, including:** • Consensus-building around a model of the relationships among people, activities, and setting in defining initial and goal states; • Guidance for practical decision-making among competing priorities or alternative design solutions; or • Improvement of processes through which design is planned, made, distributed, or evaluated.
3 PhD research is pluralistic in its perspectives; research is guided by an epistemology, a theory of knowledge that justifies belief from opinion.	**3 DDes research is framed in terms of a current model of practice and theories of change that describe short- and long-term views of the situation under study.**

4 Framing a PhD design research question sets the stage for everything that follows in the study: • Search for knowledge gaps; • Synthesis of relevant literature; • Theories for grounding the study; a conceptual framework; • Research methods and data collection strategies; • Main units of analysis; • People or situations involved; • Criteria for interpreting findings; • Standards of evidence and generalizability of claims; and • Publication.	**4 Framing DDes research in a practice setting sets the stage for everything that follows:** • Search for relevant cases or industry analyses, as well as relevant literature; • Relational views of the individual, social, and cultural dimensions of the situation, as well as the people involved; • Selection and adaptation of disciplinary research methods and scales of data collection to meet the demands of the practice situation; • Distinction between what can be measured statistically or with certainty and what is relevant to making design decisions; • Criteria for interpreting findings; and • Strategies for implementation and implications for future versions or similar cases.
5 A PhD design research question has several characteristics: • It addresses an issue in design or is directly relevant to design; • It can rarely be answered "yes" or "no"; it requires deep inquiry; • Its wording implies a hierarchy among aspects of the topic or situation; • It suggests a working theory or conceptual framework that underpins the inquiry; • It represents a hypothesis — a best guess — regarding a realistic scope of the investigation; it can be further articulated through several sub-questions that contribute to understanding the primary question; These sub-questions are not simply tasks to be executed; • It anticipates how findings might be used and by whom; • It does not use comparative terms such as "improved," "more," or "better" unless it leads to a demonstration of validity and reliability.	**5 A DDes research question has a number of characteristics:** • It is directed toward guiding future action in a specific practical situation; • It is often shaped through the participation of stakeholders; • It suggests a working model of the situation, consisting of specific actors or elements and how they behave and interact with others and aspects of the setting; • It represents a scope of investigation matched to the design challenge and may be staged or adjusted in response to emerging information (for example, tests of a prototype); • It seeks outcomes that contribute to improving a particular situation in concrete, observable ways; it does not seek the generalizability of findings.
6 PhD design researchers carry out investigations in a "planned way, with records kept of both the outcomes and process followed such as the conceptual framework, methodology and fieldwork."[59] PhD students should have a broad understanding of qualitative and quantitative methods related to a particular design investigation, experience their application through pilot studies, and apply them with rigor. They typically achieve this understanding through coursework in methods or a curated set of readings. Further, students should recognize the institutional context and philosophy under which they expect to do research.	**6 DDes researchers carry out investigations in "a planned way, with records kept of both processes followed and outcomes produced."[60]** DDes researchers select methods from a repertoire of possibilities, based on appropriateness to the research application and setting, anticipated use of findings, and time and resources for collecting data. An understanding of methods is typically achieved through coursework, a curated set of readings or both.
7 PhD design researchers communicate findings in a doctoral dissertation, consistent with the type and purpose of the research and appropriate for particular scientific or research audiences.	**7 DDes researchers summarize findings in a doctoral dissertation of significant length, accountable to accepted practice protocols and standards for claims, and consistent with the type and purpose of the research. The audience for the dissertation may be design practitioners.**

8 PhD design research ethics should apply to any study. • PhD students should apply ethical standards of contemporary research stringently; particularly practices related to the involvement of human subjects and data management, storage, and future use; • Students should evaluate the costs and benefits of research, as well as from and to whom costs and benefits ensue.	**8 DDes researchers are stewards of responsible practice; ethics should apply to any study and be a condition for any participating practice and client or organization.** A memorandum of understanding should document agreements among the institution, research students, and other participants.
9 Unless PhD design research is proprietary or covered by the intellectual property requirements of the institution, it should be shared broadly through publications, conferences, and transfer to industry.	**9 Unless proprietary or covered by intellectual property requirements of the institution, DDes research is shared broadly through publications, conferences, and transfers to industry.**
10 PhD design graduates should be qualified to mentor other researchers and serve as stewards of their discipline. The research environment is an active learning space that integrates teaching and discovery.	**10 DDes research graduates should be qualified to lead research investigations in practice as stewards of their profession.**
PHD IN DESIGN PROGRAM MANAGEMENT: **PhD design offerings require:** • Resident faculty supervisors with experience in design research, research writing, and institutional policies; • Funding for doctoral students (tuition, teaching assistantships, and research stipends); • Support for space, equipment, travel, faculty workload, and grant writing; • Regular and ongoing student access to doctoral supervision; • Library and technological resources consistent with the area of design research specialization; • Curated readings that all students in the program master, in addition to content specific to their research projects; • Access to the formal study of research methods (including PhD graduates' preparation for training future researchers); • Access to study in a cognate discipline and to interdisciplinary faculty members for doctoral dissertation committees (if advised); • Procedures for ensuring the application of ethical research practices (for example an institutional review board); • Milestone reviews that apply to all PhD students and that ensure sufficient progress to advance to the next stage of their research education; • Published and consistently applied expectations for research proposals and final graduate submissions; and • Published policies regarding student ownership of intellectual property.	**DOCTOR OF DESIGN PROGRAM MANAGEMENT:** **DDes offerings in design require:** • Resident faculty supervisors with research experience in practice settings and institutional policies for approval of doctoral faculty status; • Procedures for reaching agreements with participating practice settings regarding access; • Funding for doctoral students (tuition, teaching assistantships and research stipends); • Support for space, equipment, travel, faculty workload, and grant writing; • Regular and ongoing student access to doctoral supervision; • Library and technological resources consistent with the area of design research specialization; • Curated readings that all students in the program master, in addition to content specific to their research projects; • Access to the formal study of practice-based research methods; • Procedures for ensuring the application of ethical research practices (for example an institutional or independent review board); • Milestone reviews that apply to all DDes students and that ensure sufficient progress to advance to the next stage of their research education; • Published and consistently applied expectations for research proposals and final graduate submissions; and • Published policies regarding student or organizational ownership, or both, of intellectual property.

1 Regarding the *Nature of Design Research*

What doctoral students in design should know:

There is a difference between design research and design and between academic design research and research undertaken as part of design practice. Research is generally defined as a systematic investigation that establishes novel facts, solves new or existing problems, proves new ideas, or develops new theories.[61]

Design practice increasingly includes situated research efforts for new insights into stakeholders, activities, and aspects of context to guide practical decision-making. This research is different from investigations to produce knowledge of fundamental and replicable principles for the field at large.

Research in practice also differs from creative exploration in design planning, execution, and communication—or reflection on these activities.[62] It is intended to generate knowledge about the situation at hand as guidance for practical decisions and is not the execution of activities that are informed by that knowledge.

Research is a "methodical search for knowledge."[63] Therefore, it involves decisions about:

- Epistemology—"The theory of knowledge";[64]
- Method—"A well-specified repeatable procedure for doing something";[65]
- Methodology—The study of methods as a school of thought about an approach to inquiry. It is often confused with "method," as in "the methodology used in the present research."[66] Methodological awareness and the inquiring attitude that characterizes thinking like an independent researcher are essential for doctoral students.[67]

The epistemologies underpinning design research represent competing worldviews that shape knowledge acquisition and, subsequently, design practice.[68] Epistemological presuppositions design the act of designing; all design relies on some tacit notion of "knowledge that gives it its recognizable shape and form."[69] For example, a belief that people are experts in their own lived experiences leads to participatory design methods and place-based design solutions.

The construction of theory involves an ordered set of assertions that describes a generic behavior or structure in a valid and verifiable way that holds throughout a significantly broad range of specific instances.[70]

2 Regarding the nature of *Research Methods*

What doctoral students in design should know:

There is a difference between design research methods and design methods. *Design research methods* seek knowledge about people and other living things, artifacts, activities, contexts, and phenomena. Observations, interviews, data mining, experiments, cultural probes, and participatory activities with users are examples of design research methods. They are evidence-based and used to frame a situation or opportunity, identify key factors and problem elements, anticipate forces that could affect design outcomes, suggest a hierarchy among competing priorities, and inform and evaluate short- and long-range consequences of design action. Design research methods also study the materials,

59 OECD, *Frascati Manual 2015*, 47.
60 Ibid.
–
61 Trygve Faste and Kaakon Faste, "Demystifying 'Design Research': Design Is not Research, Research Is Design," in *Proceedings of IDSA Education Symposium 2012* (Boston, MA, August 15, 2012), 1, https://www.idsa.org/sites/default/files/Faste.pdf; and Mario Bunge, *Philosophical Dictionary*, enl. ed. (Amherst, NY: Prometheus Books, 2003), 251.
62 Faste and Faste, "Demystifying 'Design Research,'" 1.
63 Bunge, *Philosophical Dictionary*, 251.
64 Ibid., 87.
65 Ibid., 180.
66 Ibid., 80.
67 Ibid., 180.
68 Peter Murphy, "Design Research: Aesthetic Epistemology and Explanatory Knowledge," *She Ji: The Journal of Design, Economics, and Innovation* 3, no. 2 (2017): 118, https://doi.org/10.1016/j.sheji.2017.09.002.
69 Ibid.
70 Ken Friedman, "Theory Construction in Design Research: Criteria: Approaches, and Methods," *Design Studies* 24, no. 6 (2003): 507–22, https://doi.org/10.1016/S0142-694X(03)00039-5.

71 Ibid., 510–11.

processes, and information used in the artifacts and systems that human beings design.[71]

Design methods involve structured procedures, techniques, or tools used at different stages of the design process. Sketching, modeling, wire-framing, and rapid prototyping are examples of design methods. While these methods may assist in problem analysis, testing, and communication with others, they are not wholly sufficient as research methods.

What doctoral students should do:

- Select and justify methods from an inventory of quantitative, qualitative, and mixed method possibilities as appropriate to:
  - Research purpose and questions;
  - Research participants;
  - The characteristics and stability of research settings;
  - Technological or human resources available for data collection and analysis;
  - The need for triangulation;
  - Time and cost; and
  - Mitigating risk if the plan is not successful.

- Modify methods borrowed from other fields (for example, human factors, social sciences, or rhetoric) as necessary to meet the needs of a design investigation—including to account for:
  - Behavior in natural settings;
  - Holistic consideration of mindsets, actions, or settings that precede and follow the activity being studied;
  - Relationships among behaviors traditionally studied independently by other research fields (for example, the interactions among individual, social, and cultural behavior);
  - New technologies for data collection; and
  - A/B testing (i.e., comparison of two things to determine which performs better).

- Systematically apply a method or mixed methods and maintain consistent conditions across a study. Any inconsistencies in the application of data collection should be reported with research outcomes.

3 Regarding *Sampling*

What doctoral students should know:

There are different sampling strategies that respond to research intent and that qualify claims, including:

- Probability;
- Area;
- Random;
- Stratified;
- Interval; and
- Cluster.

What doctoral students should do:

Justify the choice of a population (the total set of relevant cases) or sample (subset of a population) for which research results will be reported. They should select sample sizes necessary to produce confidence in results for the purposes to which they apply.

4 Regarding *Research Standards*

What doctoral students should know:

Standards for evaluating research vary with the epistemological tradition adopted by the researcher. For example, the standards for producing generalizable theory on the nature of design phenomena or the efficacy of new design processes may differ from those seeking measured proof that design improved a particular aspect of something.

Standards for research also vary with the purpose and application of findings. Academic research intended to add to disciplinary knowledge should meet higher standards (in sampling and statistical significance, for example) than research that guides design decisions in a particular practice setting.

What doctoral students should do:

- Discriminate between the criteria for rationalistic and naturalistic studies in judging the trustworthiness of findings. Scientific research can confirm potentiality and assist realization; design research is the means for initiating and directing change based on human agency.[72] Rationalistic studies seek proof and rely on internal and external validity, reliability, and researcher neutrality to guard against the influence of contextual factors and data inconsistencies.

  Naturalistic studies seek plausible, stable, and context-relevant findings that result from prolonged engagement, persistent observation, member checks, and triangulation to overcome problems of biased interpretations and situational uniqueness.[73]

  Ecological validity is the degree of correspondence between the research conditions and the phenomenon being studied as it occurs naturally or outside of the research setting.[74]

- Address the following central issues to assure research credibility:
  - Intersubjectivity, in which members of a research community use one another as measuring sticks to establish the acceptability of a method;
  - Reliability, which tests a method for consistent results when used repeatedly under the same conditions;
  - Validity, which correlates the results of a method with predictions, theoretical constraints, or applications in other studies; and
  - Generalizability, the degree to which study results can be used to control action in new situations that are related by events, people, settings, time, or state of development.[75]

- Apply a working knowledge of statistics in determining the significance of quantitative findings.

72 Harold G. Nelson and Erik Stolterman, *The Design Way: Intentional Change in an Unpredictable World*, 2nd ed. (Cambridge, MA: MIT Press, 2014), 30–32.

73 Egon G. Guba, "Criteria for Assessing the Trustworthiness of Naturalistic Inquiries," *Educational Communications and Technology Journal* 29, no. 2 (1981): 75–91, https://www.jstor.org/stable/30219811.

74 Pat J. Gehrke, "Ecological Validity," in *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation*, ed. Bruce Frey (London: Sage, 2018), online, https://doi.org/10.4135/9781506326139.

75 John Zeisel, *Inquiry by Design: Environment Behaviour Neuroscience in Architecture Interiors* (Cambridge: Cambridge University Press, 2006).

5 Regarding *Research Ethics*

What doctoral students should do:

- Adopt ethical research behaviors, including:
  - Accounting for the potential social and environmental effects of research while describing the interests it serves;
  - Justifying the scientific, practical, or educational value of the research;
  - Being conscious of multiple roles as researchers while avoiding conflicts of interest;
  - Following standards for using intellectual property, correctly using and citing text or research output by other researchers, and following best practice in collaboration with other researchers;
  - Practicing fair participant selection;
  - Minimizing any risk to participants by placing participant health, safety, and welfare at the forefront of research considerations;
  - Protecting participant anonymity and confidentiality;
  - Obtaining the informed consent of participants while providing them the right to ask questions or to withdraw from the study;
  - Subjecting the research process and findings to independent reviews;
  - Accurately and fully reporting findings and the status of any publications; and
  - Disclosing the source of research funding.

- Submit key information for independent review and for informed consent when working with human subjects. This information includes:
  - Proposed research and research design;
  - Dates, location, and step-by-step procedures for research with human subjects;
  - Number, age, and characteristics of human subjects in the study;
  - Details of participant selection, including how names will be obtained and how participants will be contacted;
  - Procedures for collecting and storing data, including who will have access, whether individuals' data can be identified, and what will happen to data when the research is over;
  - Any risks to which participants may be subjected and the precautions taken to minimize risk;
  - Description of the informed consent, or in the case of minors, the process through which consent will be obtained; and
  - Anticipated benefits to participants and the importance of the knowledge that may result.

6 Regarding *Research Writing*

What doctoral students should do:

- Apply high standards in writing theses, dissertations, and publications.[76]
  - Introduce and define terms, including what terms mean in the context of the research study;
  - Avoid jargon and explain necessary technical language;

76 Ken Friedman, "Research Writing Workshop" (workshop, Tongji University, Shanghai, China, 2021).

- Use an appropriate and consistent writing style;
- Avoid overwriting and overstating;
- Use first-person narrative only when the author witnessed events or is a necessary actor;
- Use citations to substantiate the argument through fine-grained references to direct, indirect, and paraphrased quotations and passages;
- Use no second-hand references;
- State and explain assumptions and limitations of the research study;
- Clarify and explain key issues;
- Present and address contrary evidence;
- Maintain continuity in the argument; and
- Write iteratively; read, write, rewrite, refine, and seek advice from others.

- Follow good writing practices in submitting research articles for publication:
  - State the theme of the article;
  - Introduce the subject;
  - State the goals of the article and promise a contribution to knowledge;
  - Identify key issues in the argument and give their background;
  - Describe the approach, context, and process of the research;
  - Provide evidence for the argument and show how it leads to a contribution to knowledge;
  - Describe findings or conclusions and how they meet the goals of the article;
  - Suggest future work to answer remaining questions or unresolved issues; and
  - Provide a reference list of all cited sources.

7 Regarding *Doctorateness*

What doctoral students should know:

Examiners judge what an examinee knows from inferences about what the examinee can do based on observations of the examinee's performance on the dissertation and in the defense. Each university regulates its degrees; however, there are generic features of "the doctorate" that transcend individual universities' regulations.[77] The generic features that doctoral dissertations typically show are:

- Stated gap in knowledge;
- Explicit research questions;
- Conceptual framework;
- Explicit research design;
- Appropriate methodology;
- "Correct" data collection;
- Clear and precise presentation;
- Full engagement with theory;
- Cogent argument throughout;
- Research questions answered;

77 **Vernon Trafford and Shosh Leshem, *Stepping Stones to Achieving Your Doctorate: By Focusing on Your Viva from the Start* (Maidenhead, UK: Open University Press, 2008), 38.**

- Conceptual conclusions; and
- Contribution to knowledge.

Examiners use these generic features to judge how the examinee's performance relates to academic standards. If the examiners recognize that the dissertation seamlessly integrates all the generic features, then they can extrapolate to the conclusion that the examinee has achieved "doctorateness," that is, the methodological awareness and inquiring attitude that characterizes thinking like an independent researcher.[78]

78 Luke Feast, "Down the Brain Drain: Searching for Doctorateness in all the Wrong Places," *She Ji: The Journal of Design, Economics, and Innovation* 8, no. 1 (2022): 148–52, https://doi.org/10.1016/j.sheji.2021.11.001.

Conclusion

The doctoral faculty who participated in the Future of Design Education working group concluded that the design fields need to clarify research definitions and standards for two types of doctoral degrees: the research PhD in Design and the professional Doctor of Design. In this way, design would parallel other disciplines and discourage inflated claims of doctoral-level work outcomes closely associated with the professional studio master's degree and study in fine art. This degree strategy acknowledges design research as an increasingly important aspect of professional practice, but also recognizes alternate purposes and the application of standards from those of the academic research and generalizable knowledge generation undertaken by the PhD.

Declaration of Interests

There are no conflicts of interest involved in this article.

References

"What Is Anthropology?" American Anthropological Association, 2022. Accessed June 21, 2023. https://americananthro.org/learn-teach/what-is-anthropology/.

"What Is the REF?" Research Excellence Framework. Accessed June 21, 2023. https://www.ref.ac.uk/about/what-is-the-ref/.

Biggs, Michael A. R. "The Rhetoric of Research." In *Common Ground: Proceedings of the Design Research Society International Conference at Brunel University*, edited by David Durling and John Shackleton, 111–18. London: Staffordshire University Press, 2002. https://dl.designresearchsociety.org/conference-volumes/6.

Biggs, Michael, D. Büchler, R. Rocco, and C. Schjerven. "The Production of Academic Research and Some Barriers to Academicization in the Creative and Performing Arts." In *Proceedings of ICERI Conference 2010*, 378–85. Madrid: IATED, 2011. http://hdl.handle.net/2299/7382.

Boroush, Mark, and Ledia Guci. "Research and Development: U.S. Trends and International Comparisons." Report, National Science Board Science and Engineering Indicators 2022. https://ncses.nsf.gov/pubs/nsb20225.

Bourner, Tom, Rachel Bowder, and David Laing. "Professional Doctorates in England." *Studies in Higher Education* 26, no. 1 (2001): 65–83. https://doi.org/10.1080/03075070124819.

Brownlee, John. "5 Design Jobs that Won't Exist in the Future." *Fast Company*, September 1, 2016. https://www.fastcompany.com/3063318/5-design-jobs-that-wont-exist-in-the-future.

Bunge, Mario. *Philosophical Dictionary*, enl. ed. Amherst, NY: Prometheus Books, 2003.
Charmaz, Kathy. *Constructing Grounded Theory*. London: Sage Publications Ltd., 2006.
Cuff, Dana. *Architecture: The Story of Practice*. Cambridge, MA: MIT Press, 1991.
Durling, David. "Discourses on Research and the PhD in Design." *Quality Assurance in Education* 10, no. 2 (2002): 79–85. https://doi.org/10.1108/09684880210423564.
Durrant, Abigail, and James Price. "RTD 2015 Provocation by Sir Christopher Frayling Part 1: Research Through Design Evolution." vimeo video, 7:07. Posted by RTD Conference Series. Accessed June 24, 2023. https://vimeo.com/129775325.
European Higher Education Area. "The Bologna Declaration of 19 June 1999." Last modified April 7, 2023. http://www.ehea.info/media.ehea.info/file/Ministerial_conferences/02/8/1999_Bologna_Declaration_English_553028.pdf.
Faste, Trygve, and Kaakon Faste. "Demystifying 'Design Research': Design Is not Research, Research Is Design." In *Proceedings of IDSA Education Symposium 2012*, online. Boston, MA, August 15, 2012. https://www.idsa.org/sites/default/files/Faste.pdf.
Feast, Luke. "Down the Brain Drain: Searching for Doctorateness in all the Wrong Places." *She Ji: The Journal of Design, Economics, and Innovation* 8, no. 1 (2022): 148–52. https://doi.org/10.1016/j.sheji.2021.11.001.
Frayling, Christopher. "Research in Art and Design." *Royal College of Art Research Papers* 1, no. 1 (1993/4): 1–5. https://researchonline.rca.ac.uk/id/eprint/384.
Friedman, Ken. "Theory Construction in Design Research: Criteria: Approaches, and Methods." *Design Studies* 24, no. 6 (2003): 507–22. https://doi.org/10.1016/S0142-694X(03)00039-5.
Friedman, Ken. "Research Writing Workshop." Workshop, Tongji University, Shanghai, China, 2021.
Gehrke, Pat J. "Ecological Validity." In *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation*, edited by Bruce Frey, online. London: Sage, 2018. https://doi.org/10.4135/9781506326139.
Green, Howard, and Stuart Powell. *Doctoral Study in Contemporary Higher Education*. London: SRHE and Open University Press, 2005.
Guba, Egon G. "Criteria for Assessing the Trustworthiness of Naturalistic Inquiries." *Educational Communications and Technology Journal* 29, no. 2 (1981): 75–91. https://www.jstor.org/stable/30219811.
Jones, Alex, and Andrew Kemp. "Why Is So Much Research Dodgy: Blame the Research Excellence Framework." *The Guardian*, October 17, 2016. https://www.theguardian.com/higher-education-network/2016/oct/17/why-is-so-much-research-dodgy-blame-the-research-excellence-framework.
Kot, Felly Chiteng, and Darwin D. Hendel. "Emergence and Growth of Professional Doctorates in the United States, United Kindom, Canada and Australia." *Studies in Higher Education* 37, no. 3 (2012): 345–64. https://doi.org/10.1080/03075079.2010.516356.
Marcus, Jon. "Universities Increasingly Turn to Graduate Programs to Balance Their Books." *Hechinger Report*, April 23, 2019. https://hechingerreport.org/universities-increasingly-turn-to-graduate-programs-to-balance-their-books/.
Michalski, Daniel S., and Garth Fowler. "Doctoral Degrees in Psychology: How Are They Different, or Not so Different?" American Psychological Association, January 2016. Accessed June 21, 2023. Retrieved from https://www.apa.org/ed/precollege/psn/2016/01/doctoral-degrees.
Murphy, Peter. "Design Research: Aesthetic Epistemology and Explanatory Knowledge." *She Ji: The Journal of Design, Economics, and Innovation* 3, no. 2 (2017): 117–32. https://doi.org/10.1016/j.sheji.2017.09.002.
National Association of Schools of Art and Design. *NASAD Handbook 2021–22*. Reston, VA: NASAD, 2022. https://nasad.arts-accredit.org/wp-content/uploads/sites/3/2022/04/AD-2021-22-Handbook-Final-04-08-2022.pdf.

National Association of Schools of Art and Design, "Substantial Equivalency," NASAD. Accessed July 5, 2023, https://nasad.arts-accredit.org/services/review-services/substantial-equivalency/.

Nelson, Harold G., and Erik Stolterman. *The Design Way: Intentional Change in an Unpredictable World*, 2nd ed. Cambridge, MA: MIT Press, 2014.

OECD. *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. Paris: OECD, 2015. https://doi.org/10.1787/9789264239012-en.

OECD. "What Are the Characteristics and Outcomes of Doctoral Graduates?" In *Education at a Glance 2019: OECD Indicators*, 246–60. Paris: OECD Publishing, 2019. https://doi.org/10.1787/f8d7880d-en.

Schon, Donald A. *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books, 1983.

Scott, Peter. "Clashing Concepts and Methods: Assessing Excellence in the Humanities and Social Sciences." *Humanities* 4, no. 1 (2015): 118–30. https://doi.org/10.3390/h4010118.

Scrivener, Stephen. "The Art Object Does Not Embody a Form of Knowledge." *Art and Design* 2 (2002): 1–14. https://www.herts.ac.uk/__data/assets/pdf_file/0008/12311/WPIAAD_vol2_scrivener.pdf.

Trafford, Vernon, and Shosh Leshem. *Stepping Stones to Achieving Your Doctorate: By Focusing on Your Viva from the Start*. Maidenhead, UK: Open University Press, 2008.

U.S. Bureau of Labor Statistics. *Occupational Outlook Handbook*. Washington, DC: US Department of Labor, 2019. Accessed June 24, 2023. Retrieved from: https://www.bls.gov/ooh/.

Zeisel, John. *Inquiry by Design: Environment Behaviour Neuroscience in Architecture Interiors*. Cambridge: Cambridge University Press, 2006.