Designerly Ways of Teaching

Reflecting on folk pedagogies in design education

by

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ABSTRACT

The profession known as industrial design is undergoing a transformation. Design thinking and strategy are replacing form giving and styling. Critics are calling for curricular reform to meet the changing needs of practice, yet surprisingly little knowledge is available about how and why design teachers do what they do. In an effort to frame the problem of (re)designing design education, this study provides a framework for understanding the pedagogical beliefs and preferences of design students and educators utilizing Bruner's four folk pedagogies. This study also provides evidence that the practices of industrial design teachers exhibit what Cross (2006) has described as 'designerly ways of knowing.'

DEDICATION

This document is dedicated to the greatest teacher I have ever known: Max, my son and my sun.

ACKNOWLEDGMENTS

I offer a deep and humble bow of gratitude to the many teachers and students that have gifted me with their wisdom. Thank you.

I am also deeply grateful to the thoughtful team of experts, the committee, who supported this endeavor and brought the best out of me by bringing the best of themselves to the task. Thank you.

To my dear friends and loved ones who have supported me throughout this endeavor, I am honored by your presence, your passion and your kindness. Thank you.

And to Doctor Doctor G, for your *thumos* and your patience and your faith, I thank you.

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CHAPTER 1

1.1 Background

The discipline of industrial designing is undergoing a transformation. In fact, the profession known as "industrial" design often now forgoes its industrial heritage and is increasingly being identified as design alone. The shift in emphasis from industry to design illuminates a fundamental shift in the nature of design activity and how it is now perceived by both design professionals and the multiple stakeholders it serves. The products of designing have moved out of the spotlight as the processes that transform existing situations into preferred ones have caught the attention of industries outside of product development and opened doors for the evolution of industrial design practice into a more complex and globally integrated profession (Van Patter 2009).

The emerging recognition of design thinking as a valuable service necessitates a reconsideration of the preparation of future design professionals. The unique cognitive practices of designers, 'designerly ways of knowing,' (Cross 2006) require unique modes of instruction. The existing educational situation, with its emphasis on manual skills of form-giving, is now faced with the challenge of creating a preferred state which nurtures creative mental skills and innovation facilitation. New approaches to education must focus on critical, analytical, and reflective thinking skills of future designers (Friedman 1997; Giard 1990). There is a growing need for reform of design education but there is a lack of evidence upon which to base such efforts.

The paradigmatic shift of design emphasis from product to process reflects comparable historical swinging from polar extremes within the discipline. From theory to practice, from art to science, design has evolved as a self-conscious profession struggling to identify and assert its value in a changing global marketplace. Diagnosing the challenges and opportunities for design education requires a preliminary survey of the learning landscape, a bit of reflection upon the evolving practice of industrial design and the implications for design teaching and learning. Reflection-on-action, described by Schön (1983), provides a chance to explicate the tacit knowing-in-action practices of designers (and design teachers) and leads to critical reframing of the situation.

Very little precedent is available relating to pedagogical practices in industrial design education. Oxman (2001) provided a framework for understanding design thinking as the content of curriculum and explored its functions as a subject of teaching and learning activities. The three paradigms of design education described by Oxman resonate with the theory of folk pedagogies advanced by Bruner (1996). According to Bruner, folk pedagogies are mental models of the learner's mind that are a direct reflection of teacher beliefs and assumptions. Bruner identifies four distinct folk pedagogies that are typically tacitly held and embodied in the relationship between teacher and student.

1.2 Research Problem and Questions

The industrial design profession and the educational institutions that prepare students for professional practice lack a critical understanding of the pedagogical efforts of industrial design teachers. If efforts at reform are to have any chance of success, they must take into account the current folk theories that shape design teacher and learner behavior. There is no such understanding of the tacitly held beliefs that shape educative action which reveals a lack of historical self-consciousness about the nature of industrial design pedagogy, both existing and preferred, in the United States. To this end, the study reported herein was undertaken in response to the question, "What do reflections by teachers and students reveal about existing and preferred industrial design folk pedagogies?"

The question was deconstructed into three more focused questions that shaped the design of the research:

1. What are the existing and preferred folk pedagogies in industrial design education?
2. What do existing and preferred folk pedagogies reveal about designerly ways of teaching?
3. How might understandings of folk pedagogies and designerly ways of teaching inform the (re)design of design education?

1.3 Justification for the research

There is frighteningly little information available about pedagogical intentions and practices in industrial design education. With the exception of well-documented experiments with the Bauhaus curriculum, few efforts at pedagogical innovation or reform have been undertaken or reported in over half a century. The rapidly changing nature of industrial design practice has surpassed the pace of pedagogical innovation and today the gap between industry and academy is as great as ever. There is a pressing need to reform industrial design education and an equally pressing need to generate knowledge about just what that should entail.

Few studies have been undertaken to identify the challenges of curriculum redesign in industrial design. These surveys have offered more in terms of identifying curricular content expectations of current industry professionals than critical reconsideration of the evolution of the profession and which skills may, consequentially, be required for future practitioners. These studies reveal reliance upon industry tradition in their efforts to shape design educational practices to meet the needs of an increasingly outdated industrial model.

This study addresses a gap in existing knowledge about the pedagogical beliefs and practices of industrial design teachers and learners. In addition, this study models theoretical and empirical approaches to data collection and analysis that may inform future research efforts by industrial design educators. The research reported herein utilizes folk pedagogies to frame the problems facing the designers of design education in an effort to raise awareness and inspire critical action and reflection.

1.4 Methodology

This is an inquiry into the learning beliefs of industrial design teachers and students. Much research has explored products of design education, namely design practitioners and the artifacts they create. Yet the practice of design educators, the cognitive processes that shape the way they think about and teach design, remains largely unchartered territory. Looking through the theoretical lens of reflective practice and folk pedagogy, this study offers initial steps towards theory generation regarding the espoused practices of design educators and the pedagogical reasoning that supports these behaviors.

The research design for this study included primarily qualitative methods of inquiry including an online survey questionnaire and two teacher case studies. The online survey was administered to both industrial design teachers and students and requested descriptive data about the respondents as well as responses to questions that were designed to reveal beliefs and preferences for pedagogical approaches. The survey design operationalized the four folk pedagogies by Bruner in order to provide a framework for understanding the results and to render them comparable with other collected data.

The two teacher case studies for this research provided additional reflective insight into the nature of design teaching. Observations of the teachers in class provided examples of folk pedagogical performances which, when coded according to the four folk pedagogies, allowed for comparison with the survey data. Four interviews with each teacher participant also revealed the pedagogical intentions that shaped the teaching performances as well as the storied mental models of each teacher's understanding of the role of, and relationship between, teacher and student.

The results of the data generated from the survey instrument and the teacher case studies were also viewed through the lens of 'designerly ways of knowing' which, according to Cross (2006), involves five identifiable orientations to the problem situation. The interview data from each teacher participant was reduced in scope and re-membered into a narrative in five sections representing the five designerly aspects of knowing. These stories and the results of the teacher observations and online survey were mined for patterns that revealed preferred pedagogical practices in industrial design education. The preferred strategies were then aggregated into a format that allows for their future use as a tool for action research by design educators.

1.5 Outline of Document

This document includes five chapters. The first chapter, the introduction, provides an orientation to the research study including background information, brief allusion to the relevant research and methodology, terminology, and delimitations of the study. The second chapter discusses literature, both theoretical and empirical, that is relevant to this research. Chapter three contains a description of the research design including methods of data collection and analysis. The results of the research are reported in the fourth chapter. The fifth and final chapter of the document discusses the results of the research presented in chapter four in light of the literature reviewed in chapter two. Chapter five presents responses to the original research questions posed in chapter two and considers these responses as the point of departure for future research.

1.6 Delimitations of scope

The study reported herein is empirical in nature though theoretical in intent. It is a study that attempts to lay preliminary groundwork for future research by exploring methods of data collection and theoretical lenses for analysis. This study is not an attempt to provide generalizable information about all industrial design educators, students, and programs in the United States. Rather, it provides a snapshot of possible pedagogic preferences and beliefs that may lead to future experiments and studies with pedagogical efforts. It is catalytic.

1.7 Conclusion

This introductory chapter laid the foundations for the research report. It introduced the research problem and research questions. The research was then justified, and the methodology was briefly described. The report was outlined, and the limitations were given. On these foundations, the report may proceed with a detailed description of the research.

CHAPTER 2

REVIEW OF RELEVANT LITERATURE

2.1 Introduction: History of Industrial Design

A chronological examination of the major activities and outcomes of three pivotal design eras-including the Industrial Revolution, Modernism and Postmodernism- illustrates the collaborative metacognitive processes by which each was shaped. The developmental model of team formation explored by Tuckman (1965) provides a big picture view of the inter-related processes that have affected design as we know it today through an evolution of collective stabilizing efforts. These four phases of growth (aforementioned three plus the present moment) can, consequentially, be characterized as “forming, storming, norming, and performing”. The following synopsis of the evolution of the profession and education of industrial design over the last 150 years is therefore couched within a framework of iterative, shared growth. A review of each era will address four polarities (the roots, ideology, goals, and methodology) that reveal shifting beliefs and behaviors.

The first polarity explores roots and results through the polarity of oppressor and oppressed. Paolo Freire (1970) proposed that dehumanization characterizes the struggle between oppressor and oppressed. An act is considered oppressive to the extent that it (perpetrated by an oppressor) prevents other humans (the oppressed) from being more fully human. He writes, “The oppressor consciousness tends to transform everything surrounding it into an object of its domination. The earth, property, production, the creations of people, people themselves, time—everything is reduced to the status of objects at its disposal” (p. 58)

Oppressors are also characterized by the use of money as metric and an emphasis on having or doing over being. The exploration of the roots of each substantial design epoch will be situated within the context of the oppressor/oppressed relationship in order to critically reflect upon the struggles that each attempted to reconcile. In addition, how resulting efforts fueled the next generation of struggle (i.e. became roots for the next movement) will illuminate a pattern of extreme bipolar reactions.

The second polarity emerges around ideology, between process and product primacy. Ideologies represent values and doctrine that inform behavior. Within the context of design, the theory-of-action that dominates any movement can be ascribed to a primacy of process or product. An ideology is evidence of a collective cognitive act (i.e. a prioritization of principles informing behavior) and is thus firmly rooted in the assignment of values to potential actions and outcomes. Within the realm of design practice, the ideologies driving the predominant paradigms have been explicit and tacit (requiring the 20/20 hindsight of design historians' visions to explicate). The discernable pattern that emerges across each era is the value conflict between design process and product, between ideological emphasis on the value of an artifact versus the value of the acts which generated it.

Goals of each era can be viewed as the pursuit of either questions or answers. The objectives that underlie the predominant paradigms of design theory and practice were all noble in intention in that they confronted a perennial struggle between the notions of design as an applied art and design as an applied science. This polarity is situated along a continuum of asking questions (i.e. how to apply artisan craft to new modes of production) and prescribing solutions (i.e. design as a scientific method for arriving at the most appropriate solution). While the distinctions are not clearly black and white, the goals that motivated the advancement of prevailing thoughts tend to gravitate towards one end of the spectrum or the other.

If an ideology can be described (as it is above) as a 'theory-of-action,' then the methodology utilized in the name of said ideology can hence be described as the 'theory-in-use.' The practice of design over the past few centuries has been shaped by an allegiance to certain fundamental principles that were often explicit and agreed upon; however, the means by which certain ends were achieved varied across movements and even within them. By positioning theory on one side of an axis and practice on the other, a context is created for examining the epistemological behaviors that manifested ontological ideals of the movements under consideration. Certainly, elements of theory and practice have always been a part of design practice, but how emphasis was (or wasn't) dedicated to the development and appreciation of each represents a point of difference that requires examination.

Perhaps the most compelling evidence available regarding the state of any profession is found in its efforts to educate its future professionals. The evolving nature of design education is no exception. As the proverbial pendulums previously cited have swung back and forth over time and movements, so, too have efforts to prepare design students for the increasingly complex uncertainty of future design practice. The state of design education today is a reflection of design education in the past. Utilizing the proposed polarity framework, the bipolar reactions of design pedagogy over time illuminate fundamental challenges and opportunities that inform future curricular reform. This critical reflection aims to produce a preferred strategy- looking to the future of design education through past and present pedagogies, the struggles they have faced, and the ones they have created.

2.2 The Industrial Revolution

The industrial revolution signaled the birth of the profession now known as industrial design, the 'forming' of a discipline to use Tuckman's term. Technological advances in production capabilities catapulted the craftsman into a new role, that of designer for industry. This divergent period in the history of the profession is marked by mass curiosity and collective creativity in pursuit of methods for harnessing the potential of manufacture in service of mass production.

The roots of the Industrial Revolution can be found in the technological advances of various industries during the mid-late 1700s. Emphasis consequentially shifted from handicraft to industrial production. The machine emerged as an oppressive force on the producing and consuming human.

As time passed, the oppressive role of man in service to machine became the subject of criticism as well as the motivation for new aesthetic allegiances. (Heskett, 1987)

The Industrial Revolution marked a period of exploration and invention, a primacy of process. The fundamental task of this era was the assimilation of traditional craft practices into industrial production. The experimentations of the era involved allegiance to traditional craft forms as well as the advent of entirely new visual languages derived from mechanical influences.

Though rooted in the applied arts and crafts, the transformation of production capabilities during the Industrial Revolution created a polarizing rift that is still unresolved today. The artisan of the pre-Industrial Revolution era was challenged to situate the applied arts in a mechanized production process while manufacturers embraced the new possibilities afforded by scientized approaches available due to factory efficiency. The (largely unmet) goal of this era was a resolution of the dissonance between traditional craft practices and products with the mechanization of making. (Gorman, 2003; Meikle, 2005)

Head bowed to machine, humankind stumbled forward through the late 1800s trying to identify itself in the context of new technologies and rapid progress. As society veered towards the extreme polarity of machine as oppressor, resistance built and was manifested in the Arts & Crafts movement (originated in England) which sought to return the moral art of craft to the practice of production and relieve the burden of industrial oppression. In contrast to the dominant themes of industrialization, proponents of the Arts & Crafts movement esteemed utility, beauty, honesty, and craft as the path to unity between art and craft.

No single style dictated the creation of objects for those designers identified with the movement (i.e. William Morris, Charles Rennie Mackintosh, Gustav Stickley). As admirable as their rejection of unnecessary ornament and allegiance to handcraft were, the artisans of the movement continually struggled to produce affordable objects that allowed (as the machine did) access to everyone. The movement endured until the beginning of the World War in 1914.

A similar current of discontent with industrialization arose in various West European countries at the turn of the 20th century. Across England, Spain, France, Germany, Belgium and Austria designers struggled to resolve the expectations of art with the modern machine paradigm. Fascinated both by the concept of motion and the organic forms in nature, those aligned with the Art Nouveau movement did not oppose industrial production, rather their attempts to express an aggressive, biomorphic aesthetic was often difficult to manufacture. While Art Noveau offered a balancing force within the polarity of oppression between man and machine, it was criticized for its lack of respect for the properties and potentials available in the materials of production.

The adoption and advancement of technology and its industrial application represent a period of 'Forming'. Humankind was confronted with unprecedented potential scrambled to assimilate and adapt to new possibilities. This is similar to a team, when forming, that must first come to know each other in terms of strengths and weaknesses, fears and values.

The primary goal of the Industrial Revolution was to harness the potential of the machine to streamline the process of production, improve efficiency and decrease costs. These lofty objectives were the result of technological advances that demanded them. In essence, industrialization became a collective exploration of the questions raised by its potentialities. Though Mau's question of 'Now that we can do anything, what will we do?" was posed in recent years, it may have also been directed at the artisans and manufacturers of the industrial era who found themselves scrambling to wrap their minds and crafts around the machine.

The role of the artisan- predecessor of today's designer- was questionable during this time. While they had previously crafted the aesthetic of many household objects, artisans were often seen as expendable resources to manufacturers who found it easier and cheaper to produce copies. The dissonance between man and machine in the arena of labor gave rise to a profound question of whether designed objects should reflect the technology they embody or a familiar referent from the past. The question remains unanswered today. (Giard, 2005)

The inherent methodology that shaped industrial design practice during this era of change was a pursuit of progress. This approach is evidenced by the vast number of inventions that transformed craft production into efficient manufacturing processes. The desire to embrace such advances in the arena of production was mirrored by patterns of consumption of the time.

Education during the Industrial Revolution was characterized by the master/apprentice system that is still evident in present day industrial design curricula. Reliance upon historical referents was paramount and the 1:1 transfer of craft tradition between teacher and student enabled the perpetuation of practices that were soon obsolete. Pedagogic emphasis was predominantly placed upon the 'how' of making rather than the 'why'.

If the ideological goals of the Industrial Revolution revolved around the notion of progress, the methodological efforts of the time certainly reflect that guiding vision. Progress for the sake of progress characterized the actions of the artisans and manufacturers of the time. Focus on the rationalizing art was evidenced by efforts to mechanize craft labor. Consequently, innumerable inventions that revolutionized craft traditions can be attributed to this time (i.e. interchangeable part production by Samuel Colt, prefabricated parts for building construction, the Thonet chair, etc.).

'Forward with the machine' became a methodological paradigm as manufacturing capabilities literally paved the way to a cheaper, more globally aware society that offered possibilities for travel and consumption never before imagined. By the late 1800s, two and half machines were being produced every minute. The manufacturing practice of eagerly consuming technological possibilities was mirrored in a cultural absorption of the goods produced by such efforts.

The educative emphasis between the products of design activity and the processes that generate them is a source of continual struggle in design pedagogy. During the Industrial Revolution, the advance of technological capabilities and turn to mass production presented artisans with a predicament of adhering to their craft tradition while adapting to new methods of production. Typically situated within fine arts programs or ateliers, applied art instruction was characterized by the master/apprentice system in which students, under the tutelage of a master artist, would learn through a combination of watching and doing. The decorative nature of the profession at the time and the method of instruction left little opportunity for uniformity or consistency across the learning outcomes of the students.

Professional craftsmen faced the rise of industry with many questions and undoubtedly found themselves learning alongside their apprentices as they developed new techniques for practicing their trade. The primary focus on the process of applied art was a reaction to new technologies and the resulting culture of consumption that they produced. Just as the nature of production had undergone a paradigmatic shift, so, too would education be reconsidered in light of the establishment of factory as prevailing metaphor.

The artisans of the Industrial Revolution relied heavily upon historical referents in their confrontation with the machine. As previously discussed, the transfer of artisanal ornament to industrial manufacture was paramount. Pedagogically, the prevailing master/apprentice relationship enabled a nearly 1:1 transfer of artisan craft techniques to the next generation. This adherence to tradition would not endure as technology progressed and society evolved in response.

Little, if any, theoretical consideration was given to the nature of education in artisan practice during the early years of the Industrial Revolution. Emphasis rested squarely on learning making (the 'what' and the 'how') and not on the reasoning (the 'why'). As technology advanced, the practice of the craftsman would not be the only activity to succumb to the machine. The practice of learning quickly followed, propelled by theoretical visions of streamlined education.

2.3 Modernism

In response to the pastiche of approaches explored during the Industrial Revolution, Modernism emerged as a singular voice of unity amidst a cacophony of ornament and conspicuous consumption. Industrial design (and other disciplines) resolved to shape the lives and tastes of the common consumer with a universal theory of form. This allegiance to a unifying belief shaped not only the products (and buildings and images) of the time, it also shaped the belief systems of those who made such products and those who paid for them

The unifying efforts of Modernist advocates were rooted in backlash against the excessive ornament afforded by industrial production techniques and a desire to assert control over the machine. This “Storming” phase of disciplinary development relied upon the machine as a metaphor for addressing the dysfunctional design practices that had resulted in both material and moral ills. Modernism marked an era of man as oppressor of machine.

Perhaps the oppressor/oppressed polarity of Modernism is best exemplified by the work of Le Corbusier (Charles-Edouard Jeanneret), one of the most influential architects of the time (and, some argue, the century). Borrowing machine metaphors from the automotive industry, Le Corbusier described the need for standardization of architecture in pursuit of a perfection that could be universally felt and rationally implemented. Le Corbusier’s vision of an International Style is rooted in the belief that universal standards both exist and can be identified and adhered to by man. (Le Corbusier & Goodman, 1923) Man reigns supreme over the machine as controlling dictator. Unfortunately, the establishment of such standards was presumed the task of a select few who, in essence, served as lords of men, capable and responsible for reforming the tastes of the masses.

Modernism spread across the globe and manifested itself in marginally diverse ways according to nation, culture, and individual. Post-war power in design emerged first in the Scandinavian countries followed by Britain, Germany and then Italy. Asian entry into the Modern design scene resulted from global cultural influence, and then flourished in its own right in later decades. (Giard, 2005)

The resulting pastiche of exuberant decoration produced during the Industrial Revolution inevitably led to a backlash. Initial resistance in the Arts & Crafts movement called for an idealist return to artisanal craft and authentic forms. Enthusiasm for the future of technology unleashed another rebuff from those who embraced the machine as aesthetic metaphor for hopeful progress. Streamlined forms sped through the domestic and public sphere with little or no resolution between aesthetic and function. Above all else the streamline aesthetic exposed an obsession with control. (Meikle, 2005)

Some theoretical features that characterize the Modernist style include: decompartmentalization, social morality, truth, total work of art, technology, function, progress, anti-historicism, abstraction, universality, transformation of consciousness, and theology (Greenhalgh, 1990). The mantra 'form follows function' captures the essence of this era when hope for stability rested in the notion of simple, timeless, universal principles to guide production and ensure morally influential products. The 'theoretical practice' of Modernism attempted to apply formal and rigid theories of style and taste to the production of educative artifacts. Discrepancy between altruistic aims for the common man and disgust with popular taste was one of many ironies in the movement that undermined its success.

The Modernist ideology placed great emphasis upon the designed product as a vessel of social and moral universals. The mantra 'form follows function' embodied the belief that the importance of a designed artifact resided in its ability to enable behaviors that aligned with universal theories set forth by Modernist proponents. Above all else, the Modernist ideology evidenced a belief in the power of the product to transform society and a vigilant obsession with control.

The goals of the Modernist movement are clearly identifiable in the manifestos of the time. Where the Industrial Revolution signaled a time of questioning and an appreciation for the artistic possibilities of design, Modernism is marked as a period of prescribing answers in the form of universal design principles. The potential of the designer to transform society was asserted by the introduction of absolutist archetypes. Through its rejection of unjustified ornamentation, Modernist designers and architects sought to eliminate the irrational from consumable objects and buildings. Akin to their positivist counterparts in the scientific community, the Modernists aimed for an objective truth via experimental and hypothetical explorations according to rigorous epistemological principles. Values and ethics were subjected to the rational application of universal truths as predetermined by an elite group of upper class Caucasian men. Modernist efforts to reframe applied art as a deliberate fusion of technology and function created the idea of a technically rational profession. The rejection of historical precedent also severed Modernist practice from its predecessors as history became an object of scientific study and the abstraction of forms became synonymous with expression of purity. The principle of universality was manifested in both efforts of production (with multiple visual arts working together) and consumption (via efforts to develop a universal aesthetic that would minimize class distinctions in society). Modernist adherents united their efforts through writings, collaborations, institutions and gallery exhibits.

The Modernist methodology relied upon a positivist approach to universal theories rooted in technical rationality. The belief that there could possibly be one unifying objective truth at the heart of design practice was manifested in the flourishing interdisciplinary groups of the time and the universal aesthetics that these collaborations produced. Rejecting the individual artistic practices of the crafts tradition, Modernists paralleled their counterparts in the scientific community in pursuit of universality via experimentation with prescribed principles and products. The practice of industrial design during the Modernist era was seen as a manifestation of universal theory.

While this tumultuous time gave rise to the devastating Nazi regime, it also produced utopian moments with humanitarian aims, like the Bauhaus. Gropius was offered the chance to head a new school, to be known as Staatliches Bauhaus, which consisted of joining the School of Arts and Crafts and the Academy of Fine Arts in Weimar, where he was to create a school of architecture. Gropius' initial theories evolved with practice and application. His initial goal was to create a foundation of handicraft for all artists and architects because, he believed, that is the source of true creativity. He emphasized the need for a foundational course in aesthetic design followed by workshop courses characterized by a free and experimental approach. (Kentgens-Craig, 1999) These beliefs became the theoretical foundation for a pedagogical model that has remained influential for nearly a century and catapulted the Industrial Design practice into a professional spotlight.

For all of the boundless enthusiasm and curiosity that characterized the Industrial era, Modernism was more of a period of answers prescriptively offered by those who felt best equipped to provide them. The primary objective of the Modern movement was the salvation of society and its morality through universal design principles that would educate the masses. This 'designer-as-god complex' perpetuated the myth of the designer as creative genius capable of transforming mass consciousness. Pioneering modernists raised many questions unresolved by the advent of mass consumption. They created absolutist archetypal answers with the intention of providing a holistic worldview and resolving disparities of the past.

The goal of the International Style phase of Modernism was to assert design as a 'great improver' of things and to establish the role of the designers as central to the enhancement of human potential. Modernists loftily dreamed of transforming the existing socio-politico-economic structure through adherence to abstract ideals of beauty that, in the end, proved to be its alienating downfall. (Greenhalgh, 1990)

Modernism marks the birth of the industrial design profession, which paralleled the rise of the notion of 'Scientific Management' (Gorman, 2003). As industrialists of the early twentieth century embraced the machine and mechanical approaches to production so, too, did the educational system embrace the notion of efficiency. The single most influential design pedagogy known today, the Bauhaus, was born in Germany in 1919 during the Modernist movement in reaction to the dispute of design as a craft or as a scientific practice. Findeli (2001) describes this response to the art/science polarity as a threefold approach marrying art, science, and technology. Of the initial conception for the Bauhaus, Walter Gropius once said:

> I was aware, after what I had done already as an architect, that in order to really penetrate—that couldn't be done by one person alone—you had to build up a whole school which follows certain principles out of which it may develop. That gave me the idea for organizing the Bauhaus. ("Walter Gropius talks to George Baird," 1968)

What Gropius speaks of is an idea about a process, an approach to design teaching that rests on procedural training. In addition, he speaks of the products of this education—students who would emerge as embodiments of this ideal prepared to apply their craft in the world. There is an ironic relationship here between the champions of

Modernism as a universal product style, and the efforts by Modern educative reformists who sought to produce designers (products) well-versed in a universal process approach.

Figure 4 below illustrates the original training program in Weimar. The goal was to create an educational system that would produce “actively creative human beings” (Gropius et al., 1975). The method chosen was to combine the theoretical curriculum of the art academy with the practical curriculum of an arts and crafts school. In this way the Bauhaus was able to coordinate creative efforts and achieve a “unification of all training in art and design.” It is worth noting that the liberal nature of the school allowed students to apply their newly learned skills to a plethora of objects and events. Students of the school were often involved in theatrical productions, musical performances, costumed parties, and other opportunities for displaying creative process and prowess both within the school and beyond the confines of the compound. (Gropius et al., 1975)

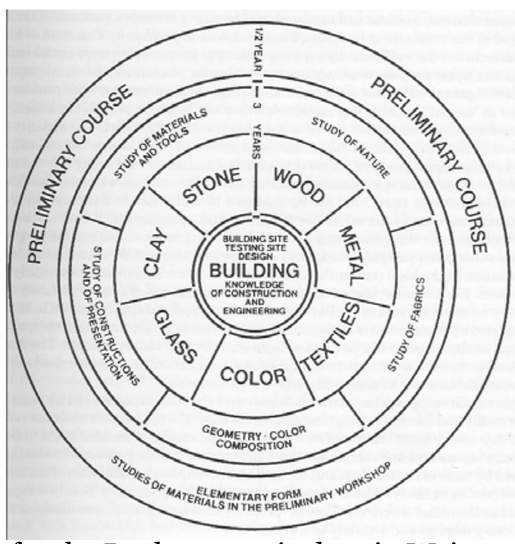


Figure 1. Original training for the Bauhaus curriculum in Weimar (Gropius et al., 1975)

The goals of Modernism were well manifested in the design of curriculum meant to perpetuate the Modernist ideas in future designers. With mechanical efficiency that paralleled the machines they borrowed as metaphor, Modernists designed rigid education programs rooted in manufacturing approaches to predetermined and compartmentalized content. The Bauhaus model that emerged during this era is still prevalent in present day curricula and emphasizes the role of teacher as authoritative deliverer of a prescribed canon of knowledge.

The curriculum of the Bauhaus, still utilized in some iterative form by the majority of design programs around the world, embodies many Modernist beliefs regarding industry as metaphor. It also embodies the characteristics of other Linearist curricula of the time that evolved from a belief in the 'school as factory' model wherein the purpose of a factory (school) is to produce products (educated students) (Thomas Barone, 2006; Callahan, 2007). This approach is characterized by the following:

- a systematic approach wherein the steps of learning are linear and that instruction proceeds from the beginning of a concept or lesson to the end in order. This concept relies upon an ends/means approach whereby the ends (or learning outcomes) are determined and then the means (or methods) are decided and implemented
- control of the learner's experience comes from above is valued to the extent that is ensures standardization. This belief demonstrates a lack of faith in teachers, students, and community while reducing the learner to a piece of "steel" to be shaped by the education process
- learning as behavior emphasizes the creation of assessable learning objectives that are evidenced by observable student behaviors
- particularization of content is exemplified by the notion of the 'teacher as mechanic' wherein different course topics are organized into independent learning modules and taught by different instructors with little overlap across the curriculum.

- predetermined content by the prevailing pedagogy ensures that each teacher has ruling principles to adhere to with little or no room for veering off course.

While the Bauhaus model offered a coherent pedagogy for the education of designers, it also reflects the prevailing machinist paradigm in which it was created. Control of the iterative process (and consequentially content and product) of the curriculum was effective at producing well-behaved learners who perpetuated the Bauhaus ideals of design as a creative art and science that capitalized on technology. Iterations of the Bauhaus curriculum in later programs certainly reflect the changing nature of design practice within the paradigmatic context of the era and belie its benefits as an enduring pedagogical panacea.

Strong reaction to the seemingly inauthentic application of art to technology led to educational reform at the Bauhaus and Ulm where design as applied science (to technology) reigned supreme. The experimental nature of the Bauhaus reveals its foundation in a spirit of inquiry while its curriculum reflected the deconstructed assembly line approach it sought to prepare its students to master. In Ulm the adoption of social science beliefs resulted in explicit exploration of theories from various disciplines including information theory, cybernetics, bionics, semiotics, and ergonomics. Theories of science and mathematics inspired the possibility of developing a solid methodological foundation for design. (Ranjan, 2005)

Additionally, the systematic documentation by both schools of their pedagogical experiments demonstrates a clearly scientific approach of describing phenomena. The Modernist educational movement reflected the positivist paradigm within the greater scientific community that valued systematic experimentation and rational analysis in pursuit of a singular, indisputable truth. The boundary between learning and producing was transparent; students were not only creators of products for the workshop, they were themselves products of the school.

2.4 Postmodernism

As Modernism before it, the era known as Postmodernism emerged in violent opposition to the efforts of the era that preceded it. While designers rejected the universal truths so prescriptively offered by Modernist proponents, the possibility of polyvocality and participation emerged. This stage in the collective development of the industrial design discipline represents a 'Norming' phase wherein the balance of power among all stakeholders was revisited and re-envisioned.

The roots of Postmodern pluralism evidence disillusionment with the potential of universality and disgust with the dehumanizing results of mechanization. Growing recognition of the oppressive nature of Modernist dogma resulted in a shift toward the other end of the spectrum where no universal truth was deemed possible. Postmodernism was rooted in strong opposition to the universality and formality manifested by Modernism and framed by the advent of new information technologies that enable globality and fragmentation.

The visionary ideals of the Modern movement failed to manifest as promised and, by the 1970s, disillusionment spread throughout the exceedingly diverse community of those who called themselves designers. Oppressed by Modernist dogma, discontent with the rationalization of design was met with resistance in the form of embracing the polar opposite, namely free expression. Preliminary resistance emerged in the US and Italy though it eventually spread around the globe.

Postmodern design inverted the relationship between designer and consumer. Where previously designers had served as elite purveyors of taste and standards for willing consumers, they now had to face harsh criticism for contributing to the new ills of the era. Strong economic growth, rampant consumption and political unrest gave birth to scathing critiques of American materialism and environmental and social degradation. Just as the Industrial Design profession had begun to increase its visibility and commitment to developing professional practice, it came under sharp criticism for its proliferation of a throwaway culture and permanent garbage. Perhaps the harshest critic of all, Victor Papanek (1985) wrote "There are professions more harmful than industrial design, but only a very few of them" (p. 1). So as designers of the Postmodern era fought to get out from under the oppressive dictums of their Modernist predecessors, they emerged into yet another power struggle, defending their intentions and actions to a hypocritical public that at once demanded and decried their efforts.

Postmodernism is deeply rooted in a resistance to the universality and uniformity embraced by the Modernists. While standardization characterized previous decades, designers of the 1970s and 1980s displayed exuberance in their radical self-expressive practices. Italian design operated at the cutting edge of nonconformity and was led by Memphis- a creative collective of designers and architects. Memphis' work has been posthumously intellectualized although its members claim they were primarily concerned with "breaking ground, extending the field of action, broadening awareness, shaking things up, discussing conditions, and setting up fresh opportunities" (Meikle, 2005, p. 196) Later postmodern efforts to counterbalance the influence of technology on humanity represent an evolution in designerly discourse about the challenges of the postmodern condition.

Rejection of universality and formality is manifested in proliferation of user-centered design practices and the possibility of user-generated content provided by ubiquitous media like television and internet. Postmodernity is framed by its influence on the Information Age, characterized by plurality and multiplicity, and its progression into the Conceptual Age and Network Society, characterized by globality and fragmentation. Lyotard, in The Postmodern Condition: A Report on Knowledge (1984) defines Postmodernity as “incredulity towards metanarratives”. With respect to the design professions, this incredulity seems present in both designers and the consumers that they serve, a sentiment that also has roots in the social critiques that have emerged in recent decades.

Referring back to the team metaphor, we find Postmodernity exemplified by the ‘norming’ phase in which members (in this case designers as well as non-designers) engage in a practice of stabilization based upon recognition of and appreciation for differences. This phase is advanced by growing trust and motivation on the part of all stakeholders. How designers participate in the reconstruction of the metanarratives of production and consumption will undoubtedly shape the role of the designer in the future.

Ideologically, Postmodernism offered a polar opposite of its Modernist counterpart through its proliferation of plurality. The re-humanization of man was pursued through celebration of multiplicity and the perpetuation of participatory efforts to engage various stakeholders in the production and consumption of designed objects. Rejecting the notion of universal products, Postmodernists invited new voices into the processes of designing and emphasizes the role of consumer emotion in the development of the material world.

The fundamental theory underlying action during the Postmodern era is one of humanization of the machine through design. The resulting products of this era reflect growing acknowledgment of diversity and multiplicity as complex products borrowed organic forms and sensitive interactions. ‘Form follows emotion’ emerged as the prevailing dogma and designers, evermore present in the public sphere, catered to the sensational potential of designed objects to evoke sentiment and inspire loyalty. Postmodern ideology also represented a return to the consumer's taste and preference. Whereas Modernists attempted to quash popular culture with prescriptive regulation, Postmodern design efforts involved the future user through user-focused research efforts aimed at soliciting user preferences during the process of designing. In this way design has adopted a 'practical theory' of user-centered design to address the beneficiary of design processes. While these efforts are laudable and have been increasing in frequency, they still constitute a 'designer as gatekeeper to the process' approach to design practice.

Unlike the clearly prescribed goals of Modernism outlined in manifestos, the goals of Postmodernism are evidenced by the advance of new theories regarding meaning making in design. Positivist prescriptions were replaced with more postpositivist social science approaches to understanding the powerful role of the consumer in 'reading' the meaning of designed artifacts. A new art and science emerged in the interplay between the designer as provocateur and the consumer as the provoked. The designer evolved from authoritative answerer to curious questioner.

The rise of tools for analysis like semiotics and structuralism challenged the power of the designer to imbue objects with meaning. A fundamental Postmodern truism is that a thing (text, object, etc.) and its creator (author, designer, etc.) have no control over how one perceives it. In essence, the absolutist goals of Modernism provoked a relativist revolution in the Postmodernist shift towards the power of the reader, the user, the consumer to make meanings. Design transformed from an objective orientation to an approach that recognized the interpretive potential of the consumer. The goals of the design community shifted towards an interest in the end user resulting in the advance of user-centered research (later to become known as human-centered design), 'product semantics' and material culture studies. (Votolato, 1998)

While Modernism sought to provide a singular ideology inspired by rationalism and advancing technology, Postmodernism instead emerged as an age of pluralistic exploration of popular culture and local taste via advancing electronic media. Marshall McLuhan, among others, focused collective attention on signification and understanding while Venturi identified the principles of 'complexity and contradiction' as the new design conventions (Votolato, 1998) Postmodernism can be described as a cultural theory of curiosity, questioning not only universal dictums but also the traditions that were squashed by such efforts. The postmodern designer emerged as an asker of questions and provoker of thought.

In opposition to the failed promises of overreliance upon universal theory to shape design practice, Postmodern designers embraced the practice of design as a reflection of imperfect understandings and uncertain cultural identities. Designers shed their adherence to immutable abstract laws in exchange for practical (and at times rather impractical) experiments with designed objects as concrete embodiments of fragmented cultural meanings. Utopian ideals were traded in for exaggerated, sensuous experiments of form and function. Universal truths were exchanged for imperfect realism and cultural probability. Reflecting on the implications of design practice for creating culture raised many questions and evolved a collective recognition of the need to explicate the inherent irony of 'design for all'.

The work of Memphis in Italy and Michael Graves in the US reacquainted consumers with the potential for inanimate objects to provoke an emotional, and therefore humanized, response. Nostalgic and familiar references to comfortable forms were used to package new electronic and digital technologies, making them more digestible for an increasingly diverse global market. Color also returned to the design landscape in an effort to soften the hard, austere edges of technological advance. Fragmentation and plurality were reflected in boisterous images and forms that encouraged people to think globally, not just nationally. Little stylistic coherence existed in an era marked by celebration of individual differences. Hence it became increasingly difficult for designers to capture the essence of the society they sought to shape and wild experimentation signaled the rise and fall of trend after trend.

The Postmodern approach to industrial design education reveals its fragmented context. Without a singular guiding set of principles for practice, most industrial design programs assimilated new technologies and belief systems into the existing Modernist models. Many programs adopted theories and strategies from tangential disciplines as dictated by the evolution of professional practice.

Over time, the influence of Bauhaus pedagogy became diluted by changing forces in the global arena. Access via electronic media opened doors of communication and inspired designers to adopt cultural referents from across the globe and influence cultures around the world. Reactions to design as catalyst for proliferation of mass consumption produced a backlash by socially and environmentally conscious stakeholders. These critiques echoed in the halls of academia where the disciplinary scope of design grew and design research emerged as a vehicle for understanding the physical, social, and environmental impacts of a now user-centered design activity.

Postmodernist educational experiments were less pronounced and perhaps more calculated than Modernist predecessors due to the capitalist academic contexts in which they found themselves situated. While some institutions veered toward the extreme end of the spectrum by adopting rigid instruction in design methods, other programs scientized design education with the addition of knowledge from other social science domains (i.e. psychology, anthropology, sociology, etc.). Postmodern pedagogy in design mirrors the postpositivist turn in scientific research that challenges the existence of universal truths and is rooted in more participatory practices for uncovering plural truths.

Katherine and Michael McCoy asked "If it can be anything, what should it be?" (Meikle 2005, p.202) and responded with an emphasis at Cranbrook in the 1980s on product semantics. Relying upon visual metaphors, the students attempted to utilize a functional coding scheme for the development of products whose function could easily be intuited by its form. While these experiments produced iconic prototypes, they were criticized for being too obvious in their analogies and unable to produce long lasting interaction following the initial punch line.

The rise of virtual technologies in the 1980s and 1990s significantly impacted design education as additional hard skills became curricular requirements. Alongside the traditional handcraft activities that design students were expected to master, various software programs emerged as industry standards. ID programs squeezed software training and user-research instruction into curricula that were already bulging at the seams. Competition increased as more universities began to offer Industrial Design programs and the business of design education learned to market itself, often through emphasis on the produced work of students which further perpetuated an academic allegiance to artifact-making and portfolios to evidence mastery of desired skills.
The resulting educational landscape is mottled with multiple theories that inform the process of a more user-centered approach to design. Young design students are led through a still-linear curriculum that now includes courses and modules dedicated to business practices and uncovering the physiological, psychological, environmental and cultural needs of the user. In this way, aspiring designers are learning to utilize theory to

inform practice. Unfortunately, the heavy reliance placed upon the student's portfolio as evidence of design skill renders representation of this theoretical learning difficult and questionable.

The postmodern death of the author (or in this case, designer) has challenged the role of the designer as one who deliberately imbues objects with meaning. Designers have now become inquirers, framing questions and seeking out answers from various stakeholders throughout the course of any project. Some ID programs have introduced interdisciplinary studio courses, though they are more the exception than the rule, and they readily acknowledge the obstacles they face in preparing students for this experience. Funded or sponsored projects are also a standard in the design studio today, providing students with industry experience during their schooling. Some critics argue, however, that this 'collaboration' represents a further industrialization of design education that unnecessarily clouds learning practices with industry paradigms.

Postmodern pluralism ran divergently rampant in search of deliberate integration of diversity and responses to harsh criticism of dehumanized mechanization. Ensuing fragmentation offered a stabilizing force to the collective community which grew to include more stakeholders. This norming phase has since reached a plateau and brings us to the present moment, where we stand poised to embark upon the next great paradigm- performing.

2.5 Industrial Design Today

Without the benefit of the 20/20 hindsight that generated descriptions of previous eras, it is not yet possible to view the present state of industrial design practice and education with the same hindsight afforded the previous discussions. The following section therefore offers a glimpse of current issues and criticisms about the present and potential future state of the profession.

Criticism about industrial design today reveals that American professionals (future and current) face an impending identity crisis as the discipline of industrial design attempts to evolve towards a collective ‘Performing’ phase of development where competent, motivated stakeholders work autonomously and interdependently toward collective visions and dissention is routed through agreed-upon channels.

Unfortunately, the very skills that catapulted industrial design into prominence as a discipline now threaten to make it obsolete. Today’s American industrial designer faces the oppressive reality that many of the traditional skills that define this profession are now being outsourced to much cheaper counterparts in Asian countries. In the meantime, forward thinking design firms have shed their ‘industrial’ allegiance and are finding new ways to frame the cognitive skills of designing for the contexts of business and organizational innovation. Industrial design now faces oppression by an age that is no longer shaped by an industrial paradigm.

Today’s designer operates within a global context and IDEO, a global leader in the design industry, leads the pack for establishing trends for the profession. Unfortunately, as IDEO co-founder Bill Moggridge once speculated, more and more of the form-giving tasks within the company are being outsourced to their Asian offices where 10 talented designers cost the same as one in America. Formulaic design skills are in greater supply than demand these days and the lowest bidder is often found in China.

It is no surprise that American businesses frequently turn to India and China to provide goods and services that are low-cost and high-quality. BusinessWeek reported that manufacturing only represents 15% of the U.S economy so outsourcing has not had heavy economic impact. So long as America focuses on moving up the value-added chain, Nussbaum reports, it will prosper. (Nussbaum, 2004) China and India, however, are threatening this territory. The global economy is moving more and more towards one based upon creative capital. The American practice of outsourcing rote design tasks illustrates a money-saving trend today. Unfortunately, the 'East Asian Quest for Creativity' (Koh, 2000) demonstrates the possibility that the remaining conceptual work that currently represents a competitive advantage for American business may soon be shipped overseas as well. If this trend is not somehow averted, the American designer of the future risks becoming an oppressed player in a global game where economic factors dictate decisions about design practice and the voices-cum-data of a collective community of global citizens are stifled and exploited by powerful corporations.

Most critics agree that we have long since left behind the 'industrial era' and have entered a digital age. The shift in perception of industry value from design product to design process reveals a need to reconsider the core skills of the industrial designer. While industrial design has vacillated its attention from practice to theory, the current predicament necessitates a reconceptualization of what the processes and products of industrial design are in order to maintain relevance in a shifting global landscape. As we emerge from Postmodernism into the present paradigm of design practice, the prevailing ideology is not yet clear. What is clear is that "design" has been thrust into the limelight as a key contributor to shaping culture and society (Manzini, 2014).

The ideological orientation of design has progressed from 'form follows factory' to 'form follows function' then 'form follows emotion'. What now? In lieu of swinging the pendulum back to an overemphasis on the designed product, and taking cue from the increasing role of designer as purveyor of service, it seems possible the next generation of designers will be 'form-less', designers not of product forms but shapers of people's interactions around a problem space. Perhaps we are encountering 'form follows experience' where designing objects plays a secondary role to the design of interactions and interfaces (Overbeek & Hummels, n.d.).

Most agree that we have transitioned from an information age into a conceptual age where the thinking skills of designers now represent their fundamental contribution to society (Pink, 2006). Herbert Simon's now famous definition of a designer signals the current conception of this role as it appears frequently across various industries and contexts. He wrote "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Simon, 1968). Designers are now faced with the opportunity and challenge of interfacing with "non-designers" to cocreate entirely new "products" like services, social interventions, organizations and communities.

The art/science debate that has plagued industrial design practice will likely not be resolved any time soon. However, the challenges currently facing the profession reveal an opportunity to situate this polarity within a collective discussion about the nature of design practice in its changing present and future contexts. Without an explicit understanding of the activities (both physical and cognitive) that constitute the industrial designer's skillset, there is little likelihood that industrial design will be able to establish its value as a professional discipline. In the end, the question of whether industrial design is art or science may be reframed as a question of which skills of industrial design (be they artistic or scientific) will be most valuable for advancing the discipline, which emerges as the most pressing goal.

If history is any indicator, it appears that the evolution of design practice and education has paralleled the paradigmatic shifts in the scientific community evolving from positivism to postpositivism. Contemplation of the current and future state of design therefore may begin with an examination of the scientific research community which, in some areas, has begun to embrace a critical and constructivist paradigm.

The aim of inquiry in both critical and constructivist paradigms is understanding and transformation. Recognizing that knowledge is structural and historic yet consensually (re)constructed, it is methodologically pursued via dialogic and hermeneutic explorations of social, political, cultural, economic, ethnic, and gender values. This epistemological stance necessarily recognizes ethical considerations and actively involves the voices of passionate participants as well as transformative intellectuals who each function as advocates and activists. (Lincoln & Guba, 2000)

Narváez (2000) explores the correlation between paradigmatic progress of both design and science as she questions the place of the meta-structure of design. She builds upon Habermas' classification of sciences in an attempt to situate the study of the design object across a continuum that includes empirical-analytical study (physical object), hermeneutical-historical study (sociohistorical object), and sociocritical study (evoker-transformer object).

Narváez' emphasis on the study of design knowledge through the vehicle of the designed artifact is valuable even as it demonstrates an historical reliance about the object as representation of design knowledge. Redirecting this emphasis towards the cognitive processes of designing offers a more revolutionary understanding of how design knowledge is generated, not only manifested. Her concluding thoughts quote Habermas:

> Through unplanned sociocultural consequences of technological progress, the human species has challenged itself to learn not merely to effect its social destiny, but to control it. This challenge of technology cannot be met with technology alone... Only by elaborating this dialectic with political consciousness could we succeed in directing the mediation of technical progress and the conduct of social life, which until now has occurred as an extension of natural history; ... The

redeeming power of reflection cannot be supplanted by the extension of technically exploitable knowledge. (1971, p6)

Dialectical reflection about the past and future of design offers the possibility of collectively reframing the role of design as mediator of future technological progress and its sociocultural consequences.

An example of such systematic reflection is offered by Kees Dorst, noted design theorist, who argued that the design research community shows signs of being in a period prior to a scientific revolution from which arises a new paradigm that is more capable of explaining anomalies unaccounted for by the existing paradigm. Relying upon Kuhn's description of scientific progress, Dorst (2008)contends that design research has been operating in a state of 'normal science' but there is currently a buildup of anomalies that are unexplainable in the existing paradigm. This will soon lead to a state of 'revolution' for design research wherein new paradigms will emerge that are superior at explaining these anomalies.

Anomalies that cannot be addressed by current research efforts signal the need for new thinking about design. As an illustrative example Dorst referenced the issue of methods and how professionals keep insisting that they don't use them while researchers keep creating and prescribing them and responding that they are implicitly used by professionals. The author asserts that the massive changes occurring in design practice (think globalization, sustainability, and so on) have yet to influence design research.

Dorst offered two possibilities for new paradigms in design research, though he admits that there are multiple potential futures. The first involves research towards the development of a framework for explaining 'the designer'. He describes a model with six distinct levels of expertise (naïve, novice, advanced beginner, competent, expert, master, visionary). The second focuses on the study of design practice as occurring within a project, informed by meta-processes, which make up the practice of a group of designers. The author concludes with a call for participatory research to re-engage practitioners in an effort to co-create the design expertise and practices of the future.

Industrial design today is experiencing a methodological transformation. Though certain 'hard skills' remain the hallmark of industrial design practice, designerly ways of thinking (comparably 'soft skills') are emerging as a valuable and tangible asset in the designer's toolkit. Decreasing the distance between industrial design practice (the 'what') and industrial design theory (the 'how') may prepare practitioners to address the increasingly complex challenges that the current global climate assures will need to be addressed.

Evolving discourse about the nature and theory of design practice has generated a great deal of research aimed at understanding the nature of design activity. Reflection upon the cognitive processes involved with designing has resulted in multiple theoretical frameworks that explain and shape current design efforts. As even greater emphasis is placed on the designer's role in society, questions of ethics and values have plagued the development of a unified understanding of design's contribution to an uncertain future.

Historically the term 'industrial designer' (used synonymously with 'product designer') has adequately described the skills and role of this profession. Lately, however, the role of the industrial designer is evolving. How can this transformation be characterized? Nussbaum writes that, "Design in America isn't about form but innovation, in the guise of new products and services" (Nussbaum, 2004). Essentially, the (industrial) designer has moved from the realm of aesthetics into the realm of business strategy. The designer's task is no longer merely about form-giving and styling. Understanding how and why to make something and for which customer segment is the new focus of the design process.

Patrick Whitney is the director of the IIT Institute of Design in Chicago and a noted design visionary who is helping reshape the value of design in business. In a speech at the Rotman Business Design Conference 2005 he stated, “If business and design are to come together fruitfully on a large scale…change must come from separating design thinking from ‘the crafting of things’. The power of design thinking must be freed up to deal with all sorts of issues on a global scale”.

The value that design thinking is bringing to business is easily illustrated. Take for example OXO, the leader in the kitchen utensil market. Commitment to the design process led to the development of products that completely redefined this market. Whirlpool also managed to go from no market share in front-end washer/dryers to a 40% market share in only one year using extensive user-research and a design effort that redefined the paradigm for that product category. Proctor & Gamble uses design to build billion-dollar brands and champions as its mission the incorporation of design into the DNA of the company. Lenovo was recently able to purchase IBM’s PC division because its commitment to and use of design have resulted in them boasting the largest market share of computers in China.

Beyond these isolated examples, new metrics are emerging to illustrate the value of design for business. For example, the global consulting firm McKinsey reported that “design-led companies had 32% more revenue and 56% higher total returns to shareholders compared with other companies” according to their newly developed McKinsey Design Index (MDI) (Schwab, 2018). The Design Management Institute has attempted to operationalize the value of design for business with their DMI Design Value Scorecard. This Index shows that US companies that invest in design and innovation have a stock performance advantage of 228 percent over 10 years (Westcott et al., 2013).

The valorization of design in corporate America is also evident as ‘design innovators’ are being brought into big businesses to guide strategic planning and roles like “Chief Design Officer” are appearing at the executive board of companies like 3M and Pepsico. (Pallister, n.d.; Stuhl, 2014) In addition, some corporations are capitalizing on their prominence as design thinking leaders and productizing their methods, think Google Design sprints. IBM made big news in 2016 when it published its internal design thinking philosophy and toolkit for anyone to use. Apparently more than 10,000 employees had gone through the IBM Bootcamp to learn about the ‘loop’ and other tenets of IBM's design thinking framework. (Stinson, 2016)

Perhaps the most well-known design firm in the world is IDEO, based in California, which is credited with advancing the field of design beyond styling and changing the face of American corporate culture. IDEO is much more than a traditional product design firm and has become a purveyor of corporate advice, consulting with corporations about how to innovate from the inside out. This approach has earned IDEO a cult-like following in corporate America and set a standard for what ‘design thinking’ can bring to business. Additionally, IDEO produces methods cards and publishes books about its process, demonstrating how their ’design thinking’ has become a commodity (Brown & Katz, 2009).

Another framework for understanding the evolution of design from an industrial paradigm to a service paradigm has been put forth by GK Van Patter, innovation advisor, design visionary, and cofounder of Humantific, a consulting firm in New York that specializes in “emerging/converging fields of design thinking, innovation acceleration and transformation science.” The existence of a firm that specializes in transformation design (IDEO started their transformation by design department in 2002) already begins to denote a reframing of the changing role of design as a catalyst for innovation. The many virtual publications and presentations of the Humantific group also advance new discourse in the field of design about the role that design thinking and leadership can play in addressing complexity at various levels and within a variety of contexts. (Van Patter, 2020)

Van Patter has championed his interpretation of the evolution of design practice as moving through four phases, from design 1.0 to design 4.0. Design 1.0 (Traditional Design) represents traditional industrial design practice and deals with small scale problems of communication, low levels of complexity, well-defined project briefs, few stakeholders, limited interaction with other steps and actors in the process, and focuses primarily upon form-giving and aesthetic considerations.

Design 2.0 (Product/Service Design) most closely aligns with the postmodern approach to industrial design with its acknowledgement of diversity and inclusion of more stakeholders in more participatory processes of creation. Van Patter describes it as dealing with larger scale problems of experience, service, and product in more complex and less strictly defined realms of uncertainty.

Design 3.0 (Organizational Transformation Design) is a relatively new evolution of design practice that addresses challenges at industry, organization and system levels which consequently involve more complexity and uncertainty as the number of stakeholders (and their interrelationships) grows. The 3.0 designer must therefore demonstrate adaptability in order to handle ever-expanding networks of stakeholders, increasingly multidisciplinary collaboration, and participatory cocreation. Design 3.0 offers a glimpse into the challenges that face today's (not so industrial) designers as the focus of design outputs shifts away from form giving and towards sense making.

Design 4.0 (Social Transformation Design) involves challenges at societal, national, and global scales. This realm of uncertainty is highly complex, involving vast numbers of stakeholders and as yet undefined understandings of how to frame, let alone address, the tasks at hand. Similar to design 3.0, design 4.0 requires a different skill set than that of traditional design practice. Design and innovation thinking in this version require abilities of collaboration, facilitation, participatory inquiry, as well as adaptability of process, orientation and scale.

Van Patter and others have asserted that the nature of design practice is changing due to some fundamental shifts. First, the types of problems that designers face are changing. They require designers to collaborate with individuals from multiple disciplines to collectively address increasingly complex and ill-structured issues. Secondly, the introduction of designerly processes is now occurring earlier and is utilized throughout entire projects. More complex contexts demand that design thinking play an integral role from initial problem seeking and framing until a collaborative conclusion can be reached that involves as many stakeholders as possible for the duration of the process.

Lastly, the 'how' of design practice is changing. No longer relegated exclusively to the task of form giver, the designer is now able to make strategic and cognitive contributions to complex social efforts. Unlike the lone craftsman or draftsman of the industrial era, today's designer has emerged from a disciplinary bubble able to work across multiple disciplines and perspectives towards a common goal. Today's designer must act as a facilitator, a re-framer of problems, a designer of social fabric and an interpreter of culture. (Kimbell, 2011; Manzini et al., 2015)

As the practice of designing evolves into an activity that involves more thinking and less physical making, a description of design thinking becomes paramount. The very cognitive practices that make up 'designerly ways of knowing' are the subject of Nigel Cross's writings by the same name (Cross, 1982, 2006). A noted professor of design studies and prolific writer on the subject, he offers a treatise on the modes of thought and resulting skilled behaviors that are unique to design ability based upon both empirical research and theoretical reflection. He also attempts to describe design ability in terms that will facilitate the nurturing of it through design education. He offers the following five major aspects of designerly ways of knowing:

- Designers tackle 'ill-defined' problems.

Calling upon Rittel and Weber's now well-recognized concept of 'wicked' problems, Cross connects the thinking of designers with the types of problems they attempt to solve. Unlike scientific or, say, mathematical problems where a correct answer can be arrived at, 'wicked' problems cannot be exhaustively analyzed. There is no certainty of a correct solution. In fact, in many cases, there are countless ways to frame the problem and always the possibility that all necessary information may not even be available to the problem-solver. The challenge of addressing such problems results in the adoption of certain strategies, which leads into the next major aspect of designerly ways of knowing,

- The mode of problem-solving is 'solution-focused'

When it is impossible to guarantee that all relevant information is available or that all possible problem approaches have been explored, a solution-focused strategy is appropriate. As conjectured solutions are explored, new ways of understanding the problem emerge and the boundaries of the problem space can be negotiated and addressed. This process necessarily involves iterative cycles of conjecture, analysis, and reframing. This synthesizing process results in the next major aspect of designerly ways of knowing,

- The mode of thinking is 'constructive'

As designers move through this cycle of experimentation with the problem space, they accumulate knowledge that informs their efforts. Each design move contributes to their growing understanding of the problem at hand as well as future problems. The constructive, creative nature of design activity is a search for synthesis, an effort to resolve problems not easily tamed.

- Designers use ‘codes’ that translate abstract requirements into concrete objects.

The problem framing and solving processes reflect each other in the codes that designers use to represent concepts and construct pattern languages. The translation from abstract to concrete and so on requires an ‘ordering principle’ that scaffolds the construction of something new, something designed.

- Designers use these codes to both ‘read’ and ‘write’ in ‘object languages’.

Designing is a process of meaning making and meaning exchanging. Designed artifacts (of whatever medium) embody the message of the making, the conversation between designer and designed. The designer is skilled in ‘metaphoric appreciation’ and codifying the abstract into concrete form.

This conclusion is based upon various sources, including designers’ descriptions of what they do and how they do it. Cross references nearly thirty years of studies of designing that relied upon various methods including interviews, case studies, observations, protocol studies, experiments, and theorizing. These studies come from various design disciplines including architecture and engineering. Cross asserts that it is productive to describe design ability as a ‘form of intelligence’ because it offers a framework for understanding and developing design ability.

In the midst next paradigm of design practice, it is evident that many avenues are possible. If historical trends are any indication, the next step will involve a bipolar reaction to the current situation. The fundamental difference between reaction and response is reflection. Rather than reacting to a situation, time to reflect generates a more thoughtful and deliberate response based upon a deeper understanding of previous acts, their roots, and their consequences. Now is a time to pause for reflection.

Praxis is described by Friere (1970) as a complex activity by which individuals create culture and society, and become critically conscious human beings. Praxis involves a cycle of action-reflection-action and is central to emancipatory education. Praxis is characterized by self-determination (as opposed to coercion), intentionality (as opposed to reaction), creativity (as opposed to homogeneity), and rationality (as opposed to chance).

The design profession is undergoing a radical transformation that has resulted in a state of upheaval and uncertainty about the future. The desired state is unclear and identifying the parameters of the problem results in identification of more problematic situations. Luckily, this is exactly the type of wicked problem that designers are trained to address. But how? Rather than allowing itself to be fashioned according to industry expectations, the design profession has a chance to actively participate in its transformation and eliminate the oppressor/oppressed polarity by actively engaging in critical, collective inquiry. This type of praxis requires revolutionary change initiated by radical thinkers. This type of praxis should be encouraged within present professionals, and within those who will evolve the field in the future.

2.6 Industrial Design Education Today

Fundamental changes in society necessitate a rethinking of the role of industrial designers of the future. Thus, the preparation of these designers today requires a reimagining of industrial design education. The prevailing curricular models for industrial design education represent an industrial context that valued mechanization and efficiency. The professional context of industrial design practice is changing to meet the needs of a more complex global context and the pedagogical practices that provide professional training require a reflective reconsideration of how to prepare the industrial designers of the future.

2.6.1 Introduction. Today Industrial design (ID) is defined as "the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer" ("ID Defined", 2005). The Industrial Design Society of America (IDSA), the prominent professional organization in the United States, publishes a document entitled "What is ID?" that describes the profession and the types of careers available to industrial design graduates. This informational pamphlet also indicates the top five skills that industrial design firms value today which include "creative problem-solving skills, ability to convey concepts with quick sketches, good verbal and written communication skills, computer proficiency in vector based or 3-D programs, mechanical aptitude and basic understanding of how things work." While it is certainly worthwhile to question how well existing design curricula teach these skills, it is equally (if not eminently more) important to ask whether or not these are, in fact, the most valuable skills that graduating designers-of- the- future should possess.

The IDSA directory lists 45 colleges and universities in the United States that offer industrial design programs. The goal of these curricula is to prepare students for professional practice upon completion of their studies. Organizations like IDSA and ICSID (International Council of Societies of Industrial Design) recommend specific core competencies for programs that include generic attributes (including problem solving and communication skills), domain specific skills (like visualization skills, knowledge of manufacturing and materials, etc.) and integrative skills (Yang, You, & Chen, 2005). The

National Association of Schools of Art and Design (NASAD) is the organization responsible for accreditation of industrial design programs in the United States that describes the essential competencies, experiences, and opportunities for ID education.

2.6.2 Recent Issues in Design Education. Both design educators and practicing professionals argue that industrial design education is not meeting the standards of industry and that changes must be made to better prepare students for fruitful professional careers. Critics of the current state of education cite a stagnant pedagogical model in need of updating in order to satisfy growing demands for designers to be more critical thinkers. While industrial design education continues to evolve, it is clear that many challenges face the educators responsible for shaping this changing field. Past pedagogical approaches provided a foundation for the practicing designers and educators working today. These same individuals now recognize the need for more changes to occur if design education is indeed going to be able to prepare the designers of the future.

A survey conducted by a faculty member at Auburn University (Liu, 2005) surveyed 1,343 designers, managers, and executives working for design consulting firms and manufacturers. The survey sample population included all professional members of the Industrial Designer's Society of America (IDSA) who were e-mailed an 18-question survey about the expectations in the design industry for recent graduates' skills and competencies. The researcher reported a 9.3% rate of return which may polarize the results if only those who felt particularly strongly about the issue responded.

In response to the question of what criteria are used to hire new design graduates, the most-cited response was 'portfolio' followed closely by 'creativity'. Of less importance were 'GPA', 'resume', and 'experience'. Another question included 14 skills to be ranked in order of importance. Problem solving skills were the most favored skill (mean ranking=10.84) followed closely by innovation (mean ranking=10.59) and sketching ability (mean ranking=9.46) demonstrating that although cognitive design ability is highly valued, visual communication of form-giving still maintains a place of prestige within the hiring process. In an assessment of the skill level of recent hires, respondents were only minutely pleased with problem-solving skills. Additionally, when asked which topics were most worthy of industrial design faculty attention, ‘problem solving’ and ‘innovation’ came in a close second to ‘design’ while ‘research’ was considerably lower.

The results of this study are somewhat difficult to translate due to the incomplete presentation of survey methodology. The researcher reported using a variety of question methods including matching, ranking, and choice in order to gain a more complete perspective. No sample survey was provided so it is unclear as to which questions relied upon which method. Additionally, the actual data presented was distilled to a discussion of results without specific reports of data analysis from each question. Numerical results of the survey were not reported in the text of the paper. Results of only six questions were presented in tables or graphs but were still difficult to read in some cases and consequently compromised the validity of the findings.

There is also some question regarding the operational definitions for the terms used in the survey. The author makes comparisons across questions (i.e. what respondents reported they wanted versus what they found in recent hires) but the validity of these connections is unclear because the terms are not defined in the text (though it is possible they were defined in the survey). For example, in one question ‘design’, ‘innovation’ and ‘’problem solving’ were distinct topics. Does this mean that problem solving is not part of design or innovation? Surely the researcher did not intend this separation, but the lack of clarification cripples the applicability of the results.

The research study invites scrutiny of its sampling strategy, survey methodology, operationalization of variables, and reporting of results. These criticisms aside, the results offer a bleak picture of industry understanding of the polarity that exists between the portfolio (product) as primary vehicle for displaying aptitude and the reportedly heavy demand for problem solving and innovation skills (process). This study also illustrates another unfortunate trend- that of relying upon industry to dictate the curriculum in design education from outside the academy walls. While such studies are informative and offer a description of what the profession currently demands in terms of new graduates, there is little room left to discuss how academia might supply the unexpected, a new and innovative kind of professional, skilled in ways that present practitioners are yet unable to envision.

A 2008 survey on the professional networking website LinkedIn cited the results from the Liu study. The LinkedIn survey creator, Rob Curedale, reports on his profile that he is a product/industrial design consultant, researcher, educator & speaker. Curedale deployed his survey via the discussion board on the IDSA group page (of which he is a member) which at the time had 2, 202 members. The survey included only one question: “What is the most important skill for an industrial design graduate?” One choice is allowed from the following options: Sketching, Problem Solving, Styling, Teamwork, and 2D +3D computer skills. Curedale indicates that the five possible answers to this question are the top five skills identified in the Liu (2005) survey.

Of the 173 respondents to the survey, 67% selected Problem Solving as the most important skill for industrial design graduates (see figure 7 below). These results certainly support previously discussed assertions that the cognitive abilities of designers (and designers-to-be) are more valued in contemporary industry than are the historically prominent skills of sketching and styling. Although Curedale clearly states how he arrived at the five choices, numerous comments posted by respondents expressed the desire to have more or different options that aligned with their beliefs.

Of course, this survey is more anecdotal than academic and is not offered here as an exemplar of rigorous survey research. Rather, it serves to illustrate very recent efforts to explore the shifting expectations of a professional association of designers who are being confronted with the evolution of their industry. It also serves as an example of the virtual deployment of a survey to a targeted professional population. And, perhaps most importantly, it demonstrates how survey design can impact survey results.

Figure 2. Recent survey of industrial design skills administered using LinkedIn online social network.

More criticism of the current state of design education has emerged around the globe by practitioners and educators alike. Donald Norman, best known for his books on design, especially *The Design of Everyday Things,* has published numerous critiques of design education that focus primarily on how the education of designers must keep up with the profession, which has expended to include interaction and experience, services and strategies. He emphasizes that increasing complexity means that design activities have to be supplemented with an understanding of technology, business and human psychology. But the focus of most education is on skills like sketching, rendering, and model making. (Norman, 2010, 2011, 2014).

Angus Montgomery (2014) went so far as to state that "90% of designers think design education is failing students" citing a poll in the UK. Although he was speaking about education in Great Britain, that same sentiment has been expressed by US designers. Gadi Amit runs a Silicon Valley industrial design firm and reviews thousands of portfolios each year. He argues that "The schools are a muddled mess, the end result of programs pulling in every direction" and suggests failing standards with basic core skills, especially sketching, along with a lack of integration between skill work (doing design) and process work (design thinking) which produces asymmetrically ill-equipped junior professionals. (Amit, 2010)

Some suggest that product design curriculum in general, and studio education in particular, is struggling to keep up with the pace of technological change and that, for example, design for digital products and the Internet of Things requires a skillset that many are not currently capable of integrating (Oygür Ilhan & Karapars, 2019). Given the role that design now serves to push businesses into innovative new territory, it is no wonder that the current state of design education is falling short. Some have gone so far as to suggest that the single biggest barrier to innovation is design education (de Bont & Liu, 2017). Clearly there is a need to critical assessment and change.

2.6.3 Educating for the Future of Design. Ken Friedman, educator and design theorist writes, "If design is a knowledge-intensive process, designers are knowledge professionals subject to the uncertainty and transformation affecting all professions in the knowledge economy" (Friedman, 1997, p. 5) He insists that design students must be equipped with the intellectual tools of the knowledge economy, including analytical, logical and theoretical tools as well as problem-solving tools. He offers a description of the evolution of design education emphasizing the historical link to craft education and argues that this method, artistic in nature, does not place enough emphasis on systemic thinking, a more scientific approach.

Friedman believes that design education must shift its emphasis from the "design of things" to the "understanding of things." This sentiment parallels a professional shift of valuing design thinking over rote form-giving skills. Freidman further estimates that 50% of what is taught in design education today will be obsolete within five years and encourages teachers to provide their students with the skill of acquiring knowledge. This notion is complemented by a need for critical thinking that transcends any occupationally-specific knowledge and, hence, a strong relationship between theory and practice. It also reinforces the notion that today's designer lives in a tech-world that requires understanding of how to design with and for interfaces and experiences. (Akkawi, 2017)

Interestingly enough, the very prosperous industrial era that gave birth to the industrial design profession also gave birth to the Linear theory of curriculum that is characterized by control, predetermined and particularized content, learning assessed by observable behaviors, and a systematic approach to content progression. This approach has been criticized for producing mechanical students adept at rote-memorization, not unlike the vocational tradesman produced by the design curriculum. Friedman equates the predominate vocational approach in design education to a mechanical trade education with the goal of teaching people how to implement tools and skill for the production of artifacts within frameworks delineated by traditions and business. He calls for an education paradigm befitting of the current state industry that is based upon "problem-solving and pattern building rather than… on repetition, exercise and imitative patterning" (Friedman, 1997, p. 19).

Further commentary on the industrialization of design education comes from Ron Levy (1990) in his discussion of the paradigm of complexity that threatens the distinction of a design as a discipline and compromises the academic institutions that aim to prepare future professionals. The prevailing scientific paradigms through which design has sought social legitimacy do not account for the epistemic nature of the activity of designing. Levy warns that global trends of close ties between academia and industry threaten the autonomous creative nature of knowledge production.

Levy offers four specific reasons why universities—and design departments in particular—should not be too closely aligned with industrial projects. First, industrial partnership compromises the knowledge imperatives of education when learning must serve an outside agenda. Secondly, schools of design should not focus only on practical skills (particularly those that can be later learned in industry) but instead should focus on developing an understanding of fundamental knowledge of processes (including creation, synthesis, interpretation, and analysis). Third, Levy argues that the social responsibility of the university should not be obligated to special interest groups. Finally, restrictive boundaries set up by professional associations and organizations must be transcended, rather than protected, by university education.

Levy offers ten components of a minimum curriculum that he justifies with references to quickly changing developments in techno-science that surpass individual and societal capabilities of comprehension. He asserts that fundamental changes in the learning process of designers would have ‘far-reaching effects on design practice, design responsibility, and design credibility" (Levy, 1990, p. 47). The ten elements of the proposed core curriculum include: inquiry systems, paradigmatic perspectives, system theoretics, communication competence, value constructs, ethical awareness, cultural conscience, historical consciousness, epistemics of science and technique, and environmental responsibility. Essentially Levy champions the articulation of knowledge constructs specific to design that can be nurtured in design education and disseminated though their eventual professional endeavors.

Jacques Giard (1990) also addressed the crisis in design education with a discussion of the need to formulate a distinct body of knowledge in design. He discusses the evolution of the field from a time when manual skills were the foundation of the profession (tracing back to craft origins) until present day, when an allegiance to form has overshadowed the importance of substance. He characterizes this trend as an emphasis on the 'hows' of industrial design over the' whys'.

Giard states that a refusal to acknowledge and respond to fundamental changes in society, the economy, and the knowledge development of other fields has resulted in an education crisis that threatens the advancement of the industrial design profession. A potential solution for the impending dilemma is a transition away from evaluation (i.e. subjective judgment) towards a descriptive (i.e. knowledge-based) ideology. According to Giard, the development of a design body of knowledge based upon inquiry is as important as the existing body of skills that is embraced by the university.

Jon Kolko (2005) is a noted design practitioner, critic, author and founder of the Austin Center for Design, Austin Center for Design, a progressive educational institution teaching interaction design and social entrepreneurship. He offers an alternative perspective that focuses on teaching collaboration, complex problem solving and user-centered contextual design to the future designer. He suggests it is time to trade in the focus on "Bauhaus style studio courses centered around individual, hands-on product development" in favor of approaches that better reflect current professional practice. He outlines three techniques: the total immersion charrette, the large scale product and development and fabrication, and industry-sponsored projects.

The prevailing paradigms of industrial design education arose out of an industrial context that prized efficiency and mechanization. But the domain known as industrial design has evolved and now requires more creative, critical thinking and critics are calling for an education model that prepares students for this new (and future) reality. The industrial designer must be as skillful at designing as he/she is at thinking about designing.

2.7 Reflection

Reflection eludes a consensually agreed upon definition. It has been the subject of many philosophical, theoretical, and practical ponderings. Differences and similarities across descriptions of reflection are typically rooted in three fundamental considerations: the purpose of reflective activity, the process within which it is situated, and the object or content of the reflecting. Four predominant thinkers of the last century are typically credited with the advancement of reflection as a process within learning and professional development. John Dewey, Jürgen Habermas, David Kolb, and Donald Schön have all contributed to our present understanding of reflection. This section will explore the three aforementioned elements of reflection according to these four proponents.

2.7.1 Defining Reflection. Situating reflection within a research context is problematic given its ubiquity in common language. As casually used, the term 'reflection' typically refers to one of three understandings of the word. First, 'reflection' is related to the process of learning and representing that learning. In this way reflection is used as a vehicle for considering something in greater detail or with more conscious attention (i.e. "I need to reflect on what you have just said."). 'Reflection' also refers to an action undertaken for some purpose. Regardless of whether it is undertaken intentionally or not, this description implies that the process of reflection leads to a helpful outcome. Thirdly, ‘reflection’ may imply complex cognitive processes about a problem for which there is no obvious solution. Beyond the simple mental processes involved in solving a math problem, for example, ‘reflection’ in this context implies a complicated activity aimed at resolution of an ill-structured dilemma. These common understandings are not mutually exclusive yet how they are considered in various contexts or frameworks generates a variety of connotations about the act of reflecting and the individuals who undertake it. (Moon, 1999)

John Dewey’s purpose for describing reflection was to illuminate the process within the context of education and in general human cognitive capacity (Dewey, 1910). He was primarily concerned with the nature of reflection and how it occurs, in essence how knowledge is manipulated and processed towards a purpose. Essential in Dewey’s conception of reflection is the notion of reflection initiated as a response to a state of uncertainty, difficulty, or doubt. The inherent desire to resolve this uncertainty creates a tension, the antecedent for judgment (i.e. identifying the difference between an existing state and a preferred one). The spirit of inquiry becomes a motivating force in the search for resolution.

Dewey describes five distinct steps of reflection. The first step (which is often closely intertwined with the second) is the perception of a problem, i.e. perplexity. The second step is the description of the discrepancy and observation that is necessitated by the need to describe the nature of the challenge. Once a problem has been identified according to a mental structure, the third step is the suggestion of a potential solution (moving from what it present to what is absent). This step may include the generation of multiple possible avenues for resolution. The fourth step involves development of a solution idea via reasoning and helps to weave complex elements into a consistent whole.

Finally, the evolved solution is subjected to corroboration via additional experimentation and observation. Dewey emphasizes that observations are separated by thinking- it should occur both at the beginning of an observation and the end (thus resulting in a new observation, and so on). Dewey characterizes reflection (this thinking between the spaces of observations) as a double movement that is both inductive and deductive, moving back and forth between meanings and facts, potentials and realities.

Dewey's model of reflection has been criticized as being too individualistic, overly cognitive, and devoid of emotion and communication. The emotional elements of reflection have consequentially been incorporated into other models and the dialogic aspect of reflection plays a prominent part in knowledge production according to Habermas and Frieire. According to Freire (1970), the concept of conscientization (akin to critical reflection) plays a prominent role in the emancipation of the powerless through critical pedagogy.

In contrast to Dewey, Jürgan Habermas (1971) described reflection as an effort to explicate and evolve epistemological issues related to the sociology of knowledge. Reflection, in this respect, is considered a tool that is utilized in the development of distinct forms of knowledge which can be discerned according to object domain, criteria for validity, form of associated human activity, and constitutive interests (i.e. technical, practical, or emancipatory). Habermas was particularly concerned with the nature of knowledge that humans have chosen or been motivated to generate.

For Habermas, knowledge in the social sciences and humanities is concerned with human behaviors and communication which cannot be subjected to scientific explanation (given its insistence on value-neutrality). Rather, this particular form of knowledge is generated through interpretation and amalgamation of ideas and meaning. The application of critical and evaluative modes of thought (i.e. reflection) develops an emancipatory knowledge that enlightens understanding of self, humanity, and the self as situated within the human condition. Acquisition of this knowledge is therefore transformational for the individual within successfully larger contexts (i.e. personal, social, global).

Both Dewey and Habermas describe reflection as an activity that generates knowledge. Dewey emphasized the cognitive process of reflection while Habermas situated this process within the context of knowledge acquisition and consideration. The key distinction between the two definitions lies in the purpose of the reflector. For Dewey, reflection is motivated by interpretive interests to gain a better understanding of the world. Habermas, on the other hand, champions the emancipatory power of reflection for those who utilize it critically.

Experiential learning theory (ELT), advanced by David Kolb (1984), was founded upon the intellectual work of Dewey, Lewin and Piaget and emphasizes the essential role that experience plays in the learning process. The aim of this approach is an understanding the cognitive experience of learning, i.e. focus on the process of learning rather than the product (or behavioral outcome). Kolb defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it" (p. 38). Kolb emphasize here the dual conditions that inform knowing- apprehension and comprehension.

The experiential learning cycle proposed by Kolb includes the four stages seen in the figure below. Reflection, the second phase, is essential for the intentional transformation of an experience into learning as the thinker moves away from existing perceptions about the action. Kolb's model also demonstrates the crucial role that reflecting plays in perpetuating learning as it moves through the cycle. The interplay between involvement and reflective detachment in this model parallels the dualities previously described by Dewey (inductive/deductive) and Habermas (self/social).

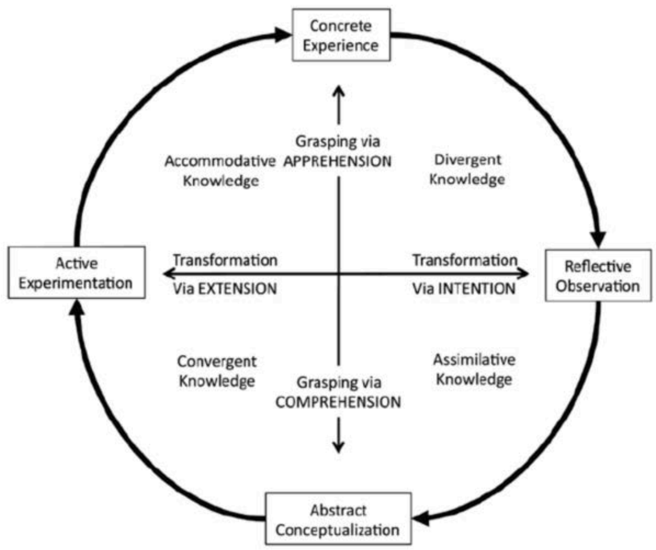


Figure 3. Experiential Learning Theory by Kolb.

Situated within the professional, Schön's (1983) theory of reflective practice involves the journey of knowledge from explicit to implicit, and vice versa, as experiences contribute to a repertoire of potential moves that can be applied depending on the frame of the problem under consideration. Key to this understanding of professional practice is the notion of two types of theories of practice (Argyris & Schön 1978). Espoused theories are those that formally characterize a profession and are typically taught to students. These 'theories-of-action' are what practitioners reference when asked to describe their work, regardless of whether or not they actually use them in their daily practice. Implicit theories, the second type, represent patterns of practice learned and developed over time in the daily work of the practitioner. These 'theories-in-use' are personally developed, tacitly held, often described as intuitive, and difficult to explicate.

The practitioner's repertoire is built and refined through two processes: reflection-in-action and reflection-on-action. Reflection-in-action occurs during an activity that is guided by a sort of tacit knowing-in-action which, when challenged by unexpected consequences, is restructured by a critical reframing of the situation and new approach. In this way reflection-in-action is a coping response to complex, ill-structured situations. Reflection-on-action, according to Schön, is the process of reflecting on the reflection-in-action. He draws a verbal line of distinction between the two wherein reflection-on-action involves representing verbally the content of the reflection-in-action. The vague distinction between these two processes is a point of contention and criticism of Schon's theory which problematizes the operationalization of reflection as a construct for the purpose of empirical study (Moon 1999).

Effective action upon implicit knowledge requires the ability to act upon that knowledge and to simultaneously reflect upon this action in order to learn from it. Argyris and Schon (1974) describe theories of professional practice as "special cases of the theories of action that determine all deliberate behavior" (p. 4). These theories are "vehicles for explanation, prediction, and control" (p.5). Tacit knowledge, it follows, is described as a theory-of- action that governs one's theory-in-use as manifested by behavior. The gap that exists between an explicit theory-of-action and an implicit theory-in-use is considered incongruence. Learning is a cognitive attempt to create congruence between these two theories.

In the text *Reflective Practice for Educators*, Osterman and Kottkamp (1993) describe theories-in-use as mental models that account for resistance to change in behavior. Explicit theories-of-action are characterized by their presence in conscious thought and, consequently, the relative ease with which they can be transformed. On the other hand, theories-in-use are developed through acculturation and do not require articulation or awareness of their existence which renders them comparatively difficult to change.

Reflective practice serves as a mechanism that facilitates the identification, analysis, and transformation of the theories-in-use that govern behavior, also known as double-loop learning (Osterman & Kottkamp, 1993, Argyris & Schon 1974). The notion here is that fundamental changes in behavior require fundamental changes in beliefs and assumptions. This contrasts with the concept of single-loop learning (which parallels a linear description of the design process as rational problem-solving and Dewey's description of reflection) wherein a problem is observed, alternative solutions are generated and assessed, a decision is made, and a plan is implemented. Double-loop learning begins with the same steps of observing problems, but proceeds with the crucial questions of "What are we doing now?" (i.e. what is the existing situation) and "Why?" (i.e. what are the underlying beliefs and actions that have created it). In this way, reflection facilitates double-loop learning.

Documenting action in order to provide objects for reflection may be undertaken utilizing what Osterman and Kottkamp (1993) call the 'case record. The case record is a tool for capturing and analyzing personal experience. It includes the following elements:

1. The problem: Who was involved? What was the pertinent background information? What was your role in the problem?
2. Outcome and/or Objectives Desired: What did you hope to accomplish?
3. Alternatives Considered: What alternatives did you consider to solve the problem?
4. Strategies Implemented: What action did you take in an attempt to achieve your objectives?

5. Results: Were your objectives achieved? What happened as a result of your actions?

6. Assessment: Did your plan work as intended? What critical events, decisions, situations influenced the outcome? What would you do differently, if anything?

The case record offers a mechanism with which observations and actions can be captured and subjected to scrutiny for the purposes of facilitating double-loop learning

Learning and reflection both represent cognitive activities of meaning making. Gelter (2003) explored some answers to the question "Why is reflective thinking uncommon?" relying upon cognitive causes for understanding the epigenetic nature of reflective activity. Here, reflection was defined as "a conscious, active process of focused and structured thinking which is distinct from free floating thoughts" (Gelter 2003. p. 338) and emphasized the importance of the concept of consciousness in understanding reflective activities. Gelter described a theory regarding the distinction between a conscious 'I' (including physical and psychological process initiated by the conscious mind) with a bandwidth capacity of about 50 bits per second and an unconscious 'me' (which includes the rest) with a bandwidth capacity of 100 billion bits per second, illustrating that the 'I' has information processing ability of only 1: 100,000,000,000 to the 'me'.

Gelter related these two modes of consciousness to the two dimensions utilized in the learning cycle described by Kolb. The first dimension is concrete and refers to sensory experience, known as apprehension. The second refers to the abstract conceptualization of the experience, how it is summarized and described, known as comprehension. The two distinct operations described also have support from 'split-brain' studies where the two hemispheres of the neocortex are credited with functional specialization and psychology where feeling and affective judgment have been shown to be separate processes from cognitive analysis. These studies have begun to explore the process known as 'intuition' whereby behaviors are guided by affective judgment not available to the conscious mind.

According to Gelter, the brain is an "enormous information reduction device" (p. 340) wherein the brain's attention (i.e. 50 bits per second) is allowed to focus on the information required for the task at hand. When a situation demands immediate response, the conscious 'I' cannot be involved rather the 'me' must react (as in a survival 'fight or flight' situation). The idea that all actions start unconsciously is supported by the fact that unconscious brain activity starts .5 seconds before action meaning that the 'I' cannot initiate actions, only implement them. However, when time permits, the conscious 'I' can actively think about what is being done (i.e. Schön's reflection-in-action) and this is where reflective thinking can be practiced in order to provide concentrated thought about actions and the conscious control that humans have over them. (Gelter, 2003)

2.7.2 Teaching/Nurturing Reflection. Given the potential value of reflection for the learning process explored in the previous section, the question now arises as to how one might actually teach or nurture reflection. In his discussion of folk pedagogies, Bruner (1996) reminds us that "We humans show, tell, or teach someone something only because we first recognize that they don't know, or that what they believe is false…No ascription of ignorance, no effort to teach." (pp. 6-7). This problematizes the notion of teaching reflection given that it is difficult to determine how students think or what they believe about reflection, and consequentially any effort to teach reflection implies a potentially unfounded assumption of ignorance on the part of the learner.

Perhaps the conundrum of knowing when or if to teach reflection to students is resolved by reframing the question of how to teach reflection, which treats reflection as a learning objective, i.e. object of instruction. Reflection is, after all, a cognitive process that lends itself to an experiential 'learning by doing' approach. This does not imply that reflection is not teachable or assessable, but rather that the process itself is well-suited as a complement to learning instead of being the subject of it. This notion is supported by the literature, which emphasizes how reflection may be facilitated and nurtured as a reflective practicum which allows learners space to evolve their own unique practice as applied in the context of other subject matter.

Addressing this very topic, Moon (1999) discusses the place of reflection in learning and offers three potential points of entry in the learning process. The first, reflection in initial learning, emphasizes the restructuring of cognitive understanding to accommodate new knowledge and the role of reflection in consequential phases of meaning making and transformative learning. Reflection can also be undertaken as a representation of learning where tools utilized have been developed for the express purpose of facilitating reflection (i.e. learning journals). Finally, reflection may assist in the transition from surface learning to deep learning, referred to as upgrading of learning. Mezirow (1990) places great importance on the role of reflection for adult learners in facilitating this type of transformational learning.

As previously described, descriptions of reflection are distinguishable according to the purpose, process and content of the reflective activity. Teaching reflection can also be thus contextually situated. The appropriate methods for teaching reflection therefore necessitate a clarification of the purpose of teaching reflection. Moon (1990, pp. 158-9) suggests that the purpose or outcome of reflection can be:

- the production of further material for reflection

- action or other representation of learning
- reflection on the process of learning
- the building of theory
- self-development
- decisions/resolution of uncertainty
- empowerment and emancipation
- other outcomes that are unexpected
- emotion
- ‘being reflective’ (an orientation to practice or life)

Assuming that any number of these objectives has been identified, the next step involves establishing a learning environment that is conducive to reflection.

For starters, students need time and space to reflect. They also need guidance by a facilitator who is knowledgeable (preferably both in theory and personal practice) of reflection and its relationship to learning. Facilitators promote reflective activities as well as model them via reflective conversations. A curricular or institutional environment that supports reflection is also beneficial for students lest they perceive reflection as a singular or compartmentalized activity relevant for only one course or module. Reflection may involve the expression of personal concerns that evoke fear or other discomfort. In order for students to feel confident and comfortable, reflective skills should be nurtured in an emotionally safe environment. Finally, Moon warns, there are many significant social norms and other hidden agendas of learning environments that may need to be tended to and addressed along the way.

There are endless examples of teaching strategies relating to reflection that range from open-ended and unfocused on one end of the spectrum to highly structured and compartmentalized according to content. A few general principles can help guide the process of determining a strategy for teaching reflection. To begin with, unfocused writing activities without a predetermined focus allow great freedom for learning to reflect, but they may overwhelm the student who is accustomed to more mandated and rote form of learning activity. Different types of activities will yield different types of reflections and unfamiliar forms of reflection (i.e. poetry, drama, art) may require sensitive handling and forethought about potential reactions and defensive feelings by the students. It is possible to guide reflection through an ordered sequence (i.e. focusing first on existing content knowledge and then moving through reflection on learning and how learning may be applied). If structure is present at the outset, it may lead to less structure over time as skill and comfort level evolve. (Moon 1999)

Preparing a teaching strategy for reflection also includes recognition of potential challenges or obstacles. For example, overreliance upon a particular structure may become rote or repetitive and compromise the learner's experience. Forethought should also be given to balancing the personal and public nature of reflection (particularly in terms of content and expectation of publicity). Individual and group reflections allow space for personal and social learning. The ability to reflect is associated with level of epistemological understanding and therefore individuals will likely differ in capacity for reflection depending upon their understanding of the nature of knowledge.

In respect for brevity of this section, no lengthy list of specific reflection activities for the classroom is included here. Instead, a few general characteristics of tasks that encourage reflection is offered as an orientation to the underlying strategies that may be considered when developing reflective learning opportunities. The following list is taken from Moon (1999, pp. 175-6):

- The task may use 'messy' or ill-structured material of learning
- Asking the 'right' kind of questions (i.e. questions that don't have a 'right' answer)

- Setting challenges can promote reflection
- Tasks that challenge learners to integrate new learning into previous learning
- Tasks that demand the ordering of thoughts
- Tasks that require evaluation

Perhaps the most common activity employed to teach reflection is writing (often in a learning journal). Various forms are possible to facilitate reflective writing (again spanning the spectrum of freedom and structure). Dialogue journals are collectively generated between two or more people, most frequently between teacher and student though this is not the only possibility. Non-verbal techniques for generating reflective thinking include artistic forms of representation (i.e. poetry, drawing, sculpting, narrative, etc.) as well as drama and role playing. Concept (or mind) mapping and guided fantasy (visualization) offer alternatives to writing.

Almost any action (be it cognitive or physical) qualifies as content for reflection provided the conditions are conducive to it. The object of reflection by budding reflective students (i.e. Dewey's perplexity, Kolb's concrete experience or perhaps the action in Schon's reflection-on-action) is often defined by the instructor or the curriculum they intend to deliver. Moon describes various considerations of the nature of subject matter to assist in the generation of reflection by using ill-structured materials. She promotes exposure to real-life situations and issues that characterize the discipline. Situations that challenge initial thinking and assumptions, as wells as those where learners are encouraged to commit themselves to judgments or choices, are also encouraged. Finally, Moon recommends the use of situations where learners must integrate new learning and previous learning, and/or those that demand the restructuring of thoughts. Design situations are characterized by many of these challenges and seem well-situated as opportunities for reflective action.

2.7.3 Reflection in Design Education. The relationship between design and reflection was firmly established by Schön though parallels between reflective practice and design practice exist in the descriptions offered by Dewey and others. According to Schön (1983), designing is a reflective conversation with a situation involving complex processes of representing multiple variables including moves, norms, and the relationships between them. Relying upon a unique language of talking and drawing, the designer makes moves and listens to the back-talk of the situation, and is confronted by unexpected consequences (i.e. Dewey's perplexity). Reflecting-in-action, the designer creates new strategies for action and models (both mental and explicit) meant to shape the situation in accordance with some desired outcome. This back-and-forth relationship with unique situations is the mechanism by which designer achieves fluency in the language of designing as his repertoire of skills and possible moves is refined over time.

Design as a reflective practice confronts a common paradigmatic belief of design as rational problem solving. This positivist epistemology is rooted in technical rationality and rests on Industrial era beliefs that human progress is achievable via deliberates efforts to exploit the power of science and technology. This belief is manifested as rigorous approaches to problem solving as a technical effort that relies upon specialized knowledge. The hierarchical nature of professional knowledge, according to this belief, proceeds from the underlying disciplinary science (theory) upon which practice, or applied science, rests. Upon that rests a skills and attitudinal component at the top of the pyramid which relates to performance within a professional client context. Notably, the more basic the knowledge, the higher the status awarded the producer. The gap between academics and practitioners within the design profession is thus described as a theory/practice dichotomy. The educative division of these various levels is evidenced in most design curricula where students must evidence mastery of basic science knowledge before proceeding to the upper divisions of professional knowledge.

Conversation is one of the most simple yet complex of all human activities. Nearly every human being engages in conversation. Baker, Jensen, and Kolb (2002, p. 1) define conversation as “a process of interpreting and understanding human experience.” Conversation, as here defined, signifies a learning process, one in which participants are free to explore, question, reflect, and respond. “Conversational learning that embraces differences as a source of new understanding and questions previous assumptions and prejudices can be called deep learning.” (Baker, Jensen & Kolb 2002, p. 3)

Design teachers are typically grounded within one of three prevailing pedagogic paradigms. These three pedagogic practices are echoed in the model of educational reform posed by Mortimer Adler (and referenced in Baker, Jensen & Kolb 2002, p. 3) wherein the teacher plays (all) three roles: the lecturer and deliverer of declarative knowledge, the mentoring coach who aids development of critical skills, and the facilitator of Socratic dialogue which generates new ideas. The interplay of multiple roles by the teacher offers potential for conversational learning wherein individuals are encouraged to collectively engage in a meaning-making process.

Conversation is rooted in personal experience, in the act of explicating tacit knowledge and consequential attempts develop new understandings through discourse and reflection (both internally and collectively). Conversational space may be characterized as public, private, textual, technological, and even imaginary (to name but a few). Textual conversations are particularly relevant to the study proposed here because it relies upon reflections-as-text for stimulating double-loop learning experiences. One of the primary advantages offered by conversations among texts is that they are “available for repeated revisiting and reflection” (Baker, Jensen & Kolb 2002, p.

8). Furthermore, technological texts (like those that this study will generate) may liberate and comfort participants by allowing time and space for asynchronistic reflections. These conversational learning spaces offer opportunities for the transformative process of creating productive understandings among equally valued participants.

Conversational learning produces a meaning making process wherein understanding is created through the interplay of oppositional forces. Kolb, Baker, and Jensen (2002) offer multiple dialectical relationships to illustrate distant but indivisible ways of knowing. Referring back to Kolb's model of ELT, concrete knowing and abstract knowing are dialectically articulated as apprehension and comprehension. Concrete knowing is apprehension- a tacit, intuitive process. Abstract knowing is called comprehension- a conceptual, interpretive process. Integrated learning occurs when both modes of knowing are engaged simultaneously.

Another dialectical opportunity is evidenced in the difference between intention and extension. Kolb (1984) articulated this central idea as follows: "Simple perception of experience alone is not sufficient for learning; something else must be done with it. Similarly, transformation alone cannot represent learning, for there must be something to be transformed, some state or experience that is being acted upon" (p. 42). The relationship between these learning dialectics is eloquently described by Kolb, Baker, and Jensen (2002) as analogous to breathing- a rhythmic process of taking in information, analyzing it and making meaning from it, then expressing this meaning in the exhalations of thought, action, speech, etc.

Other relevant dialectical tensions are evidenced in the spectra that constitute both status and solidarity (Kolb, Baker, and Jensen 2002). Status refers to a position or ranking within the group and solidarity represents the extent to which members feel connected interpersonally to others within the same network. These constructs are ubiquitous in the education context where teachers and learners share learning spaces and consequently situate themselves (and each other) at various static and dynamic places along the aforementioned spectra. Understanding how teachers conceptualize both status and solidarity is a critical step in uncovering implicit beliefs and assessing the impact that these folk pedagogies have on explicit teaching practices.

Reflective practice is often utilized in education as a model for facilitating change through intentional action. “Reflective practice is designed to facilitate identification, examination, and modification of the theories-in-use that shape behavior” (Osterman & Kottkamp 1993, p. 13). As previously described, espoused theories about teaching (and learning) are easy to describe yet are rarely acknowledged as a direct influence for behavior. Theories-in-use, mental models consisting of beliefs and assumptions, are typically easy to demonstrate through action but comparably difficult to describe. Theories-in-use are valuable in that they reduce complexity of problem solving yet they also serve to maintain the status quo and prevent growth if they remain unquestioned directors of conditioned or familiar behaviors.

Reflection is a design process wherein a teacher engages in a reflective conversation with self (process) about action (product). Designing is often described as changing an existing situation into a preferred one. Learning is described as the transformation of a real state into an ideal one. Reflection, therefore, presents itself as a process of designing one’s own learning through an active, iterative process of dialogue with self and action. Taking responsibility for one’s own learning is an act of empowerment.

Schön offers three models of coaching that can be used in the dialogue of coach and student. The first, joint experimentation, involves leading the student through a collaborative inquiry into a design problem. The 'follow me' mode relies upon the educator's ability to design student-centered performances that model the relationship between parts and whole. Finally, in the 'hall of mirrors' there is a continual shift in perspective between coach and student through reenactment and dialogue.

Design education aims to prepare students for practical application of a theoretical understanding of design processes coupled with domain knowledge. This understanding evolves via experience. Students who reflect on their learning become practitioners who reflect upon their practice. In addition to the 'hard skills' emphasized in the design curriculum, reflective skills should be nurtured in aspiring professionals so that they can continue to learn long after they have left the educational system. Just as the design studio offers a 'learning by doing' approach to learning about design, so, too should it provide the opportunity to learn reflection by doing it. Just as design educators facilitate their student's learning about design by modeling certain behaviors, designing experiential learning experiences, and providing critical feedback, so, too should they facilitate learning about reflection by weaving it into the learning experience and modeling reflective practice themselves.

2.8 Pedagogical Knowledge in Design

Previous sections have described both the historical context of this study (industrial design practice and education) and the process by which it shall be explored (reflection) and reshaped (action research). This section discusses the content of the issue at hand: pedagogical knowledge in industrial design education and a lack of understanding about its use and application. In addition, the ontological nature of this tacit knowledge and how it might be accessed epistemologically provide insight into the generation of a research program.

2.8.1 Pedagogic Content Knowledge. The concept of pedagogic content knowledge was introduced by Lee Shulman in 1987 and refers to the "unique ways of knowing and understanding their subject matter that is unique for teachers and teaching" (Gudmunsdottir 1995). Teachers' knowledge is practical; it evolves and develops over years of experience which is often communicated via narrative. Narratives allow people to interpret the world by assigning meaning and value to the elements of the story. Narratives from teachers evidence their knowledge as it is situated within the frame of learning how to teach. Gudmunsdottir writes that "through this narrative dialogue of reflection and interpretation that experience is transformed into pedagogical content knowledge" (p. 30). Narratives, therefore, offer another cognitive artifact of reflection about teaching and provide a representation of learning from reflection.

Studies of teachers' stories serve to explicate the tacit teaching knowledge described above. Gudmunsdottir proposed that any study of pedagogical content knowledge via narrative inquiry should focus on four dimensions. The first, practical experience, describes how teachers recount stories that serve as illustrations of knowledge couched within lived events. Second, narrative construction involves interpretation (it is never value-free) and requires one to look with "pedagogically-seeking-eyes" for meanings that lie embedded within the story. Reflection, in this context, refers to the explanation of past events and is the vehicle by which past events are crafted into a meaningful whole. Finally, narratives are tools for transformation as they provide understanding and situate learning into a meaningful schema. Transformation involves progression from an incoherent story to one that is complete and compelling. This is done by establishing connections between events and insights.

A visual example of the nature of pedagogic content knowledge (aka PCK) within the context of industrial design education is offered by Phillips et al. (2009) and can be found in Figure 4. They seek to illustrate that a specialized form of pedagogical knowledge in industrial design education is created from the relationships between a teacher's content knowledge in industrial design, the general knowledge of pedagogy and the knowledge that is necessary for integrating these concepts into the design classroom or studio.

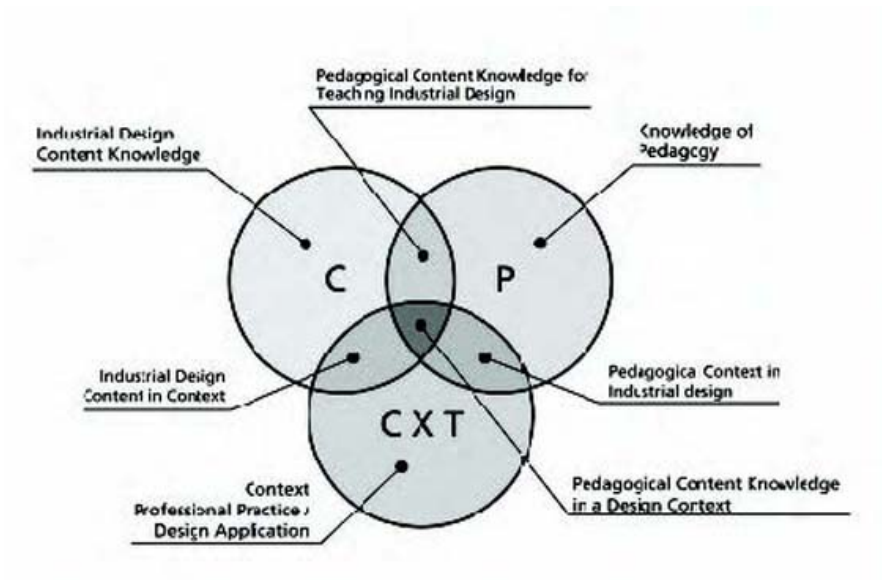


Figure 4. Model of content knowledge, pedagogy, and context in industrial design education.

2.8.2 Pedagogic Knowledge and Narrative Ways of Knowing. Narrative inquiry typically relies upon the collection and analysis of stories and/or the construction of narratives based upon collected data. According to Polkinghorne (1988) narrative inquiry can be of two types: descriptive or exploratory. The purpose of descriptive narratives is to "produce an accurate description of the interpretive narrative accounts individuals or groups use to make sequences of events in their lives or organizations meaningful" (pp. 161-2). The aim of exploratory narratives is provide causal connections among events through storied recounts by participants. Clandinin and Connelly (2000) also remind their readers that typically, with narrative research, certainty is not the primary goal and that stories are heuristic devices that provide metaphorical insight for understanding human experience.

Designing has been described as a narrative activity, a form of explanation wherein the designed artifact (be it object or space) acts as a repository of information and intention. Some critics of design education in the United Kingdom have challenged existing pedagogic paradigms for their static and ordered approach to teaching design processes, for their lack of creativity-enhancing educative experiences, and for fragmented approaches to designing that lack holistic interpretations of design activity (Dillon & Howe, 2003). These same critics recommend a narrative paradigm for framing designing. They argue that "to view an object as a 'story' offers a more complete picture of what the object really is and what it might mean" (op cit., p. 291). In this way, the 'reading' of a designed artifact can be at once subjective (as generated by the unique perspective of the designer, user, etc.) and objective (through critical analysis of potential readings and reflection upon how such criteria are generated).

Narrative inquiry has also recently emerged as a tool for teaching design. Many practice-based professions have embraced narrative as a method for exploring with students the more intangible, interpersonal, values-based issues in design practice. Danko, Meneely, and Portillo (2006) used a narrative intervention in an interior design studio course to explore the potential of storytelling as a design method. They write that "storytelling structures perceptions, organizes raw experiences into memories, and gives meaning to human experience" (p. 11). In this way, the act of story construction and sharing corresponds to the creative design process wherein meaning is generated through the interactions among various actors (characters), activities (of designing and using), artifacts (of the design process), and atmosphere (of designing and of contextualized use).

Story sharing requires reflection upon individual actions, thoughts, and feelings. Temple and Gillet (1989) write:

> Stories are about characters whose actions are sequentially organized and causally related. Characters have roles and the roles are motivated. Who people are, what they do, why they do it, and what difference it makes—these things are explained by stories. Stories are, thus, explanatory devices that help us make sense of the random and inexplicable happening of everyday life. People aren't characters until stories make them so. Events aren't grouped in logical chains until a storyteller groups and imposes logic on them. (p. 136)

The explication of internal, cognitive practices of meaning making creates narrative. Narrative requires a process of connecting experience to personal beliefs and knowledge. Reflections on raw experiences and on other's reflections therefore offer representations of the teaching and learning process.

2.8.3 A Pedagogic Model of Design Learning. As previously discussed, industrial design practice has undergone a transformational evolution with design practice today demonstrating marked differences from its ancestral heritage. Unfortunately, as Cross (2006) clearly indicates, "there have been no comparable innovations in curriculum development in design education since the Nazis closed the Bauhaus in 1933" (p. 24). He also laments that current educative processes aimed at developing design ability are "poorly understood" and typically involve reliance upon a studio or project-based approach.

The advancement of design cognition as a valued skill of the (industrial) designer has paved the way for recent interest in exploring the cognitive elements of design learning as a focus of design education and research. Unfortunately, there are few educational theories dedicated to explaining the unique practices involved in design learning and design teaching.

Oxman (2001) offers a conceptual framework for understanding the “cognitive content of design thinking as the subject of an educational program” (p. 270). Oxman argues that traditional design education models are based upon the demonstration of professional task performance and do not emphasize the cognitive content of design thinking. An understanding of how one might be educated in designerly thinking therefore necessitates an understanding of both designerly thinking and of how it functions as the subject of teaching and learning activities.

Oxman’s description of the three paradigms of design education begins with the atelier system and its deep roots in professional tradition. This educational approach is a vehicle for problem-oriented education, it simulates the professional studio, and is reliant upon a studio master and jury system. The studio simulation of the professional environment facilitates a ‘learning by doing’ approach through its problem orientation and experiential development of competence. However, as Oxman notes, there are a number of educative variations and “certain inherent deficiencies” that compromise the efficiency of this technique.

The second paradigm described in this framework emerged from the design education experimentation of the earlier twentieth century that is traced to the pedagogical advancements of the Bauhaus and HfG Ulm. The essential goal of this approach was the development of form knowledge/sensitivity and visual literacy in the designer as well as understanding of referenced theories of perception, education, and psychology. It emphasized the instruction and experimentation with general principles rather than focusing on the design process itself. The hallmark of this approach is the generation of knowledge via exploration and application of basic design principles.

The third paradigm is representative of many current curriculum, with an integration of design concepts, formal skills, and knowledge taught in a 'learning by doing' studio context. While this evolution embodies many theoretical changes it still places great emphasis on visual and formal content and focuses on the designed object rather than articulation of the 'designerly' knowledge exercised during the process. Oxman describes a general neglect of explicit knowledge of design and its cognitive content and cites "a neglect of attention to thinking in design as legitimate pedagogical content" (Oxman, 2001, p. 273). The author calls for a theoretical framework relevant to the unique cognitive aspects of design that can inform design education.

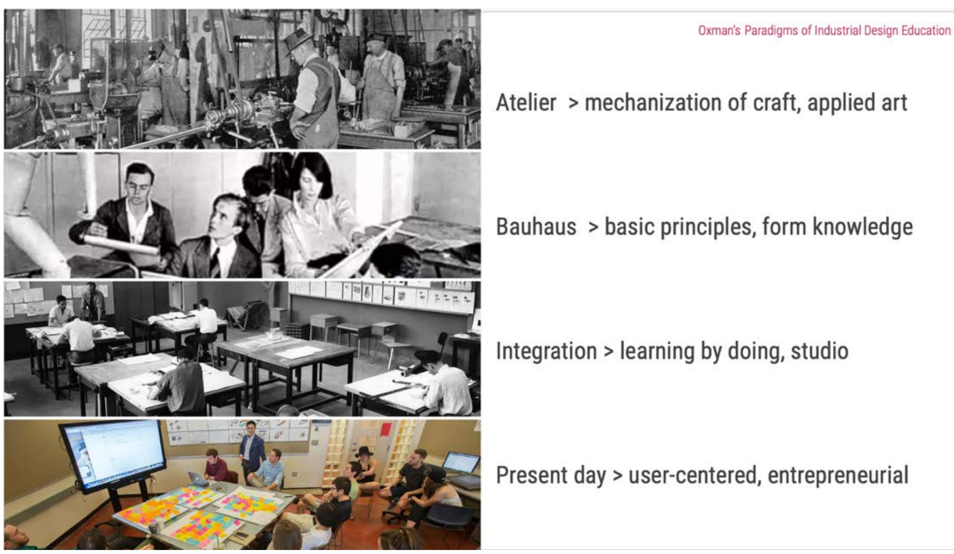


Figure 5. Visualization of Oxmans's paradigms of industrial design education.

2.8.4 Folk Pedagogy. Jerome Bruner is an education theorist who has proposed a folk pedagogy model for understanding the pedagogical knowledge of both teacher and learner. Bruner's theory is rooted in the notion of 'folk psychology' which refers to lay theories that reflect both inherent human tendencies as well as cultural understandings of the nature of the human mind. These mechanisms of explanation influence perception about how others' minds work and therefore strongly impact interactions with others even though they are often difficult to explicate.

In theorizing about the role of such folk beliefs on efforts at education reform, Bruner emphasizes the importance of considering the folk theories that are already held by both learners and teachers. He writes, "For any innovations that you, as a proper pedagogical theorist, may wish to introduce will have to compete with, replace, or otherwise modify the folk theories that already guide both teachers and pupils" (1986, p. 5). In other words, attempts at pedagogical innovation (or transformation into a *preferred* state) must proceed from an understanding of the *existing* cognitive beliefs and strategies of those who are expected to participate in the teaching and learning. If learning to teach a different way is a goal, unlearning how to teach the current way must also be a consideration. Unfortunately, little such knowledge exists about the existing (or for that matter, preferred) pedagogical beliefs and practices of design teachers and students.

Bruner contends that teacher notions about the mind of the learner inform the methods of instruction that (s)he employs. He insists that such beliefs need to be explicated and reexamined as a prerequisite to any efforts of pedagogical reform. He consequently identifies four prevalent models of the learner's mind which parallel the design education paradigms critiqued by Oxman. According to Bruner (1996) these folk pedagogies are "notions about the nature of the learner's mind… [which are] a direct reflection of the beliefs and assumptions that the teacher holds about the learner" (pp.5-6). They are rarely explicitly acknowledged or examined yet they guide behavior by both learner and teacher and are indicative of the how teachers and students conceptualize the relationship between mind and culture.

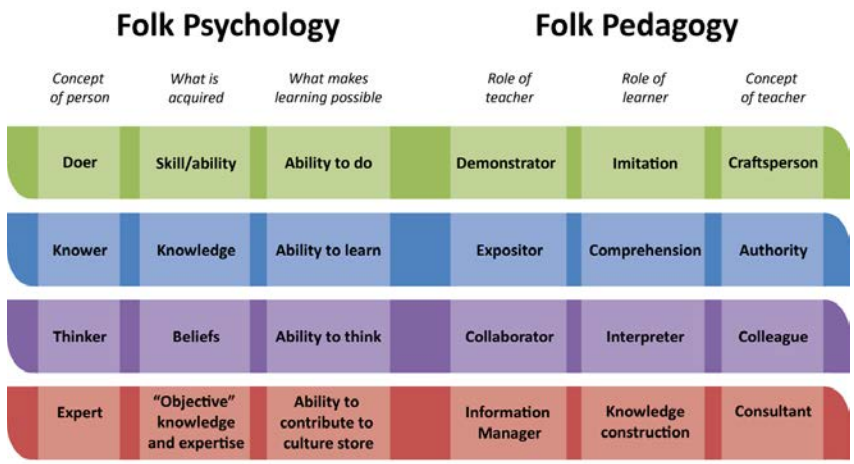


Figure 6. Comparison of folk psychology and folk pedagogy from Olson & Bruner. (1996 p. 24)

The first folk pedagogy model identified by Bruner is that of student as imitative learner. This model emphasizes the acquisition of know-how and forms the basis of apprenticeship wherein a master attempts to transmit a skill to a novice by repeated exposure and practice. This approach evidences the teacher's belief that (a) the student is able to learn that which is being demonstrated, (b) the student can learn by observing a demonstration, (c) the student wants to learn what is being shown, and (d) the student is actually trying to learn what is being taught. In order to learn via this method, the student must therefore understand the goals of the teacher, identify the means required to achieve those goals, and believe that performance of such means will result in successful learning.

Within this pedagogical interaction there is not much distinction between procedural knowledge, i.e. knowing how, and propositional knowledge, i.e. knowing that. Furthermore, reliance upon imitation as a strategy for teaching reveals an assumption that human competence consists primarily of skills and abilities as opposed to knowledge and understanding. According to this view of learning, competence can only be arrived at as the result of practice. This belief in learning through imitation echoes the atelier paradigm described by Oxman.

Bruner's second model, which emphasizes learning from didactic exposure, is grounded in the belief that students should be presented with facts and principles which they must then apply. This mental model of the learning mind assumes that the learner is ignorant of some rules or concepts that can be transmitted via presentation by the teacher. In other words, that which is to be learned exists in the mind of the teacher (and in books, databases, etc.) but not yet in the presumably blank slate, or tabula rasa, mind of the learner. Knowledge in this model is an explicit body of that which is known and can be accessed by looking up or listening. The ability to apply such knowledge presumably follows automatically from knowing the facts, theories, etc.

In this second model, learning is conceived of as the acquisition of propositional knowledge rather than the demonstration of procedural knowledge. Knowledge in this case is situated within the mind of the learner and is evidenced by mental efforts to acquire and explicate new knowledge. This model is particularly appealing because it eases the burden of assessing learning by offering opportunities for clear assessment of the achievement of learning objectives. Whether or not a student has learned a particular fact or principle can easily be subjected to testing (often in a standardized format).

Knowledge, according to this second folk pedagogy, is cumulative and results from the filling of the student's mind by the teacher, a one-way interaction where interpretation has no place. When learning fails to occur, it is the fault of the learner and their substandard mental abilities. This belief in knowledge as fixed and measurable reflects Oxman's second paradigm of the Bauhaus tradition wherein design principles formed the foundation upon which practice was built.

The third folk pedagogy identified by Bruner sees learners as thinkers and emphasizes the development of intersubjective interchange in helping the learner to think about his/her own thinking. In this model, the teacher considers the mind of the learner, how (s)he thinks and arrives at beliefs and understandings. Learners as thinkers are capable of constructing their own mental models based upon their own experiences and therefore maintain a great deal more than a blank slate. This "pedagogy of mutuality" (p. 13) recognizes that learners hold their own theories both about the world and about their capacity for constructing these theories in their own minds. The process of learning therefore involves discourse, collaboration, and negotiation of meanings as theories move into a shared frame of reference between teacher(s) and learner(s). Knowledge is not authoritative or pedagogic, rather it is seen as the product of interpretation, construction, and argument. This approach is decidedly learner-centered.

Bruner describes four recent programs of research into this perspective of teaching that are congruent with various research efforts into design ability and cognition. These areas of inquiry are primarily aimed at understanding the learning mind of the child and include intersubjectivity (how children learn to read what others think or feel), theories of mind (learning to understand other's intentional states including conceptions of truth), metacognition (how children think about learning and thinking), and collaborative learning (how children explicate and negotiate knowledge through discourse). The common theme in these programs (and those in design that they parallel) is the focus on understanding both the mind of the child/learner (or designer) and the organizing frameworks that shape the individual's understanding of their mind. This parallels Oxman's third paradigm which focuses on the development of cognitive processes of design reasoning and strategizing. Through discussion and interaction (i.e. in a studio environment) the human mind is capable of moving toward a shared frame of reference with others regardless of whether their points of view align.

Bruner acknowledges criticism of this approach due to its flexible interpretation of what constitutes knowledge. Similar to critiques of postmodernist contentions that accepts relatively subjective and unsubstantiated notions of 'truth', the question here arises as to how shared constructions of knowledge hold up against pragmatic epistemological beliefs that claims of 'truth' must be reasoned, justified and resistant to disproval. Bruner responds that "the very nature of the knowledge enterprise has changed in our times" (p. 15), a sentiment echoed by deign critics in previous sections regarding questions of what currently constitutes design knowing. It is the very nature of knowledge construction by a community that allows for its testing, interpretation, and eventual acceptance or rejection. This is precisely the pedagogical intention of the third model, to nurture the development of such cognitive capabilities in the learning mind.

The fourth model proposed by Bruner, which has no direct parallel in Oxman, is that of learners as managers of objective knowledge. It contends that teaching should help learners distinguish between personally held knowledge and that which is culturally constructed. Relying as much upon social discourse as historical precedent, the goal of this model is to help the student understand the difference between personally held beliefs and cultural assumptions about what is known. This leads to a deeper understanding of the nature of knowledge through a critical reflection on the relationship between individual and collective hypotheses and beliefs. Elements of this approach may fit into the third paradigm of Oxman depending upon the extent to which personal design practice and cognition is situated within a larger historical and global context. The figure below illustrates the four folk pedagogies described by Bruner in the context of the Oxman's paradigms. This figure is not a precise scientific description, rather it offers the researcher's interpretation of how these four folk pedagogies might be reflective of various design eras and paradigms of thought.

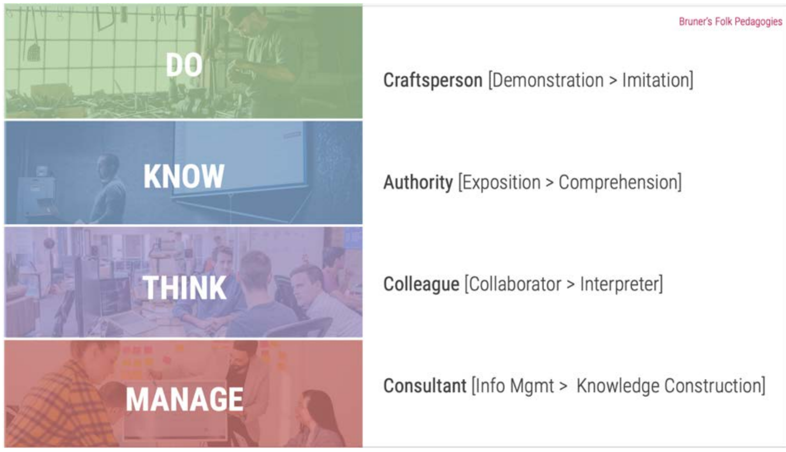


Figure 7. Comparison of Bruner's Folk Pedagogies with Industrial Design (education) evolution.

Folk pedagogies refer to explicit beliefs about teaching that are often grounded in implicit beliefs about learning. Argyris and Schon (1974) describe two different theories held by professionals. The first are theories-of-action, the way one describes how something (like teaching) should be done. Explicated personal assumptions about how one should act are not always congruent with the deeply held, intuitive beliefs that are evidenced by behavior (i.e. performance in the classroom). These tacit beliefs are known as theories-in-use and (in the example of teaching) are often informed by experiences as learners. The gap that lies between theories-of-action and theories-in-use is characterized by an incongruence which reveals an opportunity to learn more about one's teaching practice.

Bruner challenges educators to reconsider the folk pedagogies present in the classroom in order to evolve teaching practice for the benefit of both teacher and learner. This type of questioning by design educators represents the type of critical reflection required to catapult design education into its next paradigmatic shift. Without it, design education (and the designers it produces) runs the risk of historically repeating itself, which implies yet another extreme bipolar reaction rather than a reflective response grounded in a preferred vision of the future of the profession.

Barett (1997) uses Bruner's notion of folk pedagogy to explore moral dimensions of higher education. His study is heavily rooted a narrative mode of inquiry and reads very much like a story. Barett studied three professors from three flagship colleges at one institution: Arts & Sciences, Business, and Engineering. Each professor was observed once a week for an entire semester and interviewed six times for approximately 45 minutes to 1 hour. The interviews explored the following topics: professional and educational background, relationship between teacher and student, learning, teaching, higher education as a context for learning, and moral dimensions of education.

Barett utilized the interviews and observations to generate narratives that revealed specific folk pedagogies for each of the three professors and explored through them the moral dimensions inherent in each. In this way, Barett employed Bruner's concept of folk pedagogy and not the four folk pedagogies outlined above as a lens for understanding the moral discourse of the participants. The resulting report of this research reads like a narrative of three different protagonists, filled with their own words and the first-person analysis of the researcher, in what Barett refers to as "stories of action" (p. 20). The stories serve as evidence of the teacher's construction of meaning about their teaching beliefs and practice.

2.10 Research Problem and Questions

The previous nine sections serve as an orienting introduction to the evolution of pedagogical challenges in industrial design education and models that may serve as frameworks for further exploring them. The practice of industrial design is undergoing a transformation from a form-giving profession to one that relies heavily upon creative cognitive ability. The shift of value from design making to design thinking hence reveals a gap between existing pedagogical practices and preferred ones. This wicked problem requires a reexamination of predominant modes of teaching and learning—a clarification of the pedagogy problem— if any efforts at curricular reform are expected to be productive. In essence, the research problem that this study is undertaken to address is the lack of critical understanding of industrial design pedagogy, both existing and preferred, which is necessary for framing the problem of how to design industrial design education to meet the future needs of the profession.

The following research question therefore emerges to guide this inquiry: What do reflections by teachers and students reveal about existing and preferred industrial design folk pedagogies?

This question has been deconstructed into smaller sub-questions that allow for operationalization of the specific variables of the study and provide a framework for exploring the primary question:

1. What are the existing and preferred folk pedagogies in industrial design education?
2. What do existing and preferred folk pedagogies reveal about designerly ways of teaching?
3. How might understandings of folk pedagogies and designerly ways of teaching inform the (re)design of design education?

CHAPTER 3

RESEARCH DESIGN

As described in the previous chapter, the current body of knowledge about design teaching and learning lacks empirical support for a broad theoretical foundation. This study aimed to support evidence-based efforts to innovate and reform industrial design education by providing insights from individuals who currently teach and learn in product and industrial design courses within such programs in the United State. In addition, explicit theories of teacher action were investigated with purposively selected faculty from the same academic institution to uncover the narratives that shape such theories-of-action and how they are tacitly embodied in theories-in-use.

3.1 Purpose & Justification

The aim of this study is to generate new knowledge about pedagogical beliefs and behaviors in the industrial design education experience. This study involved two separate phases of data collection and analysis. Both quantitative and qualitative methodologies were incorporated into the research study in an effort to provide a fuller description of the breadth and depth of pedagogical beliefs and practices in the context of industrial design education.

The quantitative phase utilized an online survey instrument to operationalize the four pedagogies described by Bruner and to broadly explore tacit knowledge of design teachers and learners. These descriptive and prescriptive data served as empirical evidence of explicit and implicit theories-of-action and theories-in-use. Variance across survey responses was tested against multiple teacher and learner variables including age, years of experience, type of courses taught/taken, etc.

The qualitative phase of data collection and analysis included observations and interviews with two faculty cases in order to more deeply explore the thoughts and beliefs that shape teacher behavior. Case participants for the second phase of the study were determined following preliminary analysis of the survey data and consideration of potential factors influencing pedagogical variance. In-class observations and teacher narratives hence provided concrete descriptive examples of the pedagogic practices and beliefs that resided in a more abstract form in the online survey results.

3.2 Phase One: Online Survey

Given the lack of empirical precedent regarding description of design pedagogy, an online survey instrument was developed to gather information from both students and teachers about basic demographic information (i.e. age, number of years as student/teacher, course content and type, etc) as well as pedagogic beliefs and practices. The survey was constructed using multiple question types (open-ended, closed, Likert, and forced ranking). Analysis of survey data included descriptive statistics and qualitative coding for patterns that emerged from the open-ended data.

3.2.1 Online Survey Instrument Development. The online survey was designed to explicate both theories-of-action and theories-in-use by design educators and students. The survey in its entirety can be found in APPENDIX A. Its design included the following:

The first question of the survey asked the respondent to identify as learner or teacher, thereby separating responses into two datasets: one for students and one for teachers. Respondents were then asked to provide information about their teaching and learning context (i.e. age, years of experience, teacher training, types of classes taught/taken, sizes of classes, content area, nationality, learning location, institutional pedagogy, etc.). These questions provided contextualization of responses and allowed for analysis according to multiple variables. These questions were nearly identical for both datasets with the exception of occasional wording oriented towards teacher or student, and an additional section that solicited information about teaching experience.

This section contained two subsections to explore pedagogic beliefs and preferences utilizing different question strategies. The aim of this section was to capture respondent theories-of-action regarding design learning, the learning mind, and the role of teacher. Both of these sections framed questions within the folk pedagogy theory by Bruner that included four fundamental pedagogical orientations, from here on identified as 'Do', 'Know', 'Think', and 'Manage'.

The first subsection focused on existing pedagogical beliefs about design education and included six forced ranking statements. Each statement required respondents to rank four possible statement conclusions representing one of the four folk pedagogies. Only one number between 1 and 4 was allowed with 1 representing the least agreement and 4 representing the highest possible agreement. One statement related to design learning while three remaining statements described design students and two described design teachers. The four statement conclusions were randomized to minimize bias or influence due to order.

The next section included 20 statements that required respondents to indicate level of agreement utilizing a Likert-type scale (Babbie, 2001). Five statements were generated for each of Bruner's folk pedagogies. For each statement, respondents were asked to indicate level of agreement from the following four options: Strongly Agree, Agree, Disagree, Strongly Disagree. The choice of the 20 statements and the use of only 4 options were determined during the pilot of the survey instrument (see section 3.2.2

below). Statements were randomized during survey deployment to reduce potential effects from order and increase validity of responses.

This prescriptive portion of the instrument consisted of only one open-ended question. The aim of this section was to capture respondent theories-in-use regarding design learning, the learning mind, and the teacher's role. In essence, 'tips for teachers' served as operationalized performances of pedagogical beliefs about how teaching (and learning) should occur.

The respondent was asked to provide guidance to a novice teacher. In the case of the teacher respondents, the role of mentor was assigned and guiding principles for ideal teaching experiences or "I wish someone would have told me this when I started" was requested. For the learner dataset, the respondent was asked to complete the statement "If I were the teacher, I would…" with suggestions for ideal learning experiences. The online survey was designed to request a minimum of five tips and a maximum of ten tips per respondent.

3.2.2 Online Survey Pilot Study. Before the survey was deployed, two pilot surveys were administered in online form to students and faculty in the design school of a large university in the American southwest. The first pilot survey was completed by two faculty and two students. This initial exercise revealed that some wording was, as suspected, problematic and some instructions were not clear and easy to understand. Based upon feedback from the four participants from this initial pilot, the survey instrument was then redesigned and deployed again with a larger pilot sample. Some faculty offered extra credit in their large lecture courses for student participation, resulting in a large survey sample (n=246), though it should be noted that most of the students were pursuing degrees in design disciplines other than industrial design (i.e. interior design, graphic design, etc.).

At the end of the pilot survey, respondents were asked to indicate their willingness to join a focus group about the survey design by including their email address. The researcher's email address was also included so that respondents could send an email with feedback about the survey design. The researcher received five emails with feedback about the survey design and three individuals (one undergraduate student, one graduate student, and one faculty member) participated in a focus group about the survey design. Email recommendations included the use of the Basic Carnegie Classifications of higher education for determining the type of home institution as well as the addition of a "don't know" option for certain questions that offered only "yes" and "no" options.

The focus group offered a chance to clarify any ambiguous language of the survey. The focus group session was audio recorded (with participant consent) so that the researcher could consult the recording during survey redesign. Each participant was given a paper copy of the survey and asked to review it, marking with a pen any items that they wished to question or discuss. Then each section was reviewed in an open forum with all participants offering their input and interpretation of problematic wording until consensus was reached. For example, the very first question requiring respondents to select "teacher" or "student" was reworded as "student of design (present or past)" or "teacher of design (minimum one year as primary instructor of course)" to eliminate any ambiguity (particularly for those graduate students who serve as teachers and/or teaching assistants).

In the case of the second descriptive section, the pilot study included 28 items (seven for each of the four folk pedagogies) and a 'neutral' option. The researcher intended to remove eight items following pilot testing, so this section was discussed with the focus group participants and eight items were removed because of wording or lack of clarity of intention. Remaining items were also discussed to ensure that wording was clear. The use of a 'neutral' category was also discussed with the participants who believed that it allowed respondents to 'opt out' of really considering what the questions were asking and therefore become a bit 'lazy' about responding.

The pilot study also provided an opportunity to consider treatment of the final, open-ended tips section of the survey. Initially, a code was developed that relied upon the four folk pedagogies (i.e. 'Do', 'Know', "Think', and 'Manage') which was then applied to each of the tips. It became apparent that a layer of meaning was missing in the translation from tip to pedagogy code and that the codes felt forced onto the data without deeper consideration of the meaning inherent in the tips themselves. In order to better understand the beliefs and preferences evidenced by the tips, an alternative coding scheme was developed that included two phases of coding, one more grounded in the data itself and the second congruent with the folk pedagogy theory.

3.2.3 Online Survey Sampling Strategy. The survey was deployed through the online software surveymonkey and was accessible by following a hyperlink. Recruitment occurred online through targeted email correspondence (to chairs of 51 industrial/product design departments at post-secondary institutions which are listed in APPENDIX along with the recruitment email which can be found in APPENDIX) and publication to relevant listserves (i.e. PHD-DESIGN) and online design journals (i.e Design Perspectives, an IDSA newsletter with versions for both students and professionals).

A snowball sampling strategy was chosen to improve the likelihood of a significant sample size. Email recruitment letters were sent to those listed above with a request to forward the recruitment letter on to both students and faculty. Recognizing the possibility for a recruitment email to get overlooked or forgotten, the original recruitment letter was sent out on three separate occasions (one-two weeks apart) to the 51 department heads. In a few cases, the researcher received confirmation from the department head that he/she had taken the survey themselves and/or forwarded it on to students and faculty.

3.2.4 Online Survey Data Analysis. Data obtained through the survey instrument was analyzed for frequency of responses and organized so as to illustrate varying orientations towards the four folk pedagogies.

Responses to the initial question of the survey served as a method for separating the consequential responses into two datasets, one for students and one for teachers. Comparisons between the student and teacher datasets attempted to reveal any differences or similarities between the two in terms of pedagogical beliefs and/or preferences. Additional data from the teacher dataset was also analyzed for frequency in order to illustrate patterns of beliefs about institutional pedagogy from questions that were only available to the teacher respondents of the survey.

In section 2 of the survey, demographic information was analyzed for frequency and other descriptive statistics (i.e. mean, mode, etc.). This data offered a broad view of the learning and teaching make-up of survey respondents including the content and types of courses taken/taught, number of students in those classes, etc. Analysis for this section was undertaken separately for each dataset though most of the results were comparable across all respondents (i.e. gender percentages of students compared to gender percentages of teachers or frequency of class size taken by students compared to frequency of class sizes taught by teachers).

For the results of the forced ranking section in the descriptive section of the survey (the first subsection), the mean of each possible statement conclusion was calculated. For each of the six statements, the four possible conclusions were represented by numbers 1-4 with 1 indicating the least agreement and 4 indicating the highest possible agreement. For the two separate datasets the mean of each possible response (representing the four folk pedagogies) was calculated in order to render comparable the beliefs of students against those of teachers. In other words, this made it possible to see the extent to which students and teachers agreed about the fundamental goals of learning in design (or the role of the student, the teacher, etc.).

For the second subsection of the descriptive portion of the survey, the 20-item Likert questionnaire, each of the four possible responses was assigned a numeric value representing its level of agreement. Strongly Agree was coded as a '2', Agree was coded as '1', Disagree was coded as '-1' and Strongly Disagree was coded as '-2'. For each possible response the coded numeric value was multiplied by its corresponding number of responses. Then totals from all four possible responses to one statement were summed and divided by the total number of responses to determine the mean value for that particular statement (i.e. a smaller negative number like -1.3 or .2 represented less agreement than a larger positive number like 1.6). This was done for each of the 20 statements and was done separately for the student and teacher datasets. This method allowed for comparison of each statement (and each statement within its group of similar folk pedagogy orientations) to be compared across student and teacher datasets.

The final portion of the survey, the open-ended section requesting tips for teachers, was analyzed qualitatively in two phases (based upon pilot analysis efforts described in section 3.2.2). The first phase included what Babbie (2001) refers to as 'open coding', wherein codes are developed through close scrutiny of the data and code generation does not rely upon any prior theory. This allows for discovery of similarities and differences in the data as well as an exploration, by the researcher, of assumptions about the phenomena under scrutiny. Some codes were singular while others involved secondary codes for clarification, like the ROLE code that was assigned whenever a tip prescribed a particular role to the teacher. There were, of course, many roles prescribed so, there were multiple qualifying codes for this one code.

Once tips had gone through an initial phase of open coding, the open codes were then subjected to a second phase of coding according to the four folk pedagogies under consideration. A coding key was developed during the open coding which included both the code and a description of its application. Only the coding key, and not the raw data to which it referred, was used in the secondary analysis. In this way, the assignment of folk pedagogy codes to the open codes applied to raw data offered the possibility of understanding the data through the lens of the theory without forcing the raw data into that framework from the outset. Figure 10 illustrates the ROLE open code and qualifying code as well as the corresponding folk pedagogy codes. Essentially, this protocol allowed the patterns of raw data to emerge before they were subjected to an ordering theoretical framework. The entire coding protocol for the tips section is viewable in APPENDIX D.

ROLE	AUTH	authoritative,deliverer of content, procedural knowledge	KNOW
ROLE	COLLAB	collaborator, colleague	THINK
ROLE	DEMO	to demonstrate, model, show them how	DO
ROLE	GUIDE	guide, mentor, consultant, facilitator, encourager	MANAGE
ROLE	TENFR	teacher not friend	KNOW
ROLE	TRAIN	train for world of work, act as boss, give orders	KNOW

Figure 8. Example of open and folk pedagogy codes applied to prescriptive survey data analysis.

3.3 Teacher Case Studies

Although the survey data provided a broad understanding of how teacher and student perceptions of pedagogy might be understood through the lens of the folk pedagogy theory, the nature of the survey instrument offered an interpretation of the theory in an abstracted form. In other words, perceptions of pedagogy were couched within an abstract form of statements versus experiences in a classroom context. According to Yin (2017, p. 82), case studies help a researcher to "reveal the multiplicity of factors [which] have interacted to produce the unique character of the entity that is the subject of study".

In an effort to address this ambiguity and provide flesh to the skeletal understanding of folk pedagogies provided by the survey data, a multiple case study approach was undertaken to explore, via concrete example, how teaching acts could be understood using the folk pedagogy framework. Additionally, these case studies served as examples of how different pedagogical approaches might be interwoven throughout a single teaching session or within a single teacher. (Grauer, 2012; Yin, 2017)

3.3.1 Teacher Case Studies Methodological Approach. The goal of the case studies was to explore how folk pedagogies are enacted in the design classroom and how these teaching behaviors embody professed beliefs about teaching. In order to understand both teacher beliefs and teacher practices, a qualitative study involving both teacher observation and interview was therefore undertaken with two teacher cases.

Research design of the case studies integrated the critical considerations offered by Corcoran et al. (2004) in their review of case study research for higher education. They suggest paying rigorous attention to purpose (of the study and chosen cases), roles (clearly articulating choices and decisions), tensions (between the universal and contextual), and challenges (which evoke potential for transformation).

Each teacher participant was observed during one class session per week for five weeks during the spring semester. Observations were documented utilizing a field note form that can be found in APPENDIX E. Field notes captured teacher behavior in terms of verbal utterances and physical or virtual demonstrations as well as strategic moves like questioning, directing, and guiding. Student responses were also recorded and considered in the consequential coding of the teacher behavior. Handouts, quizzes, and other relevant materials used in the classroom were also collected. Duration of the observed courses ranged from one hour to three hours. Written field notes were photocopied for consequential analysis.

Documentation of teacher observations proceeded in a chorological format and attempted to include both teacher behavior and teacher tools. This often meant that a seemingly singular event had multiple acts contained within it. For example, a teacher advancing a slide in a PowerPoint presentation and then speaking about the content of the slide was documented in terms of the media used (the slideshow) as well as the content and strategy of the statements that accompanied it (i.e. question read from slide by teacher, answer provided by teacher and then expanded upon with accompanying visual examples referred to in the same slide). In this case, the unit of analysis for the field notes emerged as individual acts and tools that were often clustered in assemblages of intentionality (i.e. a single slide was imbedded within a grouping of multiple elements aimed at communicating a single principle).

Utilizing a series of four semi-structured interview guides created by Barret (1997) for his study of folk pedagogies and moral dimensions of four different educators (see section 2.8.4), each teacher participant was interviewed for approximately one hour on four separate occasions. The final two interviews of Barret's study were not included here as they focused on moral dimensions of pedagogy, a subject not relevant to this inquiry. The topics of each interview included (in chronological order) professional and teaching background and training, the relationship between teacher and student, learning, and teaching. Interviews were audio recorded for accuracy and transcribed for analysis. As in the Barett study, the interviews offered a narrative account from the teacher about their teaching practices and beliefs. Stories of action from the classroom hence provided reflective reconstructions of pedagogical beliefs about the learner's mind and revealed the meaning making practices of the teachers.

Classroom observations complemented the interview script and offered the chance to explore illustrative examples of how accurately the teacher described their teaching practice. In addition to the interview questions outlined in the script, flexibility of interview format allowed for deviations from the guide in order to reference researcher observations of the teacher/interviewee and provided the chance for the interviewee to situate their responses within the context of the lived experience of the classroom through questioning by the researcher.

3.3.2 Teacher Case Studies Sampling Strategy. The purpose of the case studies was to provide tangible examples of the folk pedagogies as observed in teacher behavior and as described in teacher narratives. Purposive sampling was used to identify and recruit two educators who are currently teaching in product or industrial design departments at a school of design in the southwest United States. Though a larger number of cases may have offered more depth and breadth to the study, the primary goal of the cases for this study was to take initial steps towards identifying and describing designerly ways of teaching via the folk pedagogy theory. In other words, this study does not attempt to assert generalizable conclusions about how these pedagogies are or should be used, rather it is an attempt to explore how the lens of folk pedagogy theory may be used to generate deeper (and currently unavailable) understanding about the practices and beliefs of design educators in the classroom/studio in light of survey data about existing and preferred pedagogical practices. Additionally, teacher reflections provide narrative accounts of their theories-of-action and offer insight about where theories-in-use are generated.

Based upon survey data and analysis, as well as researcher attempts to operationalize the folk pedagogies for the survey instrument, it was deemed unlikely that four separate cases could be selected to represent each of the four folk pedagogies. In fact, that was not the primary motivation for the case studies (as described above). Rather, the case studies were undertaken as preliminary efforts to understand how the different folk pedagogies might operate similarly and differently in the classroom and in the mind of the teacher, and what factors may influence these practices and beliefs. To that end, various criteria for similarities and differences were generated to aid in the selection of the faculty cases.

Before describing these criteria, it is first necessary to explicate researcher assumptions that framed the development and application of the criteria in case selection. The first assumption was that it would be possible to identify more than one folk pedagogical orientation within one faculty case (i.e. the same teacher may exhibit or describe both 'Do' and 'Think' pedagogies in their practice). Secondly, it was also assumed that various factors may influence the folk pedagogical orientation of a teacher. For example, teaching beliefs and practices may be impacted by length and type of professional and teaching experience. Other potentially influential factors included content of course, type of course (i.e. lecture versus studio), level of course materials and students (i.e. undergraduate or graduate), and size of class (i.e. less than 50 or more than 100). Given the historical development of the industrial design profession as well as its educational models (see sections 2.1 through 2.6), the researcher also assumed it possible that a teacher who had been exposed to traditional industrial design education models followed by exposure to professional practice in industry might approach teaching in a different way than an educator with a different educational and professional background.

Given the assumptions espoused above, criteria of similarity and difference were generated to inform the selection of two faculty cases. Criteria of similarity hence included the following: must be teaching students enrolled in a NASAD-accredited industrial design program (preferably the same one in order to eliminate the possibility of departmental pedagogy as a confounding variable), must teach in a variety of class types and sizes (i.e. lecture/studio and small/large), must have experience teaching both undergraduate or 'lower-level' students as well as 'upper-level' and graduate students, must have a minimum of five years of teaching experience from which to draw reflections about teaching practice, and must exhibit a willingness to reflect upon and discuss teaching practice. Criteria of difference included the following: professional and educational background (i.e. industrial design or not), instruction of traditional industrial design content (i.e. curricular content outlined by NASAD for industrial design programs). Table 1 below illustrates how these criteria were operationalized in the purposive sampling of the two faculty cases recruited for the case studies.

The participants for the teacher case study were asked to generate a pseudonym for themselves for this study. From these pseudonyms, only the initials were utilized as identifiers during data collection. The teacher participant identified as Case1 in table above is referred to as JA in the data and in this document. The teacher identified as Case 2 in the table above is referred to as RP in the data and in this document.

Table 1.

Criteria Applied in Selection of Faculty Cases

Criteria	Case	Case
Teaching in NASAD accredited higher education program	X	X
Teaching variety of course types (i.e. studio, lecture, etc)	X	X
Teaching variety of course sizes (i.e. +/- 20 students up to 200	X	X
Teaching variety of student levels (i.e. undergraduate and graduate)	X	X
Teaching for minimum of 5 years	X	X
Willingness to participate in study and reflect upon teaching practice	X	X
Educational training in industrial design	X	--
Professional experience in industrial design industry	X	--
Teaching NASAD-recommended curricular content for industrial	X	--

3.3.3 Teacher Case Studies Data Analysis. The teacher participants for this study teach multiple classes in a given semester. For this study, faculty case 1 was observed in two separate but related courses in alternating weeks. One week the teacher was observed teaching a lecture section of a required undergraduate, 'lower division' course about Basic Design Principles. In alternating weeks, the teacher was observed teaching one of the many studio sections required to accompany the lecture course.

Teacher case 2 was observed in the same lecture course each week. This decision was based upon a consultation with the teacher during which it was communicated that the other studio courses being taught at the time were co-taught with other instructors who tended to play a dominant role in controlling the curriculum. The teacher participant for this study indicated that (s)he played more of a consultant role in those courses and therefore felt that the lecture course that (s)he had designed and taught for more than 20 years was more indicative of pedagogical practices.

Observational field notes of both teachers were photocopied in order to maintain integrity of the original records. Copies of the records were then analyzed for thematic content and, once again, an open coding approach was used to develop—from the data themselves—codes to describe what was observed in the classroom. These codes were then organized into a descriptive coding protocol. This protocol was then subjected to the theoretical lens of folk pedagogy wherein each data-generated code was assigned one of the four possible folk pedagogy codes. For example, the first round of coding resulted in the code PRINC (referring to principles) and the subcodes V for vocabulary, D for definition, IT for If/Then and so on.

After coding was completed, these codes were then subjected to another round of coding wherein each was assigned a folk pedagogy code that was indicated by a term and a color. So, back to the example, "PRINC D" and "PRINC V" were coded as "Know" because they relied upon the transmission of basic facts or rules from a standard canon of knowledge. Alternately, PRINC IT was coded as "Think" because it involved the use of a different pedagogical intention to get students thinking of the potential cause and effect relationship between the knowledge and its application. Figure 11 offers an example from the coding protocol of how the PRINC code and its qualifying codes were coded through the lens of the four folk pedagogies. This process of initially doing a round of open coding of raw data followed by secondary coding of those open codes with folk pedagogy codes was undertaken twice and both coding protocols can be viewed in their entirety in APPENDIX F and APPENDIX H.

PRINC	Principles, concepts, guidelines	D	Definition/Description/Concept	KNOW
		V	Vocab/Lexicon	KNOW
		IT	If/Then	THINK
		PB	Personal Belief	THINK
		C	Choice, experimentation, trial & error	MANAGE
		R	Reasoning, justification	MANAGE

Figure 9. Example of open and folk pedagogy codes applied to teacher observation data.

In accordance with recommendations by Miles et al. (2014) to undertake data analysis early in the research process, observation data was coded often and typically closely followed the data collection process with each weekly observation coded within two days of its completion. A memoing technique was utilized to capture questions and comments that emerged during the coding about observed phenomena and assumptions involved in the development and application of various codes. Once the initial open coding was complete, the coding protocol was then coded utilizing the four folk pedagogies as codes (i.e. 'Do'- green, 'Know'- blue, 'Think'-purple, and 'Manage'- red).

After this first effort was completed, it became apparent to the researcher that the emergent coding process may have resulted in inconsistent application of the various codes and that the meaning of codes applied to earlier data may have evolved to have different meanings over the course of many weeks of coding or that new codes had been created in later phases that had not been applied to earlier data. Additionally, the stream of codes for a single observed class session did not account for the discreet and distinguishable phases and transitions in the class (i.e. transitioning from one slide to the next or one activity to the next). For this reason, the entire two-part process of coding observations was undertaken a second time in an effort to (1) improve the consistent application of codes, (2) demonstrate the discreet actions and intentions for clusters of teaching events and (3) address any theoretical or methodological concerns revealed in memos from the initial coding attempt.

In the first coding protocol, for example, presentations (of images, artifacts, verbal examples, or textbook materials) were open coded as PRES then qualified by, respectively, I, A, VX, or TB. These were then given the folk pedagogy code of ‘Know’ based upon the researcher assumption that the presentation of an example illustrated the delivery of knowledge from an available canon by the teacher to the student. However, during observations it became clear that the act alone of presenting an image or artifact did not necessarily reveal any distinguishable pedagogical intent.

During the second round of coding, therefore, codes such as PRES, MEDIA (which was added in the second round), RFS (also added in the second round), and HUM (Humor) were not given a folk pedagogy code. Rather, a greater effort was made to ensure that open coding explored the pedagogic intention surrounding these actions. This often meant that a seemingly singular act, like advancing a slide and reading the definition on it, was given multiple codes to address the medium, the definition, the teacher behavior, etc. In other words, PRES was not given a folk pedagogy code, but other codes included in the cluster of codes for that grouping were given a folk pedagogy code. See Figure 12 below for a before and after example from the two rounds of coding.

LINK	RW	KNOW
PRES	I	KNOW
QUEST	N	KNOW
STORY	3	THINK
DIR	T	KNOW

MEDIA	P	
LINK	RW	MANAGE
PRES	I	
STORY	3	THINK
QUEST	N	KNOW
QUEST	N	KNOW
SUGG	P	KNOW
PRINC	V	KNOW
DIR	T	THINK

Figure 10. Example of first and second round of coding from observation data.

A third studio class of participant JA was also included in the data for this participant. This class was dedicated entirely to students working on an upcoming project and getting feedback and consultation from the teacher. The teacher kept an audio recorder in his pocket during this class and transcriptions of these consultations with students were analyzed to illustrate the one on one interaction between student and teacher. In many cases, the audio recording was muffled and the consequential transcription was of poor quality resulting in a limited amount of data.

Transcriptions of the eight interviews (four for each teacher case participant) were utilized to explore how each teacher storied their pedagogical beliefs as they reflected upon their own educational and professional background as well as their pedagogical intentions. The interviews offered a richer picture of the pedagogical intentions behind the teaching actions in the classroom. They also revealed historical development of these beliefs.

Analysis of teacher interviews involved the identification of pedagogical intentions revealed in stories of the classroom. Interview responses were coded using the four folk pedagogy codes in an effort to identify any potential patterns and to render the analysis comparable to the classroom observations. The basis of these codes was derived from the experience of coding the observation data so that the logic of that coding schema carried through into the interview data as well.

Because these design educators are not necessarily designing “objects”, understanding of the designerly modes of teaching were explored via the manifestation of their moves, experiments, choices and codes. In other words, the “objects” of the teacher’s design process was evident in their syllabi, projects, presentations, explanations, interactions, classes and overall course design, etc. (Dillon & Howe, 2003).

Consideration was given to the observed practices of the teacher and to understanding how the interview narratives might serve as explanatory vehicles for teaching practices or how they might reveal specific orientations to the learner's mind. After the initial coding was completed using the Bruner's Folk Pedagogies lens, another round of coding and narrative construction provided a deeper layer of understanding the relationship between teacher's theories-in-action and theories-in-use.

Gudmundsdottir (1995) described teachers' stories as cognitive artifacts, i.e. the objects of processes designed to make meaning. Thus, narrative construction was used as a method of analysis to construct stories-as-artifacts for understanding the pedagogic content knowledge expressed by teachers. These stories-made-of-stories mimic the "stories of action" created by Barrett (1997) in his dissertation study about the moral dimensions of folk pedagogies. They are also inspired by the narrative approach to constructive analysis taught by Goodall (2008) and modelled by educational researcher Tom Barone in his book, *Touching Eternity* (Barone, 2001).

CHAPTER 4

RESULTS OF DATA ANALYSIS

This section describes the analysis of data generated from the online survey (see section 3.2) and the teacher case studies (see section 3.3). Analysis for the two phases of the study will be treated separately here though the discussion and conclusion section (5.0) will consider what the analysis of each means in the context of the other.

4.1 Purpose and Justification

As described previously, the purpose of this study was to collect data that would describe both existing and preferred orientations towards pedagogy in industrial design education. This involved the survey collection of both descriptive data that espoused existing beliefs, and prescriptive data that espoused preferences. The teacher study provided a deeper look at two educators and how the four folk pedagogies might be embodied in classroom behaviors and teacher reflections. The following analysis is therefore offered as initial steps taken to adequately frame the problem of what gaps exist between existing and preferred pedagogical models of industrial design education.

4.2 Results from Data Analysis of Online Survey

The online survey was completed by 209 respondents including 145 students and 62 teachers. A complete response criterion was utilized to remove the entire response set from any respondent that did not include answers to every question of the survey. This resulted in the final survey sample used for this analysis which included 158 respondents, including 108 students and 50 faculty. The following section will describe the respondents themselves in terms of their educational background and (for the teachers) teaching and professional experience. It will then provide an analysis of the responses to the descriptive and prescriptive portions of the survey.

4.2.1 Learning Orientation of the Online Survey Respondents. As already described in the previous section, of the 158 respondents to this survey 108 identified themselves as students of design (present or past) and 50 identified themselves as teachers of design (minimum one year as primary instructor of course), see figure 13 below. These designations served to separate the entire respondent set into two distinct datasets for analysis, one for students and one for teachers.

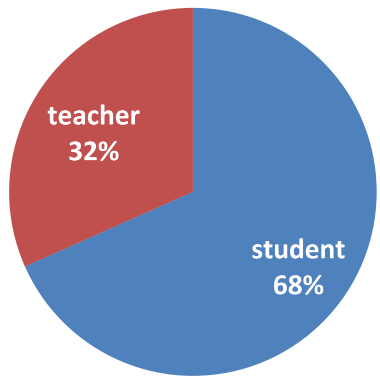


Figure 13. Online survey respondent learning orientation that generated two separate datasets.

4.2.2 Results Regarding Respondent Demographic Information. Various demographic and professional/vocational information was collected from survey respondents. This section will present the results of this analysis for both the student and teacher data sets. While similar information was collected from both respondents types, additional information was also collected from the teacher respondents regarding teaching and professional experience as well as pedagogical beliefs about the institution in which they teach.

Respondents were asked to identify their gender. Of the 158 respondents, 104 (or 66%) reported being male while 54 (or 34%) reported being female. The figure below illustrates the comparable analysis of respondent gender for each data set separately. For the student dataset (n=108), 66 respondents reported as male while 42 responded as female. For the teacher dataset (n=50), 38 respondents were male and 12 respondents were female.

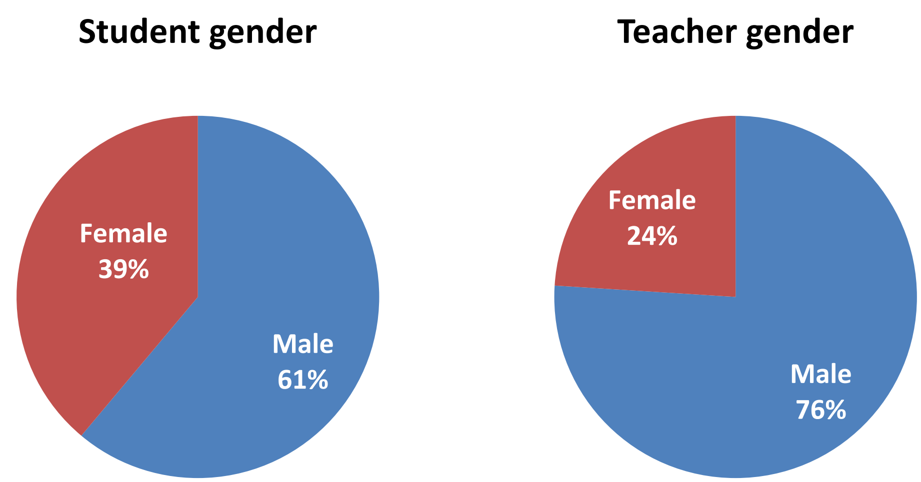


Figure 14. Gender identified by respondents for both teacher and student datasets.

Respondents were also asked to identify their age. The mean age for the entire dataset (n=108) was 30.52 years of age. The mean age for the student dataset (n=108, R=18-46 yrs.) was 22.60 years of age and the mean age for the teacher dataset (n=50, R=28-70 yrs.) was 45.00 years of age.

Survey respondents were also asked to indicate their level or status as either student or teacher. Students were provided the following options: Undergraduate Student, Graduate Student- Master's program, Graduate Student- PhD program, Recent Graduate (past year), Professional Practitioner (graduated over one year ago). The majority of student respondents (78%) were undergraduate students. Teachers were offered the following options:

Faculty Associate, Lecturer, Adjunct Faculty, Visiting/Guest Lecturer, Visiting Assistant Professor, Assistant Professor, Associate Professor, Professor, Administrator, Professor and Administrator. The teacher respondents displayed more variance across response with the majority identifying as professor (24%), assistant professor (20%) or adjunct faculty (20%). The responses to this question according to the two datasets are illustrated in figures 15 and 16 below.

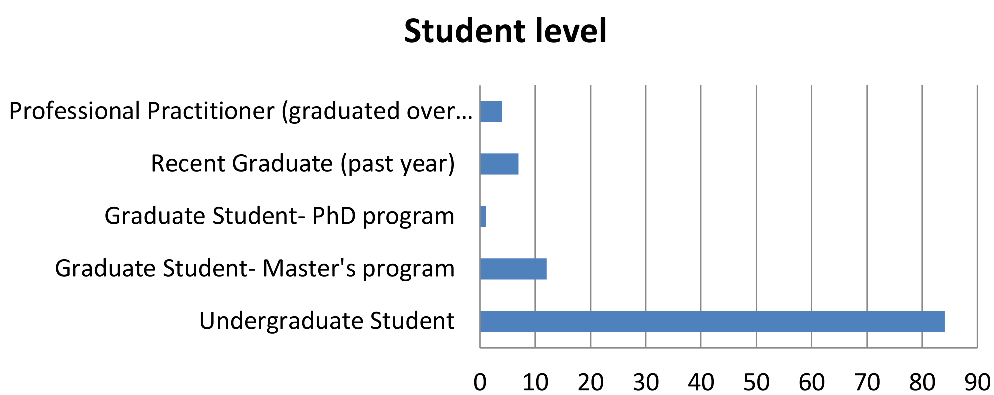


Figure 15. Online survey responses for student level (n=108).

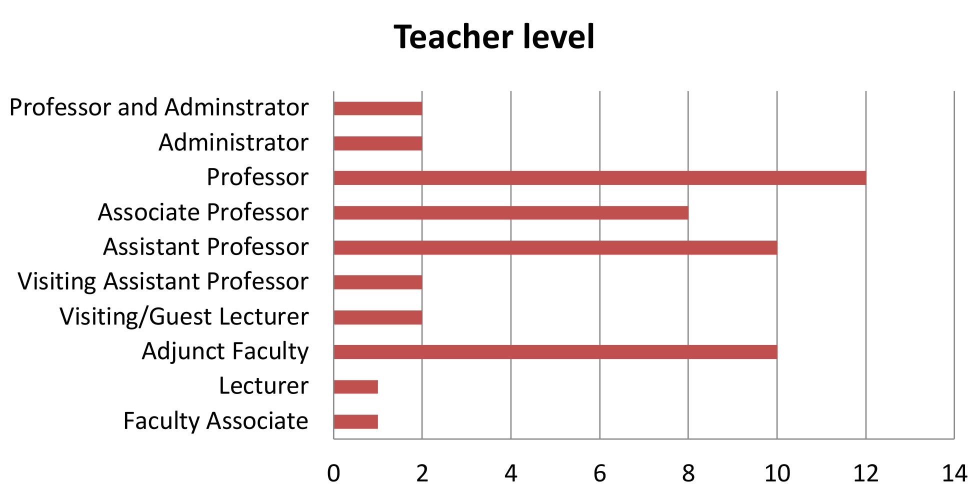


Figure 16. Online survey responses for teacher level (n=50).

Respondents were asked to indicate which course content they had either taken (for the student dataset) or taught (for the teacher dataset). This question provided another layer of understanding the educational background and experience of the respondents. Figures 17 and 18 below illustrates the results of this question for both datasets including number of responses to each. Respondents were asked to check all that apply so the total number of responses exceeds the number of respondents for each possible response.

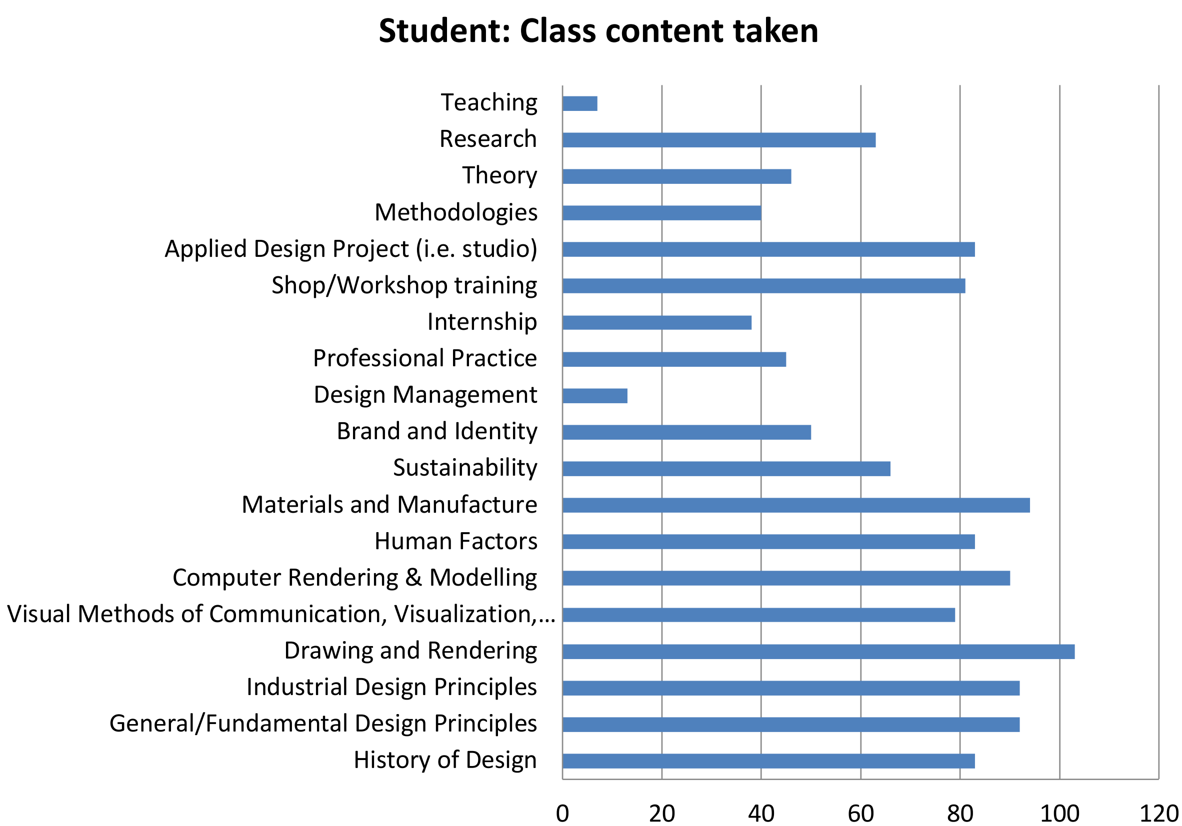


Figure 17. Student responses regarding content of courses taken (n=108).

These results indicate that the most commonly reported course content for students are 'Drawing and Rendering' (95%), 'Materials and Manufacture' (87%), 'Computer Rendering and Modelling' (83%) as well as courses relating to design principles (both at 85%). Less likely course content that students were exposed to include 'Teaching' (1%) and 'Design Management' (12%).

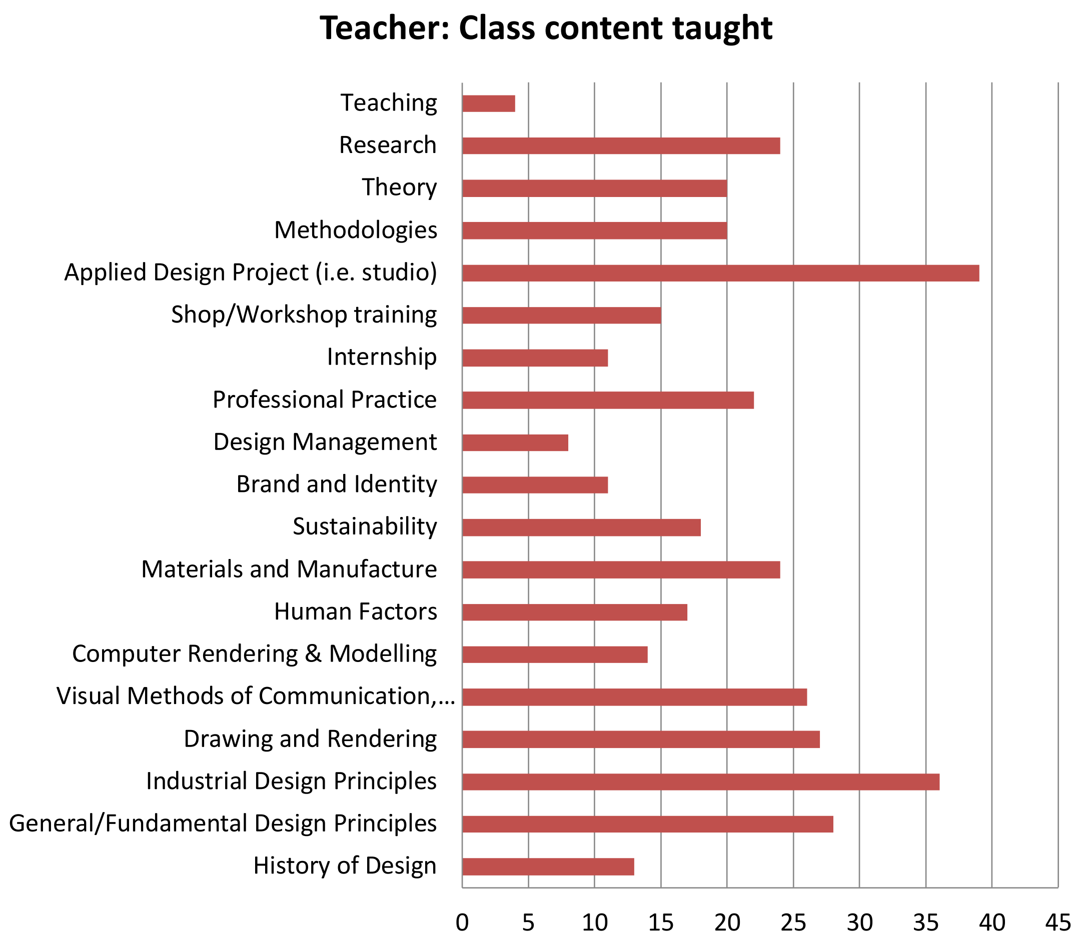


Figure 18. Teacher responses regarding content of courses taught (n=50).

Teacher responses reveal patterns of reported course content taught that are similar to what the students report taking. For example, the majority of teachers (78%) reported teaching courses in 'Applied Design Studio' while 77% of students reported this course. The principles courses which 85% of students reported taking were reported by 72% (for 'Industrial Design Principles')56% (for General Design Principles) of teacher respondents.

Respondents were also asked to indicate the types of courses taken or taught. Industrial design curricula include various course types, including studio courses and lecture courses for example. This data provides a picture of the frequency distribution of course types for the respondents. Again, respondents were asked to select all applicable responses. In both cases the studio and lecture course were the most frequently cited responses with online and practicum courses being the least frequently reported.

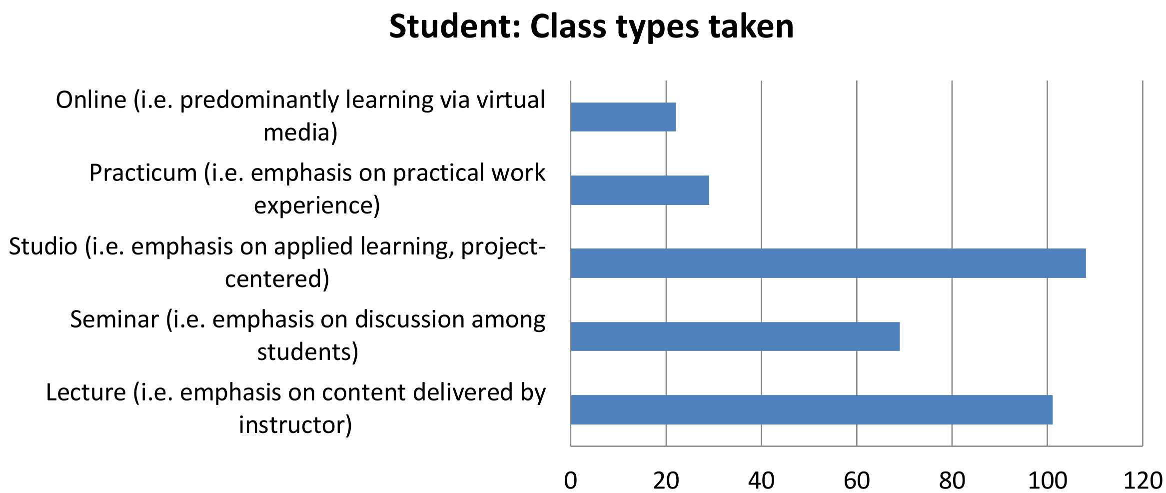


Figure 19. Student responses regarding types of course taken (n=108).

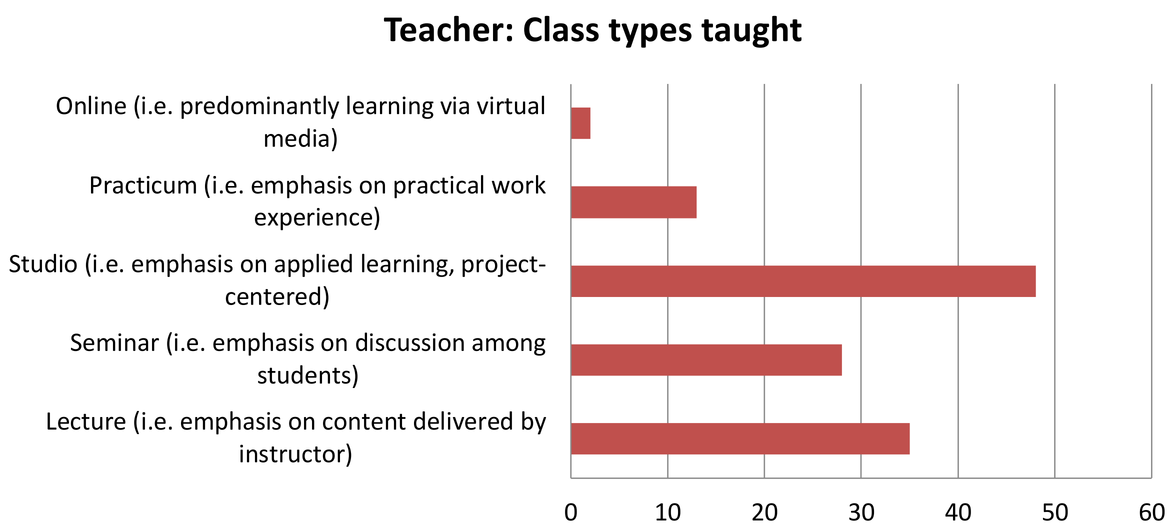


Figure 20. Teacher responses regarding types of course taught (n=50).

As illustrated in the figures above, 'Studio' courses were the most commonly reported by students (100%) and teachers (96%). 'Lecture' courses were reported by 94% of the students and 70% of the teachers. 'Seminar' courses were the third most commonly reported course type at 64% by students and 56% by teachers.

Additional information about classes taken and taught that was requested from survey respondents included the size of classes taken. Figures 21 and 22 below illustrate these results.

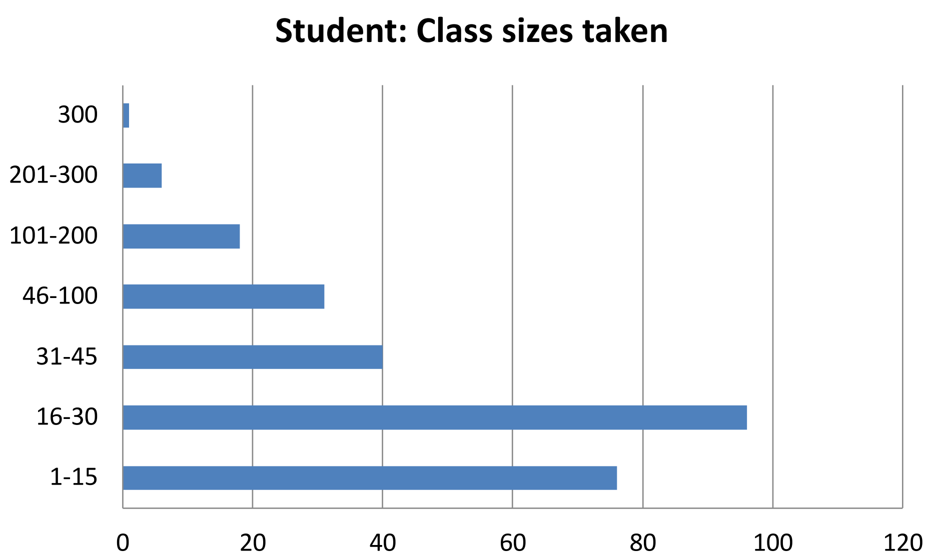


Figure 21. Student responses regarding sizes of courses taken (n=108).

The most commonly reported class size was the 16-30 student class size which was reported by 89% of student respondents. The even smaller class size of 1-15 students was reported by 70% of students. Larger classes were less commonly reported, i.e. '31-45' by 37%, '46-100' by 29%, '101-200' by 17%, '210-300' by 6% and only 1% reporting have taken a course with more than 300 students.

Teacher responses for sizes of classes taught were similar to the results from students. The most commonly reported class size taught by teacher was '1-15', reported by 90%. The most common class size for students, '16-30', was reported taught by 80%

of teacher respondents. Remaining class sizes were less frequently reported, i.e. '31-45' by 24%, '46-100' by 16%, '101-200' by less than 1% with no on reporting having taught courses larger than 200 students.

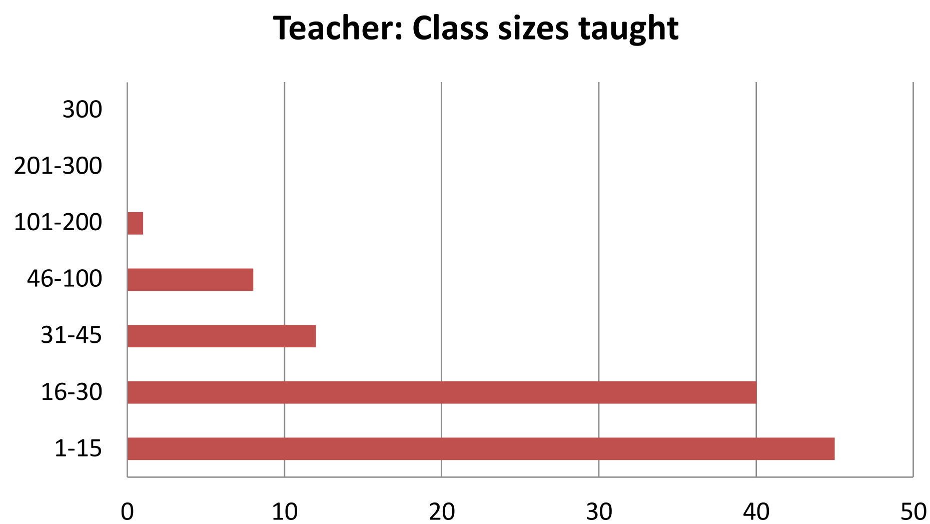


Figure 22. Teacher responses regarding sizes of courses taught (n=108).

As previously indicated, most question items for the student and teacher datasets were the same. The following results, however, were generated from a section of the online survey only administered to teacher respondents. The mean age for teacher respondents was previously reported as 45 years of age (R=28-70 yrs). Teachers were also asked to report their number of years of professional experience (M=16.4 yrs, R=1-37 yrs) and their number of years of teaching experience (M=10.1 yrs, R=2-45).

Teacher respondents were asked to describe their institution utilizing Basic Carnegie Classifications. The majority of respondents (total of 72%) indicated that they teach in a Doctorate-granting University (36%) or a Baccalaureate College (36%). 24% of respondents teach in a Baccalaureate College and only 4% reported teaching in a Special Focus Institution.

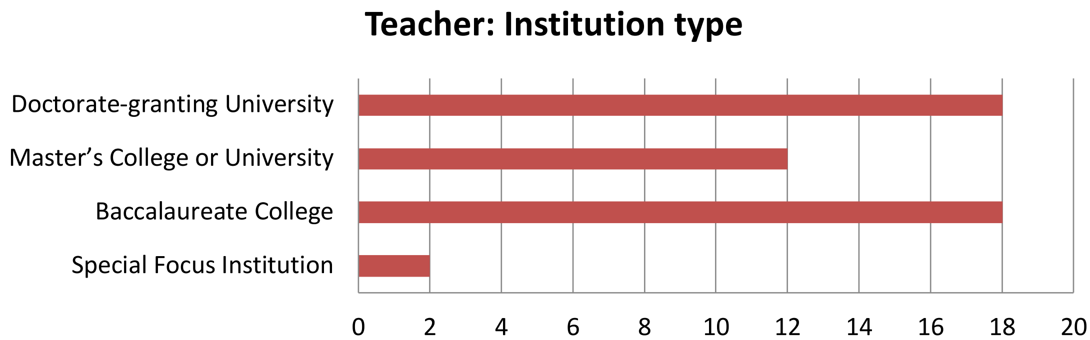


Figure 23. Teacher responses about institution type using Basic Carnegie Classifications (n=50).

Teachers were also asked to indicate if their institution or program was accredited by National Association of Schools of Art and Design (NASAD) which establishes national standards for industrial design degree programs. Most of the teacher respondents (84%) reported that their programs are accredited by NASAD. Of the remaining respondents, 10% indicated their program was not NASAD accredited and 6% did not know.

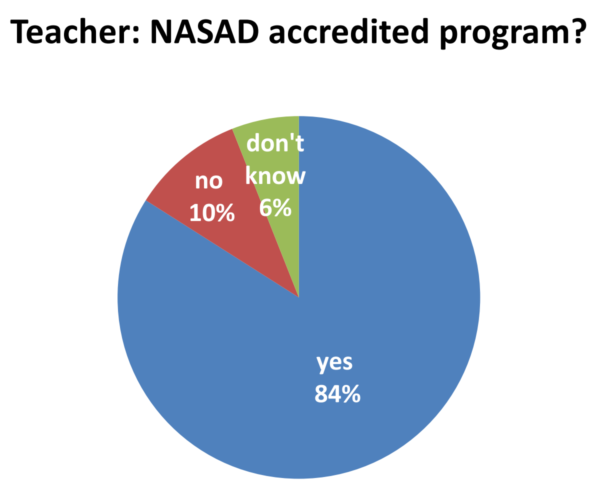


Figure 24. Teacher responses regarding NASAD accreditation of program (n=50).

Teachers were also asked to indicate which other programs were typically housed in the same College or department as the industrial design program. For this question respondents were asked to select all appropriate options. As figure 24 illustrates, the most common program to be found within the same department as industrial design is Graphic Design (reported by 72% of respondents), followed by Fine Arts (66%), Interior Design (58%), and Architecture (52%). Less common programs included Applied Arts (38%) and Engineering (26%).

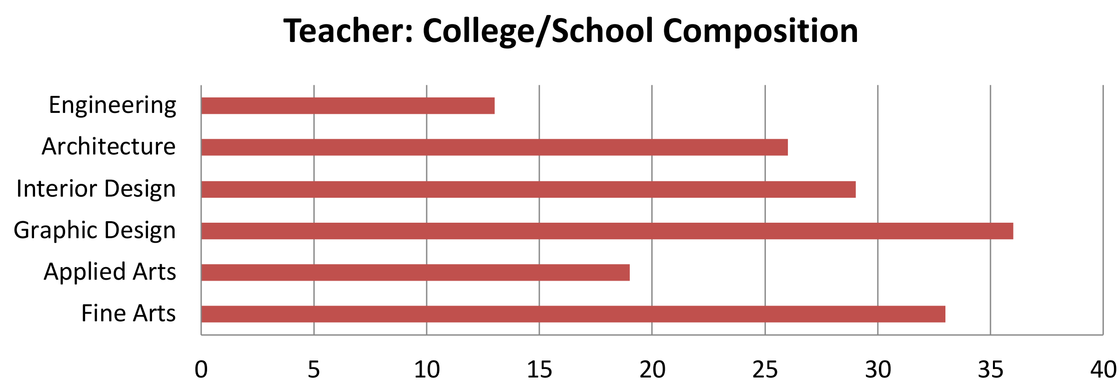


Figure 25. Teacher responses regarding types of programs also housed in same department with industrial design (n=50).

Teachers were also asked to respond to a question about their experiences with course design. Respondents were asked to check all experiences that applied to their own teaching from those statements provided. As seen below, most teachers (90%) indicated that they had 'designed a course 'from scratch'' and 'cotaught a course with another instructor'. Also common was 'modified or revised a course designed by another educator' reported by 80%. Over half of the teachers reported that they had 'taught an interdisciplinary course' (62%) while 56% reported having 'taught a course designed by another educator' and 46% have 'taught a graduate level course'. Only 40% reported having 'taken any teacher training courses, workshops, events, etc.'

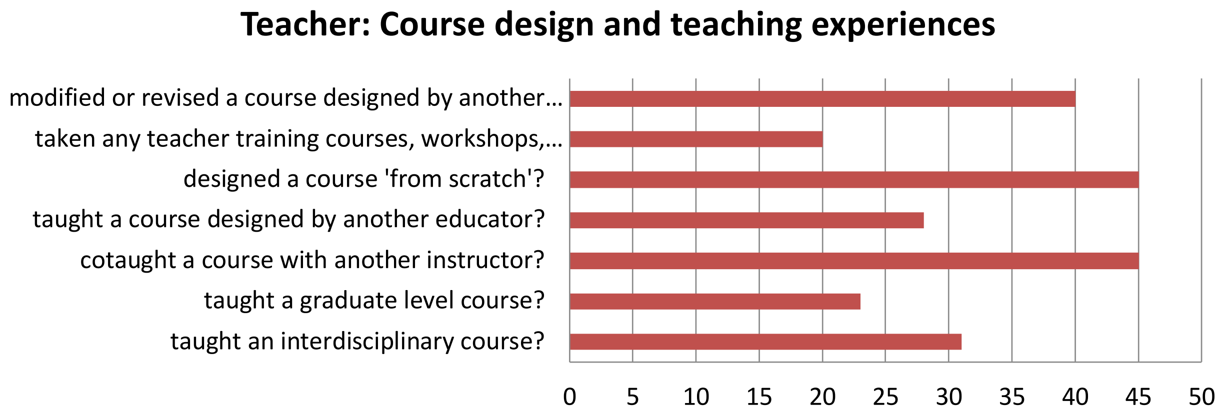


Figure 26. Teacher responses about various course design and teaching experiences (n=50).

The last question posed only to teacher respondents dealt with pedagogic practices and departmental teaching context. Respondents were asked to indicate their level of agreement with each statement according to a Likert-type scale with the options of 'Strongly Agree', 'Agree', 'Neutral', 'Disagree', and 'Strongly Disagree.' . Figure 26 below illustrates the results of this section.

The two statements that generated the strongest agreement were 'I regularly reflect on my teaching practice' and 'I modify the classes I teach from one semester to the next' with 48 of the 50 respondents (96%) indicating either Strongly Agree of Agree for both. The next strongest agreement was reported to the statement 'I often experiment with different teaching methods' with 94% indicating either Strongly Agree of Agree for each. The strongest disagreement was evidenced by 46 respondents (92%) selecting either 'Strongly Disagree' or 'Disagree' to the statement, 'I rarely discuss teaching approaches with my colleagues.'

In terms of departmental pedagogy, agreement varied across responses. For example, for the statement 'The pedagogic goals of the department are unclear,' 56% of respondents either disagreed or strongly disagreed, while 22% of respondents indicated agreement or strong agreement. The remaining 22% of respondents were neutral. Similarly, in response to the statement 'The pedagogy of the program is similar to my own,' 62% of respondents either agreed or strongly agreed while 16% either disagreed or strongly disagreed and 20% were neutral. In response to the statement 'The program pedagogy was a persuasive factor in my decision to teach here,' 52% either agreed or strongly agreed while 30% either disagreed or strongly disagreed and 20% were neutral.

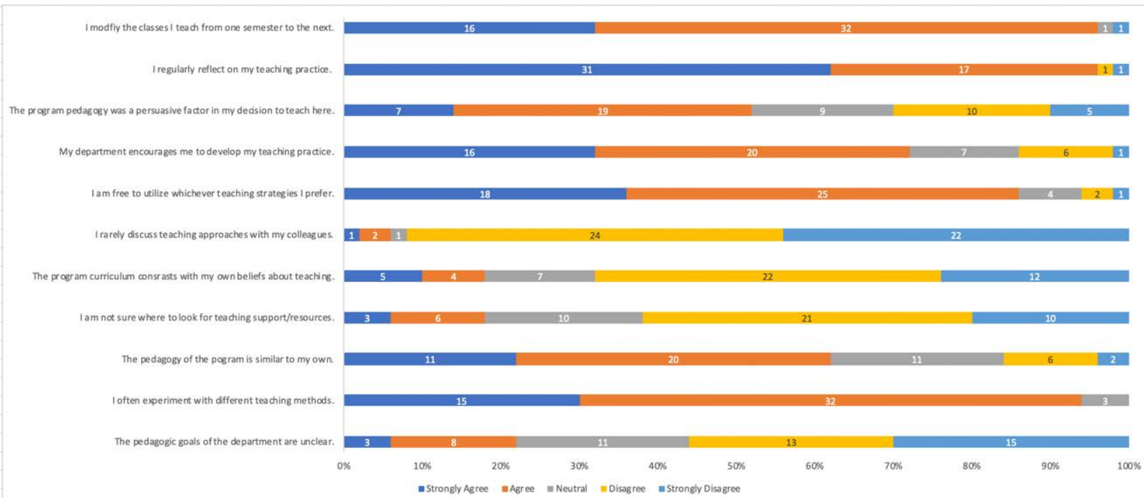


Figure 27. Teacher responses about pedagogic practices and departmental teaching context (n=50).

4.2.3 Results from Descriptive Portion of the Survey. The descriptive portion of the survey contained two sections. The first section, the forced ranking section, included six statements each with four possible conclusions that had to be ranked from 1 to 4. The four possible conclusions represented each of the four folk pedagogies so ranking provided an opportunity to examine the pedagogies in relation to each other for a number of factors (i.e. teaching and learning).

The first statement of this section was "Design learning is essentially about…" with four possible responses to be ranked. Figure 27 below illustrates the resulting responses to this item. The figure includes color-coded answer options to visually communicate the classifying folk pedagogy- these options were not colored in the actual instrument.

Recall that the higher number indicates the greater agreement. The figure includes the mean score for teacher responses (n=50, in the left column) and the student responses (n=108, in the right column). The numbers in each column represent the mean ranking for each answer option. For both the teacher and student columns, the highest ranked folk pedagogy has been indicated by a colored box in the center. In the figure below, the highest ranked response was the same for both teachers and students (hence the 'Think' band across the center) although the actual mean score for each was not identical. The 'Think' item had a mean score of 3.36 for the teacher dataset and a mean score of 3.32 for the student dataset.

The second highest ranked item for the two groups was not the same. For the teachers, 'skill acquisition', representing the 'Know' pedagogy, was the next highest ranked item with a mean of 2.40. For the students, the next highest mean score was 'critical management of information' representing the 'Manage' pedagogy, with a score of 2.55. This also indicates that the lowest ranking item was not the same for the two datasets. Teachers ranked 'knowledge acquisition' (of the 'Know' pedagogy) the lowest while students ranked 'skill acquisition' (of the 'Do' pedagogy) the lowest.

Design learning is essentially about…

Answer Options	Mean (n=50)			Mean (n=108)
acquiring personal beliefs	**3.36**	**THINK**	**THINK**	**3.32**
skill acquisition	2.40	DO	DO	2.01
critical management of information	2.14	MANAGE	MANAGE	2.55
knowledge acquisition	2.10	KNOW	KNOW	2.12

Figure 28. Teacher and student responses to first forced ranking item.

The next statement to be finished in the forced ranking section read “The main task of the design student is to…” Figure 28 below illustrates the mean conclusion rankings separated, once again, for teachers (on the left) and students (on the right). Again, teachers and students agreed on the option that ranked the highest, ‘imitate,’ with only a .03 difference in the mean score. They also agreed on the lowest ranked response, ‘comprehend’ with only a .05 difference in the mean score. Both respondent groups therefore ranked the ‘Do’ pedagogical response the highest and the ‘Know’ pedagogical response as the lowest.

The main task of the design student is to….

Answer Options	Mean (n=50)			Mean (n=108)
imitate	**3.78**	**DO**	**DO**	**3.75**
interpret	2.20	THINK	THINK	2.07
construct knowledge	2.12	MANAGE	MANAGE	2.32
comprehend	1.90	KNOW	KNOW	1.85

Figure 29. Teacher and student responses to second forced ranking item.

Another statement from this section that related to the student began, “In order to be successful, a design student must possess the ability to…” The response options and ranking means can be found in figure 29. Once again, student and teachers ranked the same response, ‘contribute to culture’ which represented the ‘Manage’ pedagogy as the highest. They also ranked the same statement conclusion as the lowest, “think” which represents, not surprisingly, the ‘Think’ pedagogy.

Similar to the previously reported question, student and teacher mean scores were not far apart. For the highest ranked item there was a .07 difference, no difference in the mean score for the 'do' response, .06 for the 'learn' response and .13 for the 'think' response.

In order to be successful, a design student must possess the ability to...

Answer Options	Mean (n=50)			Mean (n=108)
contribute to culture	**3.58**	**MANAGE**	**MANAGE**	**3.51**
do	2.52	DO	DO	2.52
learn	2.46	KNOW	KNOW	2.40
think	1.44	THINK	THINK	1.57

Figure 30. Teacher and student responses to third forced ranking item.

The third question of this survey that focused on design students read "A design student is most like a(n)..." with resulting responses found in the figure below. Once again, teachers and students agreed on the highest ranked statement conclusion, 'expert' representing the 'Manage' pedagogy. In fact, the ranking order for this question was the same for both the students and teachers with the 'Manage' response the highest (and only a .01 difference between mean scores. The 'Know' statement ranked second (again with only a .01 difference between student and teacher means scores), the 'Do' response ranked third and the 'Think' response had the lowest ranking of 1.42 by teachers and 1.46 by students (a .04 difference).

A design student is most like a(n)...

Answer Options	Mean (n=50)			Mean (n=108)
expert	**3.48**	**MANAGE**	**MANAGE**	**3.49**
knower	2.86	KNOW	KNOW	2.87
maker	2.24	DO	DO	2.18
thinker	1.42	THINK	THINK	1.46

Figure 31. Teacher and student responses to fourth forced ranking item.

The final two questions of this section focused on teachers. One statement began "A design educator is most like a(n)..." As occurred with previous questions, students and teachers agreed here on the order of ranking for all four possible statement conclusions. The highest ranked response, ‘craftsperson’ represented the ‘Do’ pedagogy. The second highest ranking was for ‘authority’ which represented the ‘Know’ pedagogy. The third ranked response, ‘colleague’, represented the ‘Think’ pedagogy and the lowest ranked item, ‘consultant’ represented the ‘Manage’ pedagogy.

A design educator is most like a(n)…

Answer Options	Mean (n=50)			Mean (n=108)
craftsperson	**3.38**	**DO**	**DO**	**3.07**
authority	2.68	KNOW	KNOW	2.98
colleague	2.38	THINK	THINK	2.42
consultant	1.56	MANAGE	MANAGE	1.53

Figure 32. Teacher and student responses to fifth forced ranking item.

The last forced ranking question also dealt with perceptions of teachers. Again, teachers and students agreed and ranked the same statement conclusion, ‘presenter,’ the highest and therefore put the ‘Know’ pedagogy option at the top. All mean scores for this question were in the same range, i.e. between 2.00 and 3.00. The highest score was 2.90 (by teachers) and 2.99 (by students) for ‘presenter.’ Teachers ranked the ‘Do’ response second highest, the ‘Manage’ response third, and ‘collaborator,’ the ‘Think’ response, last. Students ranked the ‘Manage’ response second, the ‘Think’ response third and ‘demonstrator,’ the ‘Do’ response, last.

The primary role of the design teacher is…

Answer Options	Mean (n=50)			Mean (n=108)
presenter	**2.90**	**KNOW**	**KNOW**	**2.99**
demonstrator	2.74	DO	DO	2.23
information manager	2.34	MANAGE	MANAGE	2.46
collaborator	2.02	THINK	THINK	2.32

Figure 33. Teacher and student responses to sixth forced ranking item.

The second part of the descriptive portion of the survey included 20 statements that had to be rated by respondents in terms of how much (or little) they agreed with them. As described in section 3.2.1.3, these statements were randomized in the online survey. For this section, the statements will be presented in clusters according to the folk pedagogy they were designed to represent in order to clearly visually communicate the response patterns.

DO	Mean-T	Mean-S	Dif
Design competence consists primarily of talents, skills, and abilities.	0.16	0.55	0.39
Design students learn best by imitating teachers who are experts.	-0.68	-0.62	0.06
Students cannot master skills unless they have seen them demonstrated.	0.04	0.26	0.22
Apprenticeship is the best way to learn design skills.	0.40	0.69	0.29
Teaching is like a performance of how to do things correctly.	-0.22	-0.06	0.16
			0.22
KNOW			
Design students should be presented with facts and rules of action to remember and apply.	0.28	0.09	0.19
When a student knows facts and theories, knowing how to apply them will necessarily follow.	-0.88	0.09	0.97
Problem solving is applied theory.	0.54	1.04	0.50
The learners mind is like a blank slate (or vessel) to be filled.	-0.84	-0.08	0.76
Knowledge is delivered by the teacher to the student.	-0.22	0.31	0.53
			0.59
THINK			
Students should understand both what they think and how they arrive at those beliefs.	**1.58**	**1.52**	0.06
Discussion is an essential element of design education.	**1.74**	**1.74**	0.00
Collaboration is an essential element of design education.	**1.50**	**1.59**	0.09
It is important for design students to be capable of thinking about their thinking.	**1.50**	**1.58**	0.08
Reflection is not important in learning to/about design. (-)	**-1.56**	**-1.36**	0.20
			0.09
MANAGE			
Learners should understand the difference between knowledge held personally and knowledge held collectively by the design community.	1.02	1.22	0.20
Students must learn to scrutinize commonly held assumptions about design.	**1.30**	**1.31**	0.01
Historical knowledge should not be questioned by students. (-)	-0.98	-1.06	0.08
Students should be encouraged to question what they are learning.	**1.40**	**1.59**	0.19
Design students should consider evidence and reasons behind beliefs in the design field.	**1.34**	**1.33**	0.01
			0.10

Figure 34. Teacher and student mean agreement scores for the descriptive statements.

The figure above illustrates the mean agreement scores for each statement. The color coding and titles indicate which folk pedagogy the statements represent. Figures in the left column are mean scores from the teacher dataset (n=50) and figures in the middle column are mean scores from the student dataset (n=108). The right column reports the difference between the two means with the bolded figure offering the average difference for each pedagogy cluster of statements. The highest possible mean is 2.0 (if all respondents had selected 'Strongly Agree'), the highlighted scores indicate scores of 1.25 and above. Please note that two statements were framed so as to generate inverse agreement (i.e. strongly disagree indicates positive support for the pedagogy) and therefore the negative figures represent strong agreement with the statement.

As can be seen below, there was little agreement by both teachers and students with the statements representing the 'Do' and 'Know' pedagogy. In fact, in nearly half the statements (5 out of 10 for the 'Know' pedagogy and 4 out of 10 for the 'Do' pedagogy) the mean agreement scores were negative, indicating disagreement of varying degrees.

Difference in mean agreement scores between student and teacher datasets for the 'Do' statements were varied. The statement 'Design students learn best by imitating teachers who are experts' revealed the most agreement between teachers (M= -.68) and students (M=-.62) with a difference of only .06, however it also reflected the strongest disagreement of all statements in the 'Do' section with the lowest scores of all 5 statements. The least agreement between teachers (M=.16) and students (M=.55) occurred with the statement 'Design competence consists primarily of talents, skills, and abilities' with a mean difference of .39. Overall, the mean difference in agreement scores for the 'Do' pedagogy was .22, which was considerably less than the difference for the 'Know' pedagogy section.

The weakest agreement between teachers and students occurred in the 'Know' section with a mean agreement difference of .59 (R=.19-.97). The statement in this section that generated the most agreement between teachers (M=.28) and students (M=.09) was 'Design students should be presented with facts and rules of action to remember and apply' with a mean difference of .19. The statement in this section that generated the most disagreement between teachers (M=-.88) and students (M=.09) was 'When a student knows facts and theories, knowing how to apply them will necessarily follow.' In fact, this statement received the lowest agreement score of all of the statements in this section (with the exception of those inversely oriented statements where a negative score actually indicated agreement).

On the other hand, the strongest agreement scores for both teachers and students occurred with the statements from the 'Think' pedagogy. These statements all generated mean agreement scores above 1.25 with the highest score of all statements (1.74 by both teachers and students) occurring with the 'Think' statement that read 'Discussion is an essential element of design education.' In this section there was less variance between teacher and student scores with most differences less than .10 and the greatest difference of .20 from the statement 'Reflection is not important in learning to/about design' which received a mean agreement score of -1.56 from teachers and -1.36 from students. The mean difference between agreement scores for each statement in this section was .09 (R=0-.2). In other words, the 'Think' pedagogy statements generated the most agreement by students and teachers and the most agreement between them.

The statements representing the 'Manage' pedagogy also generated high agreement with only one possible mean score less than 1.0. The exception here was the statement 'Historical knowledge should not be questioned by students' (an inverted statement) which received a mean agreement score of -.98 from teacher respondents, though it received a mean score of -1.06 from students (difference= .08). The highest agreement score from the 'Manage' section was the statement 'Students should be encouraged to question what they are learning,' which received a score of 1.59 by the student respondents and a score of 1.40 by the teacher respondents.

Regarding similarities across teacher and student responses, there was a tie between two statements for lowest mean score difference between teachers and students, both with a difference in mean score of only .01. The first statement 'Students must learn to scrutinize commonly held assumptions about design' received a mean score of 1.30 from teachers and 1.31 from students. The statement 'Design students should consider evidence and reasons behind beliefs in the design field' received a mean score of 1.34 from teachers and 1.33 from students. Overall, the mean difference in agreement scores for the 'Manage pedagogy was .10, which was only .01 more than the difference for the 'Think' pedagogy section.

4.2.4 Results from Prescriptive Portion of the Survey. As described previously in section 3.2.1.4, the prescriptive portion of the survey requested that survey respondents offer a minimum of five and maximum of ten tips for design teachers. The resulting data included 455 tips from teacher respondents and 709 tips from student respondents for a total of 1,164 tips. The coding process, described in section 3.2.4.4, allowed for the tips to be analyzed according to their pedagogical intent through the lens of the four folk pedagogies under consideration here.

As with other coding efforts, certain open codes were not included in the folk pedagogy coding as they did not disclose any pedagogical intent (i.e. the code 'TIME' which referred to time management was not assigned a folk pedagogy code because it was not distinguishable as one code instead of the others). Once those items that were not assigned a folk pedagogy code were removed, the resulting datasets totaled 424 tips from teachers and 650 from students, for a total of 1074 tips coded for folk pedagogical intentions.

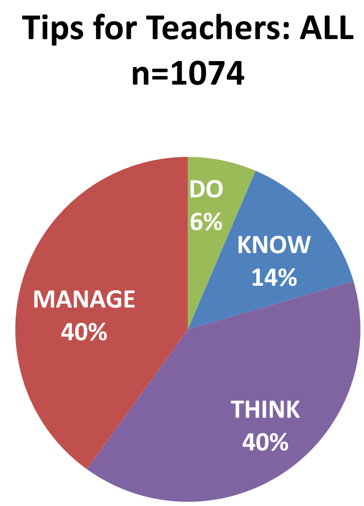


Figure 35. Analysis of all teaching tips coded according to folk pedagogy.

Figure 34 displays the resulting distribution of folk pedagogy codes for the entire dataset (teachers and students). There are clearly a larger number of tips representing the 'Think' and 'Manage' pedagogies. Tips coded as 'Do' represented only 6% of the total tips and 'Know' tips only constituted 14% of the total. This displayed preference for the 'Think' and 'Manage' pedagogies is similar to results from the previous prescriptive section where strongest agreement was towards statements from these two pedagogies.

Referring back to the example coding offered in section 3.2.4.4, the following are some teacher tips that came from both teachers (T) and students (S) and how they were coded. "Monitor the students' progress during each class period and adjust your teaching as needed." (T), coded as ROLE GUIDE and then 'Manage.' "Every detail you "touch" as a design educator should be well designed (syllabus, handouts, website, etc.)" (T) coded as ROLE DEMO and then 'Do.' "Treat students like friends more than dumb students who know nothing" (S) coded as ROLE COLLAB and then 'Think.' "Give more instructions on techniques" (S) coded as ROLE TRAIN and then 'Know.'

Examples of other codes that were generated during the open code phase included STUCENT which was applied to statements that offered tips about teaching in a student-centered way, i.e. "Get to know the students individually so you know how they learn best" (T) finally coded as 'Manage.' "Use analogy and storytelling as methods to bring "light" to a subject" was coded first as STORY and then as 'Think' (this is an example of a code that was also used in the teacher study). Some comments referred to course content and specific skills. Comments about skills of artifact and model making, for example, were coded CRAFT and then 'Do.' Some tips referred more to course management and instructional strategy, for example "Start a class seriously and firmly. Hard to create order from a chaotic class, but easier to relax a strict class" (T) which was coded first as FIRM and then as 'Know'.

As can be seen in figure 36, both teachers and students provided many more of tips that reflected 'Think' and 'Manage' pedagogies over the 'Do' and 'Know' pedagogies.

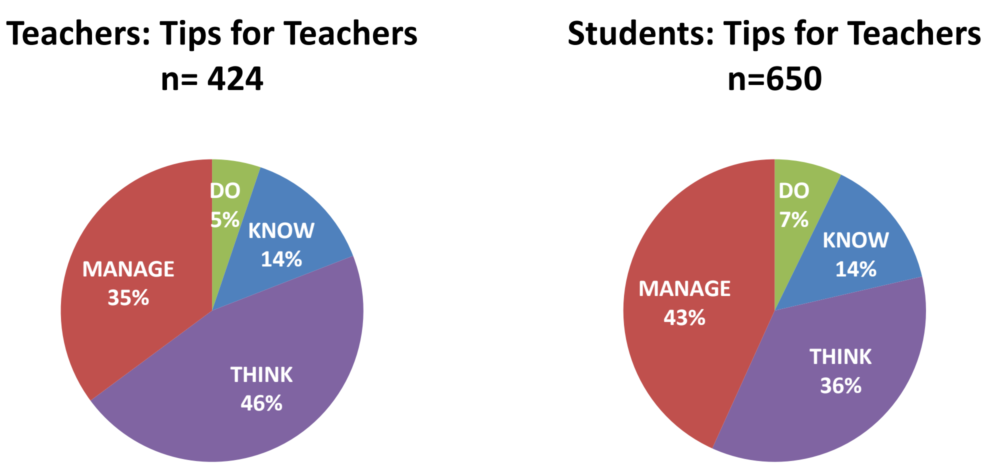


Figure 36. Distribution of all teaching tips coded according to folk pedagogy for both datasets.

4.3 Results from Analysis of Teacher Case Studies

The teacher case studies included two teachers of different professional and educational backgrounds who teach different types of design course content. This section will describe the results of the two-part case study of each teacher which included both observations of teaching behavior and interviews about teaching. Results of the observation data analysis are described here through the lens of the folk pedagogy codes while the interview data results are presented as a narrative account of each participant's personal folk pedagogy in their own words.

4.3.1 Results from Teacher Observations. Each teacher participant was observed in five classes over five weeks. The researcher captured these observations with field notes which were later open coded and then coded for folk pedagogies. This two-part coding process was undertaken twice. The entire coding scheme for each teacher participant and for each class can be found in APPENDIX H and APPENDIX I.

Although the teacher observations were not undertaken to provide quantitative descriptions of teaching practice, an introduction to the data via descriptive statistics does offer an orientation to the two cases and begins to reveal patterns for consideration. For example, during the second phase of coding, a total of 1135 open codes were assigned to the JA observation data. Of these 1135 open codes, 701, or 61.76% were also assigned folk pedagogy codes. A total of 761 open codes were assigned to the RP observation data with 493, or 64.78% also assigned a folk pedagogy code. Figure 36 below illustrates how the open codes were distributed across the two teachers.

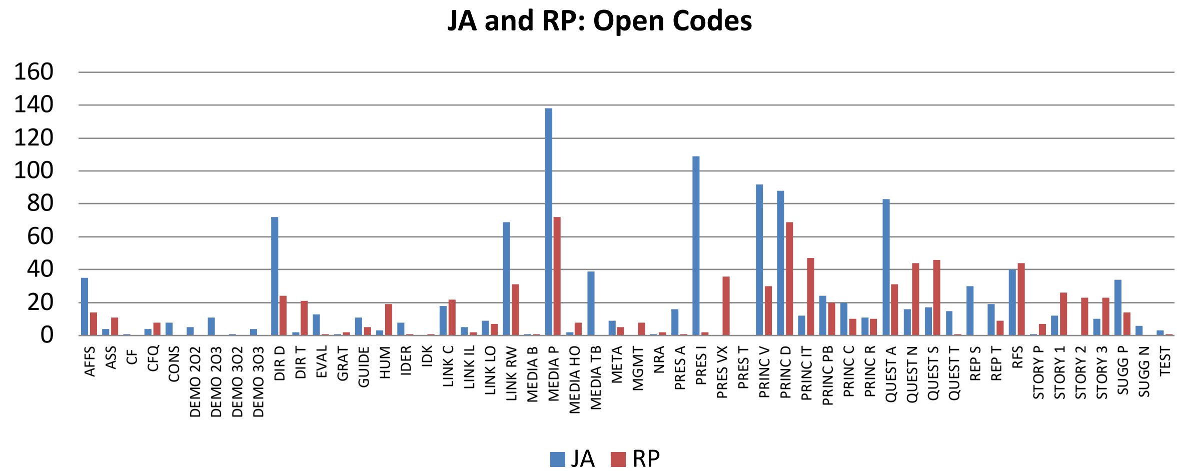


Figure 37. Open code distribution for both JA (n=1135) and RP (n=761) datasets.

It must be noted that the figure above does not represent a legitimate comparison across the two teacher cases because the total number of codes for each teacher is not the same. Therefore, the numerical value of one code does not necessarily lend itself to direct comparison with the number indicated for the same code of the other teacher. Rather, this figure is meant to illustrate a simple overview of the distribution of the codes across each dataset and provide orienting information about the frequency of each code within each dataset.

Another look at the open coding with folk pedagogy codes for each of the teacher cases provides a clearer overview of the distribution of the folk pedagogy codes. In figures 37 and 38 below, the coding for each teacher is presented with the bars color coded to represent each folk pedagogy. The black bars indicate open codes that were not assigned folk pedagogy codes.

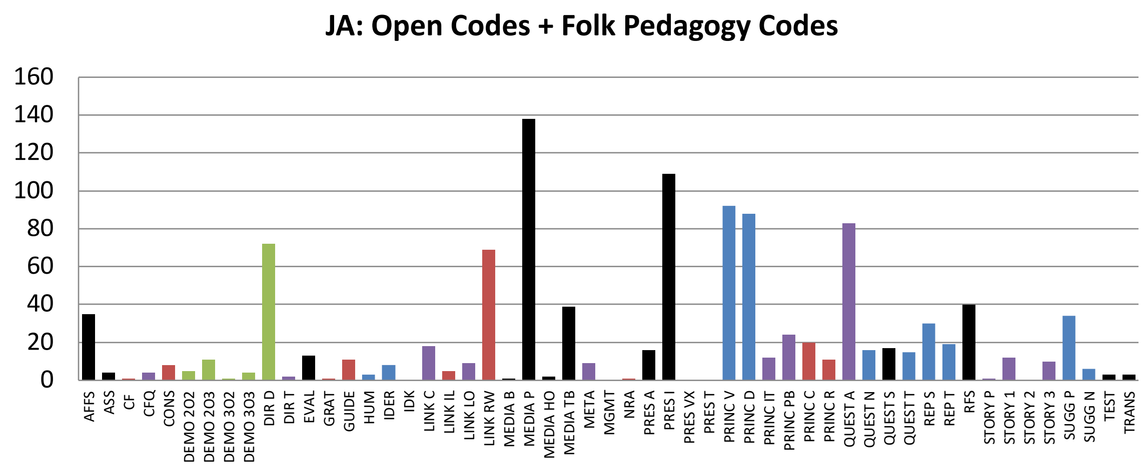


Figure 38. Open code and corresponding folk pedagogy color code for JA observation dataset.

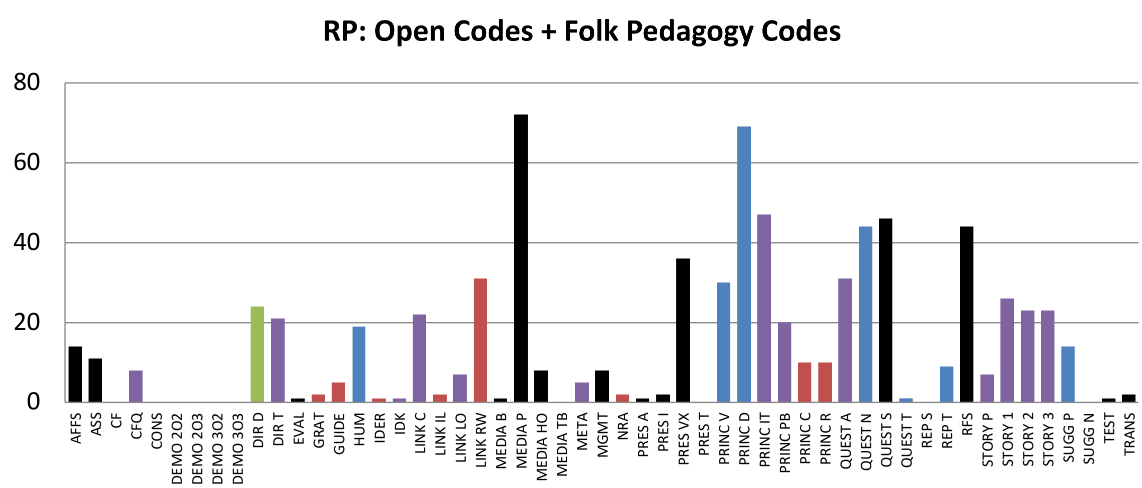


Figure 39. Open code and corresponding folk pedagogy color code for RP observation dataset.

Another numerically based view of the data provides both an overview and an opportunity for comparison across the two teacher cases. Figure 40 illustrates the frequency of each folk pedagogy code observed for each teacher case. The 'Think' and 'Know' pedagogies are most prevalent for both teachers though proportions of each vary.

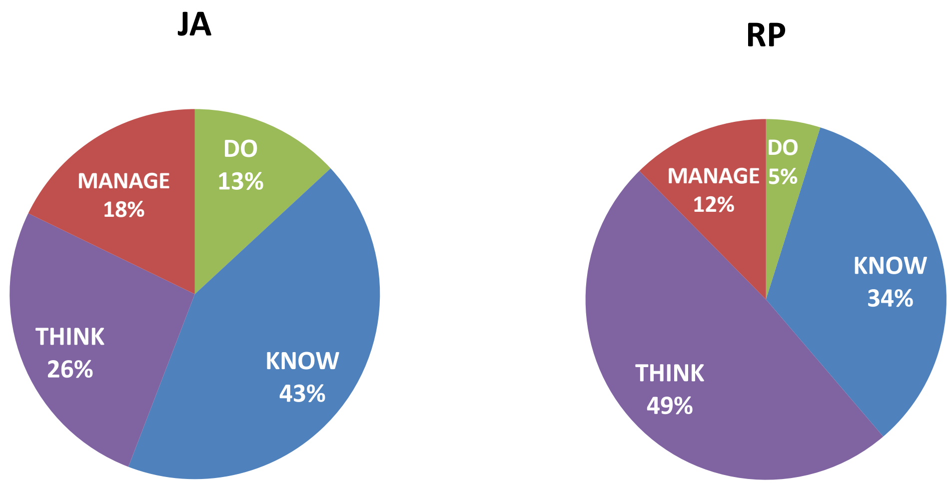


Figure 40. Distribution of folk pedagogy codes from observation data for both teacher cases.

For JA, the 'Know' pedagogical approach appears most common (43%) with the 'Think' approach only represented in 26% of the codes. 'Manage' (18%) and 'Do' (13%) appear less frequently. The greatest difference that exists between the percentage of any two codes is 17% as seen between 'Know' and 'Think'. The remaining differences are only 8% (between 'Think' and 'Manage') and 5% (between 'Manage' and 'Do').

The RP data, on the other hand, evidences considerably more 'Think' codes at 49% with 'Know' codes following at 34%. The largest gap between two codes is present between 'Know' and 'Manage' (12%) totaling 22%/ This figure is 5% larger than the greatest comparable difference in the JA data, where the biggest difference was 17% between 'Know' and 'Think'. The remaining differences between code assignments was also greater in the RP data at 15% 'Think' and 'Know' (the most frequent) and 7% between 'Manage' and 'Do' (the least frequent).

Because the JA observations occurred in two different class types (i.e studio and lecture) the observation data for this teacher case was split into two separate datasets (one for the studio class observations and one for the lecture class observations) and subjected to the above analysis again. The total number of observations open coded for the lecture dataset was 761 of which 412, or 54.14%, were also assigned a folk pedagogy code. The total number of observations open coded for the studio dataset was 374 of which 290, or 77.54%, were also assigned a folk pedagogy code. The difference in percentage of folk pedagogy codes assigned between the two course types is likely due to the use of PowerPoint presentations in the lecture course- for which an open code is assigned but no corresponding folk pedagogy code. In fact, of the 761 open codes for the lecture dataset, 174 (22.86%) were MEDIA codes and 107 (14.96%) were PRES codes, totaling 281 (36.93%) codes related to presentation medium that were not given folk pedagogy codes.

As can be seen below, in figure 40, there is a marked difference between the distributions of folk pedagogies in the two different class types. In the lecture course, the 'Know' folk pedagogy is most prominent with 55% of the total. The nearest neighbor is the 'Think' pedagogy (22%) only 4% higher than the 'Manage' code (18%). The least frequent pedagogy in the lecture dataset is 'Do' with only 5%.

The varied distribution and proportions of the lecture dataset are markedly different from the nearly evenly distributed folk pedagogy codes of the studio dataset. In fact, both the 'Do' and 'Know' codes each represent 25% of the total. 'Think' is a bit higher than the others with 33% of the total codes for the studio observations, and 'Manage' is a little lower with 17% of the total.

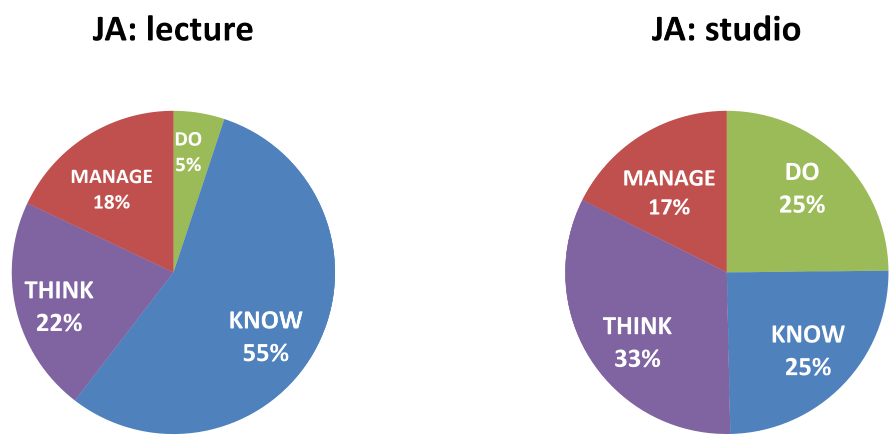


Figure 41. Distribution of folk pedagogy codes from observation data for separate JA datasets.

Given the fact that the RP observations only occurred in lecture courses, another comparison is warranted here between the JA lecture dataset and the complete RP dataset. By looking only at the lecture class data and comparing across the two teachers, there is a potential for identifying differences that may not be attributable to class type. This also prevents the drawing of conclusion about class type based only upon the results of one case.

As can be seen below in figure 41, there are noticeable differences between the folk pedagogy distributions of both lecture datasets. The primary difference is between the 'Think' and 'Know' pedagogy codes. For JA, the 'Know' code was assigned to 55% of the open codes and only 22% were assigned 'Think' codes. For RP, however, the 'Think' codes were predominant representing 49% of folk pedagogy codes with 34% of assigned codes as 'Know'. The frequency of the 'Manage' codes varies from 18% with JA to 12% with RP, in both datasets is nestled between the more frequent 'Think' and 'Know' codes and the much less frequent 'Do' code, only 5% in both datasets.

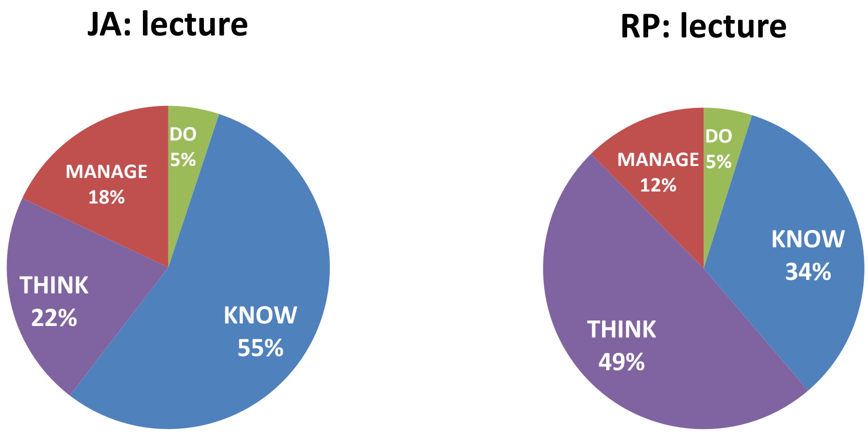


Figure 42. Distribution of folk pedagogy codes from observation data for lecture datasets.

4.3.1.1 Results of teacher observations for teacher case 1: JA. Turning now to the separate observation data for the two teacher cases, we begin with teacher participant JA. JA appeared to have very specific content and procedural goals for the lecture classes. Each observed class followed a similar agenda: first, the students began with a quiz over the previous week's material, then the teacher led a review of the quiz from last week (for the material covered two weeks before) and the duration of the class period was dedicated to a PowerPoint presentation of new material from the textbook.

The quizzes themselves at the outset of the class represent a 'Know' pedagogy (and were coded as such) because they rely upon a canon of knowledge that is presumably delivered to the student by the teacher (and text) and then regurgitated (correctly) in the form of a quiz. The quizzes themselves assessed the student's ability to identify correct definitions, match vocabulary with correct descriptions, and fill in the blank of a descriptive statement with the proper term. The quizzes were then followed by a review of the quiz from the week before.

The review of quizzes from previous weeks typically followed the same routine. Students would pick up their graded quizzes before the review. The teacher would read each quiz question aloud and wait for students to provide the answer. This was often followed by the teacher repeating the student's responses and/or elaborating on them. This interaction was repeated for each question of the quiz and is characterized by the clusters of 'Think' and 'Know' codes at the beginning of each class. There are always more 'Know' codes in these clusters given the format of teacher posing question and students responding.

These reviews were then followed by a lecture on a topic from the course textbook. The day's lecture topic was always communicated via a projected PowerPoint presentation, on from the moment the students entered the classroom. Each slide indicated the pages from the textbook where the material from each slide could be found and many students were observed following along in their textbooks during the teacher's presentation.

The slide presentations were often organized using a 'Q & A' format. A question or vocabulary term would appear first on a slide. The teacher, often reading from the slide, would ask the students the question or read the term aloud and, sometimes, talk about the question or term. The teacher rarely took any student answers from this slide. Rather, the following slide typically provided the answer, definition, or description requested in the previous slide and was then read by the teacher and expanded upon with story or image examples or discussions of how the content related to the real world context of practice or academic benchmarks like portfolio review.

These slide groupings typically include 'Know' codes for the principles (including terms and definitions) that are communicated within each slide. They also often include 'Think' codes for the use of questions (which the teacher poses and then takes answers from the students) and metaphors for explanation. The 'Manage' codes in these clusters indicate the use of story, links to real world context, discussion of reasoning behind content being taught and indication that students have a choice in their application of the material.

Analysis of the lecture class data revealed the pattern described above. This, paired with comments by the teacher participant during the interviews, also revealed a potential pattern between pedagogy and type of content being taught. In other words, given the emphasis (both in the curriculum and by the instructor) on the need to ensure that fundamental design principles are learned during this course (given its place in the overall curriculum), are there patterns of pedagogy associated with the teaching of these principles? This further analysis was also justified by the fact that of the 412 folk pedagogy codes assigned to the lecture observation open codes, 188 (45.63%) were for PRINC codes. Of the 290 folk pedagogy codes aggregated for the studio class observations, 58 (20%) were assigned to PRINC open codes.

In pursuit of an answer to the question posed above, additional analysis was undertaken of the data from observations of the lecture classes. In this case, only the PRINC codes were included and their corresponding folk pedagogy codes were analyzed. Recalling the description of the PRINC codes as an example in section 3.3.3.1, the different methods of communicating design principles were given different codes depending on their pedagogical intent. For example, offering a vocabulary term PRINC V) and definition or description (PRINC D) was coded as 'Know' for its reliance upon situating the teacher as authority and deliverer of established canonical knowledge.

Communicating principles in the context of statements of personal beliefs (PRINC PB), which were typically preceded with statements like "I think" or "I personally believe," and those statements that were couched within an if/then statement

(PRINC IT) were coded as 'Think' given their tendency to frame the principle as one that may be negotiable according to personal beliefs, context, and/or preferred outcomes.

There were two other open code possibilities for principles that were eventually coded as 'Manage' folk pedagogies. The first, PRINC C, was assigned to cases when a principle was described as a choice or a topic of exploration, i.e. "I am not saying that everyone should do this. These are inspiration for you to think about" (from JA observation #3L). The second, PRINC R, was assigned to those cases where the teacher described the reasoning and justification for why a principle was being taught. For example, during a presentation about the principle 'center of gravity' JA offered some visual examples of transportation design and stated "It is important with this…of course you don't want people falling. You deal with center of gravity everyday for mobility" (from JA observation #3L). Again, both the R and C qualifier codes resulted in a 'Manager' folk pedagogy code because they allowed students to consider the source, context, and justification of the principle as well as emphasize the possibility of rejecting the principle entirely by choosing not to apply it. It is worth noting here that these statements were usually given other codes, too. For example, the center of gravity example above also included the PRINC V code because it utilized a vocabulary term that the teacher was trying to convey.

Figure 43 below illustrates the distribution of each of the different PRINC codes for the three lecture classes that JA was observed teaching. It is clear from the figure below that most, rather 87%, of the content delivery of principles by JA occurred via the D and V methods, via a 'Know' pedagogical approach. Only 4% of the principles were couched within the framework of a 'Think' pedagogy and only 9% of the content was delivered in a 'Manage' pedagogical approach. In section 4.3.1.2 these results will be compared with lecture class observations of teacher participant, RP.

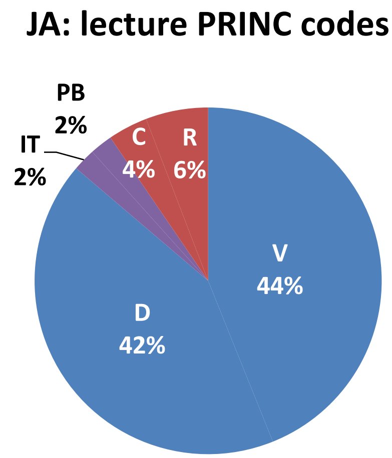


Figure 43. Distribution of folk pedagogy codes for principles (PRINC) in JA lecture classes.

This analysis was also undertaken for the studio class observation for participant JA, the results of which can be seen in figure 43 below. The use of V and D approaches (i.e. 'Know' pedagogy) for the teaching of principles appears to occur with less proportional frequency in the studio class than in the lecture class. In the studio course 'Know' pedagogical approaches were observed in 28% of the principle codes compared to 87% of the principle codes in the lecture class. The teacher also appeared to utilize more 'Think' approaches to the delivery of principle in the studio course (49% of codes) than in the lecture class (4% of the codes). Lastly, the 'Manage' codes were also more prevalent in the studio course (23%) than in the lecture class (9%).

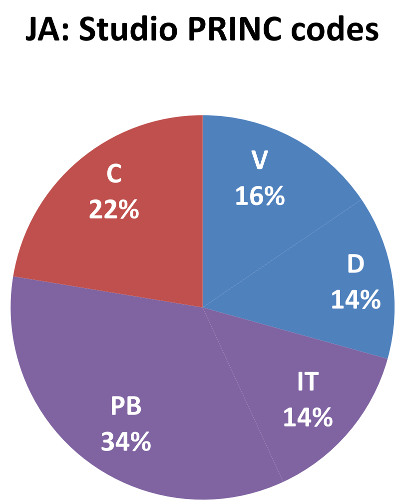


Figure 44. Distribution of folk pedagogy codes for principles (PRINC) in JA studio classes.

This analysis was undertaken, as previously explicated, for the sole purpose of identifying any possible pedagogical patterns with regards to the teaching of principles in the different design classrooms. In fact, this analysis did yield results that evidence the possibility of different pedagogical approaches being employed depending on the course type (i.e. studio or lecture) and also the possibility that the proportions of code distribution reveal a preference for one combination of pedagogies over others depending on course type. These results also provide further evidence of a pattern that was initially identified in figure 40 which illustrates overall patterns of pedagogy for the two class types (not focusing only on PRINC codes). Essentially, the lecture class includes more 'Know' pedagogical practices while the studio class evidences more diversity across the 'Know,' 'Think,' and 'Manage' folk pedagogies.

Participant JA demonstrated more variance in folk pedagogical approach in the studio class than in the lecture class. While lecture class coding reveals clusters of 'Know' and 'Manage' together or 'Know' and 'Think' together, the studio class codes reveal an entirely different pattern. The number of 'Do' activities in the studio course is considerably higher than in the lecture course and these occur throughout the class (rather than primarily at the beginning and end as in the lecture curse). In fact, in the studio data, clusters of codes often include all four pedagogies.

An example of a cluster that includes all four folk pedagogies is taken from JA observation #2S during a pin-up critique. Students were asked to pin up their drawings side by side along a wall. The teacher asked each student to critique the drawing pinned up next to theirs. The teacher facilitated the process by calling for the next student and, once the student had made the initial critique, asking questions of the student critic and guiding through the process of using vocabulary and principles from the class to evaluate the works. Figure 45 below illustrates a coding cluster from one such teacher-student critic interaction.

The figure below illustrates the open and folk pedagogy coding for one student-teacher interaction during the critique. First, the teacher directed the next student to offer a critique of the drawing. As the students offered the critique, the teacher repeated what the students said and asked a question, "What are some of the positives?" The teacher prompted the student when (s)he slowed by offering back to the student some terms (s)he used in the initial critique, "and you mentioned the line weight…" When the student critic finished, the teacher affirmed the critique "Yes, I would agree" and then discussed some real world applications of the project, suggesting to all of the students "You want to think about these drawings as being able to hand off to the guy in the model shop." This statement is also a reference to a story told by the teacher in a previous class about production by the model shop of a chair that did not match the designer's intention due to a drawing mistake.

DIR	D	DO
REP	S	KNOW
QUEST	A	THINK
GUIDE		MANAGE
GUIDE		MANAGE
AFFS		
LINK	RW	MANAGE
LINK	RW	MANAGE
SUGG	P	KNOW
LINK	PCM	THINK

Figure 45. Example of coding cluster from JA studio class critique exercise.

The comparatively fewer instances of 'Know' pedagogical practices in the studio course begs the question of how principles (which are the primary content for which the 'Know' pedagogy is a vehicle in lecture courses) are taught in the studio class. Another example, this one taken from JA observation #4S, illustrates how principles are negotiated during teacher-student dialogue during a critique. The student has just presented a shoe design made of paper that was tested for functionality by taking "one active step." The shoe broke and the teacher took it from the student, directing the student to describe the shoe concept. The students utilized multiple terms from the lecture course when describing the shapes and interrelationships of them. Figure 45 illustrates the coding for the teacher's actions and remarks.

The teacher took the shoe from the student, holding it up for the class to see, and asked the student questions about the design and construction (QUEST A). Then the teacher instructs the class to look at a specific part of the shoe (DIR D), "I want you to notice this part here (pointing) because even though it fails, it actually works." The teacher then discusses the student's hypothesis for the design and experimentation that led to the resulting shoe (PRINC C). He asks the student a clarifying question (QUEST A) and then goes to the chalkboard at the front of the room to illustrate through a two-dimensional drawing the three-dimensional concept of the shapes and the result of force upon the shapes (DEMO 2O3).

QUEST	A	THINK
QUEST	A	THINK
DIR	D	DO
PRES	A	
PRINC	C	MANAGE
QUEST	A	THINK
DEMO	2O3	DO

Figure 46. Example of coding cluster from JA studio class critique exercise.

In this way, the teacher is communicating about design principles taught in both the lecture and studio classes by using actual objects (the student's shoe) along with questioning the student about design choices and process. This also affords the teacher the opportunity to discuss the principle of experimentation with a tangible example with which each student can identify. The use of the drawing to further illustrate the concepts demonstrates an additional pedagogical method of communicating the principles under discussion. In this example, the teacher never uses the specific terms or definitions of the principle though they are clearly described visually and through the artifact.

The agenda for the studio classes varied during the observations. The first studio class began with a critique of completed projects (drawings) which were then handed in and followed by an introduction to the next assignment, with examples of previous students' work shown. Once the assignment was given, the students were given the remaining two hours of the three-hour class to work on the next assignment. The next studio class observed involved two different critiques, one of an actual artifact (the shoe) and a second critique of the drawings made of the shoe designs. For this critique students were instructed to pin up their drawings and then vote for the one they thought best exemplified the criteria for the assignment by placing a pin next to it. The teacher then guided the students through the critique by asking them to discuss why they voted for the ones they did and why the ones that didn't get votes did not merit them.

Transcriptions from the studio class dedicated to student work and teacher feedback also provided evidence of how the teacher utilized these one-to-one interactions to communicate learning objectives (namely design principles). Many of these interactions were initiated by the students who asked questions about their design concepts for a bridge and the actual models they were testing for weight bearing ability. The following excerpt from the transcript demonstrates how the teacher includes reference to terminology and concepts in the interaction with the two students who are asking for feedback.

> JA: ...No, because as you saw the second layer had absolutely no purpose, it just completely popped. But this one stayed. I mean, it held up quite a lot of weight, so, I think we can presumably say we can learn, preserve these parts of the bridge that preserved themselves and then modify that, but still keep your design language, it's still going to be an arch. It's just, let's blow this up to an 18x20 inch.
>
> STUDENT: And make these bigger, too. For part of the thing, I was worried that these were too long with the (Unclear) and if they're smaller, they're going to be stronger, so I wasn't really sure if these were going to be a problem. So, now I think that I should, I don't necessarily need to make these taller, I just need to make this...
>
> JA: Wider. ... Remember, this structure, half of it survived, and it was just because of that torqueing of that bridge because it was unevenly built ... that's

what caused the bridge to suddenly just do this under the weight, but that's just what happened. It got destroyed, but this thing held up. So, it's actually strong. So there's something that potentially could also be integrated.

In this case the teacher emphasized the strengths of the concept and encourages the students to learn from the failure of the bridge. The teacher also utilized the terms from the lecture course when discussing the failure of the bridge due to it s design. In the next example, the teacher once again clarified the design principle (i.e. of torque) through the discussion of the bridge design as well as the concepts of experimentation and compromise.

STUDENT2: We're having questions (Unclear) I mean the bottom part (Unclear) hold the arches.

JA: … And it's a center, so your design is basically going to look like this. You're going to have a single rod down the center. I think that could work.

STUDENT1: And the curved parts would be the only internal, not the only, but the main internal part.

JA: Right, because that's what's going to prevent this thing from sagging in. These things are going to prevent the structure from torqueing … This is a pyramid, it's going to take essentially take a huge amount of weight right here, so you're going to need these two to make contact point to each other on that center rod so that you…like I said, what the general shape of the bridge that made 80lb at 1.1oz, was basically shaped like a truss. It's just a (Unclear) truss. So, basically you're doing the same thing from the side view. It's a truss, and it's going to be very powerful. From this view, of course, it's a lot more complex in terms of the form, but all of that's helping that bow. I think it's a nice compromise. Keeping it low like this, then you don't have any of that torque. If it gets too high, and you have more stability for (Unclear) keeping it nice and low. Like you said, this is the part that survived, so we want to make a bridge of the part that survived. It should be very, very strong. Like I said, this is all survived from your studies. So it proved itself.

STUDENT1: (Unclear) strong.

STUDENT2: Something like this? And…one high and one low, I guess? I mean for the arc, because I'm not sure (Unclear) because the arc was high (Unclear)

JA: Well, again, you have to figure out what's the height? Where can you go in the structure? How far or how high in order to maximize this design? If it's too low, it might not function as properly, because of the way this thing was…

STUDENT1: (Unclear) so this is too low.

JA: And that one probably functions correctly. You're right, so I would play around with how high to go with this thing.

Again, this interaction illustrates how the various principles are incorporated into a discussion about the application of the principles. The teacher also demonstrated an effort to guide the students through the experimentation that will help them determine the direction to take the design. The teacher modeled the use of questioning as a mechanism of experimentation with the possible applications of the principles and does not tend to answer student questions with a simple "yes" or "no" or rigid instructions. Rather, JA qualified answers with more questions and with discussion of the principles as applied to the design itself, continually encouraging more experimentation based upon the student's objectives.

The results of the data analysis of teacher participant JA reveal patterns of similarity across the two class types as well as some discrepancies in the distribution of folk pedagogical approaches. Further analysis of the data in response to questions that arose regarding the potential impact of course content on pedagogy was also explored. Comparisons of the results of data analysis of the JA observations will be compared with the results from the RP data analysis in section 4.3.1.3.

4.3.1.2 Results of teacher observations for teacher case 2: RP. The second teacher participant, RP, was observed only in lecture classes. As seen in figure 39, the predominant folk pedagogy observed for this teacher is the 'Think' pedagogy (49%) followed by the 'Know' pedagogy (34%). A number of patterns of pedagogy were observed in the analyzed data from the RP observations that will be discussed here.

Participant RP displayed a consistent pattern in the agenda for starting the class. Every class session began with a guided meditation exercise that lasted between 5 and 10 minutes. This was typically followed by RP reviewing the students' reflections from the previous week (generated through student response to standard reflection questions via an online tool). During this time the teacher would read aloud questions from the reflections and offer responses. This activity was often followed by a call for other questions that student may have. Then the teacher would transition into the presentation for the day, offering an overview of the class including what topics would be covered, what complementary materials were available online and reference to any assignments that were due at the end of the class.

The slide presentations (which were part of all five classes observed) always included quotes or other short phrases attributed to various individuals (these were coded as STORY P). The remainder of the slide presentations included vocabulary terms and, often, definitions or other descriptive information. Sometimes the slide only offered a term with the remaining discussion about the concept offered verbally by the teacher. Coding clusters from these presentations usually included multiple types of PRINC codes as the teacher presented a term (PRINC V), offered some sort of definition or description

(PRINC D), and then told a story (STORY) or offered his personal opinion (PRINC PB) or a trigger for student reflection (DIR T) and then a concluding statement in the form of an "If…then…" statement (PRINC IT) or a statement about the application of the materials being a matter of student choice (PRINC C). An example of one of these coding clusters can be seen below in figure 46.

MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
PRINC	C	MANAGE

Figure 47. Example of coding cluster from RP class observation #2.

In the above example, the teacher advances a slide (MEDIA P) and then presents the terminology along with a description of a facet of multiple intelligences (PRINC V and PRINC D). This is followed by a third-person anecdotal account of Mozart and his years of practice (STORY 3). The teacher then concludes with an "either/or" statement to the students regarding their understanding and application of the concept (PRINC C). There were multiple examples of this pattern of slide change, term/concept presentation, story or statement of personal belief, and concluding remarks about potential options for use or application of information.

Another common cluster of activities observed in the RP lecture was the use of questions. In fact, the 31 QUEST A and 44 QUEST N open codes make up a total of 15.21% of the 493 open codes that also received folk pedagogy codes. An earlier section described the Q & A strategy employed by JA in both the design and delivery of the course content. With RP, however, questions were utilized in a different way. Oftentimes questions were posed either to the class as a whole to generate discussion among the 200 students, or a question was posed to the class and no answer was discussed. In this case, the question served as a point of reflection for the students and the teacher would typically preface these questions with a statement like “I want you to think about…” or “So ask yourself…” and allow some temporal space for contemplation before continuing on with further discussion or on to another topic.

Another apparent strategy employed by RP involved using questions as an orienting device that engaged the students in the topic before it was discussed and demonstrated the relevance of the topic. For example, before going into a discussion of time management, the teacher asked the class, “I want to see a show of hands. How many of you make to-do lists?” (RP observation #1). Students raised their hands and looked around the room. Then the teacher began to talk about the effectiveness of to-do lists. These questions were open coded as QUEST N because the teacher did not solicit or take any answers from students. Because there is no opportunity for the student to respond, the one-sided QUEST N open codes were assigned a ‘Know’ folk pedagogy code.

MEDIA	P	
MEDIA	HO	
DIR	D	DO
DIR	T	THINK
QUEST	N	KNOW
LINK	RW	MANAGE
QUEST	N	KNOW
LINK	RW	MANAGE
PRINC	R	MANAGE
PRINC	R	MANAGE
PRINC	C	MANAGE

Figure 48. Example of coding cluster from RP class observation #5.

The challenge of applying an folk pedagogical intention to the QUEST N open code can be seen in the above example from RP observation #5 where the teacher has given the students directions to think about a series of questions and then write down the answers on a provided handout (MEDIA HO, DIR T, DIR D). As can be seen in figure 47, this coding cluster includes all four folk pedagogy types. The teacher posed the question to the students and did not take any responses (QUEST N). He then talked about the question and connected it to real world examples (LINK RW). This led into another question (QUEST N) for contemplation and the teacher said "What I mean is…" and offered a clarification by connecting the question to the students' own lives. The teacher then talked about the reason for discussing the concept (PRINC R) and concluded with a statement about choices of how to utilize the information (PRINC C). In this example the use of an unanswered question (QUEST N, 'Know') was employed as a strategy to facilitate consideration of knowledge creation and application (PRINC R and PRINC C, both 'Manage' approaches).

The above coding cluster also illustrates one of the few instances of a 'Do' folk pedagogy code in the RP observation data. In fact, only 5% (24 out of 493) of the folk pedagogy codes from RP observations were of the 'Do' type and these all occurred around the DIR D open code, when the teacher would instruct the students to perform a task. Again, in the case of RP, most of these instructions to students were to write down something they had been asked to reflect upon, or in one instance to write a poem which were then shared aloud.

Similar to the analysis of JA observation data above, the RP data was also subjected to an analysis of the PRINC codes in order to determine if any patterns were present that indicate a preference for one method of delivery over another. Figure 48 illustrates the results of the analysis of the 185 PRINC codes which represent 37.53% of the folk pedagogy codes from the RP observations. This is less than the 45.63% of PRINC codes identified in the JA lecture class data, but more than the 20% present in the studio class observations.

The figure below reveals that the majority (53%) of PRINC codes represented a 'Know' pedagogical approach through delivery of terms and definitions. However, there is also a significant percentage (37%) of 'Think' codes present indicating the teacher's discussion of personal beliefs and use of 'If/Then" statements. This percentage is considerably higher than the JA lecture results of only 4% 'Think' codes. It is lower; however, than the 49% of 'Think' codes identified in the JA studio data results. For RP, the 'Manage' code was applied to 10% of the PRINC codes which is comparable to the 9% found in JA lecture data and over half of the 23% identified in the JA studio data. The above figure also shows how RP attempted to balance the presentation of fundamental knowledge ('Know') with discussion of the reasoning, meaning and application of that knowledge ('Think' and 'Manage').

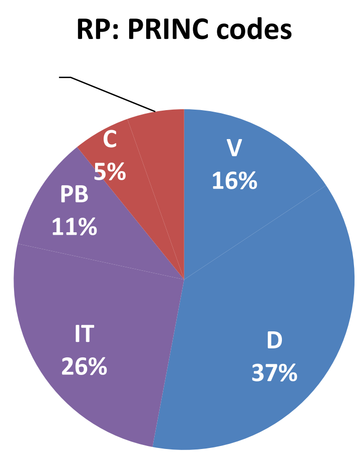


Figure 49. Distribution of folk pedagogy codes for principles (PRINC) in RP classes.

A specific example of the use of multiple PRINC codes in a coding cluster from RP observation #4 is presented in figure 50 below. The teacher advanced the slide (MEDIA P) and read the description of a personality type (PRINC D) from the screen

(RFS). The teacher then expanded upon the description by discussing how the personality functions as a logical decision maker in a group or team setting (LINK RW) and referenced a statement made by a student earlier in the class (LINK CCE). Next, the teacher told a story about himself and an interaction with a personal friend (STORY 1), and concluded with the statement, “So if I need to make a decision, then I go run it by this person” (PRINC IT).

The use of story (as seen below) by RP was a common feature of the observed classes. In fact, the four different possible story codes (STORY P, 1, 2, and 3) represent 89 of the total 493 open codes subjected to folk pedagogy codes, or 18.05% of the total folk pedagogy codes. The ‘Think’ codes was assigned to all STORY codes because it situated the teacher in a less authoritative and more collegial role with the students and because the use of story relies upon the student to utilize imagination to interpret the meaning of the story and consider the application of the concept in the context of the anecdote. In the case of the STORY 2 code, where the story is told in the second person, i.e. “you are in the middle of this project and you are thinking...” (RP observation #4) it is particularly evident that the story serves as a device to get the student thinking about their own thinking.

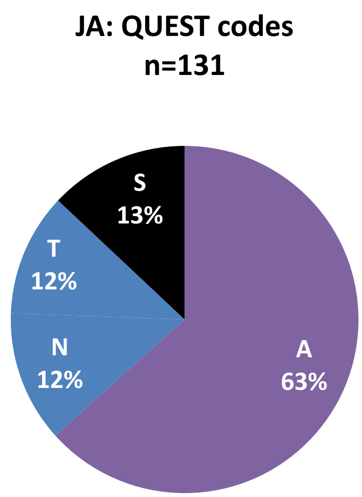
MEDIA	P	
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
LINK	CCE	THINK
STORY	1	THINK
PRINC	IT	THINK

Figure 50. Open and folk pedagogy coding cluster from RP observation #4.

The use of story is similar in pedagogical intent to the use of personal belief statements and “If/Then” statements because they also require the student to interpret meaning and situate their own beliefs within the context of the information presented. The PRINC PB and PRINC IT were also common in the RP observation data, representing 20 (PB) and 47 (IT) of the 493 open codes subjected to folk pedagogy coding. This amounts to 13.59% of the total folk pedagogy codes for the RP data. Aggregating the STORY and PRINC PB and PRINC IT codes reveals that this ‘Think’ and ‘Manage’ combination approach constitutes nearly 32% of the observed teaching practices of RP during the lecture classes.

4.3.1.3 Comparison of results across both teacher observation datasets. This section will compare the results of data analysis for both of the teacher observation datasets according to a number of codes (both open and folk pedagogy). The purpose of this analysis is to uncover any similarities or differences across the two teacher cases that may be identifiable via examination of specific pedagogical practices and intentions. More specifically, this section will consider the questioning, suggesting, directing, presenting, narrating and linking practices for the two teacher cases.

The previous sections described the use of questioning strategies by both teacher participants. Here, these practices are compared side by side (see figure 50). The corresponding folk pedagogy colors (‘Know’- blue and ‘Think’-purple) have been applied in the figure below in order to render comparable the pedagogical similarities and differences. The QUEST S (Question from Student) open code was not assigned a folk pedagogy code so it remains black.



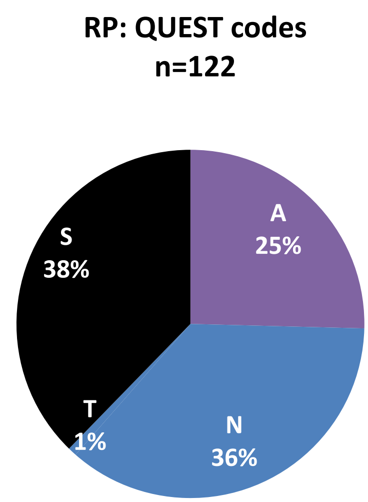


Figure 51. Comparison of distribution of QUEST codes from both teacher observation datasets.

It is evident in the figure above that the teachers exhibited preferences for different questioning strategies. For teacher JA, 63% of questions were posed with the intention of taking an answer from the student. It is worth noting here that this high figure may be a reflection of the consistent practice of reviewing quizzes at the outset of class where the teacher would ask a question that the students had a correct answer for on the page in front of them.

The QUEST T code that was applied in 12% of all QUEST codes indicates that the teacher posed a question which was then answered by the teacher. This figure, though not terribly high, is likely a result of JA's practice of using a Q & A approach to the PowerPoint presentations in the lecture class. During these presentations the question that appeared on one slide was consequentially answered on the next slide by the teacher. The QUEST N code, which indicates that no answer was taken, was also applied to 12% of the QUEST data. This too may be attributed to the posing of questions during the lecture class without requesting or allowing a student response.

The QUEST S code indicates a question from a student. The 13% figure from the JA dataset is most likely indicative of the lecture class approach taken by JA because the studio observations did not include the one-to-one interactions between students and teacher which likely (and as evidenced by the transcript from these interactions) involved numerous questions by students. This figure still indicates a significant difference in the frequency of questions posed by students to the teacher in the lecture class compared to the 38% seen in the RP classes.

The RP dataset also reveals that this teacher utilizes two questioning approaches with similar frequency. The QUEST A approach is found in 25% of the question data and the QUEST N approach in 36% of the open codes. The N figure is likely indicative of the repetitive exercise of posing questions to students for contemplation and reflection rather than in-class discussion. Also notable in this figure is the comparably low frequency (1%) of QUEST T codes where the teacher poses a question then answers it.

While it is evident that each teacher utilizes questioning in class to frame the learning experience, the intentions that shape how these questions are executed appear somewhat different. JA tends to use questions as a design element, repetitively utilized to engage the student in a conversation with the material, i.e. "Why study perspective?" and "What is torque?" JA's questions tend to have 'correct' answers, whereas RP tends to utilize questioning as trigger for reflective contemplation of the material, a conversation that occurs within the student's mind as they internally negotiate the material. No 'correct' answer is offered or discussed. Perhaps it is this very uncertainty about 'correctness' that results in the higher instance of student questioning in the RP lectures.

The SUGG code was introduced in the second round of coding because there was some difficulty in applying a DIR code (indicating a direction to perform a task) when the teacher was offering a suggestion of a possible approach. This also conflicted a bit with the PRINC PB code which was applied when a teacher indicated how they might approach a particular task, i.e. "I would probably…" The SUGG code therefore emerged as a way to identify whenever a teacher would use the second person to indicate a potential approach or tactic, which was phrased, for example, as "You want to…" or "You should…" or "You could always try…" or "My suggestion is…" (from JA observation #2S).

This code was assigned the 'Know' folk pedagogy because it maintained the authoritative stance of the teacher as the one capable of making a suggestion of the preferred way to approach something. It also relied upon the student's ability to comprehend the suggestion and assimilate that knowledge in order to apply the knowledge. In other words, if the student could comprehend what the teacher suggested, it was assumed that they could then apply that knowledge. Both P and N qualifier codes were used to indicate when the suggestions were more Positive (i.e. "you should do this") or Negative (i.e. "you don't want to do this) though they were both coded as 'Know' and there was little difference between them in terms of pedagogical intent as observed in the classroom. Figure 52 illustrates the frequency of SUGG codes for both teacher cases.

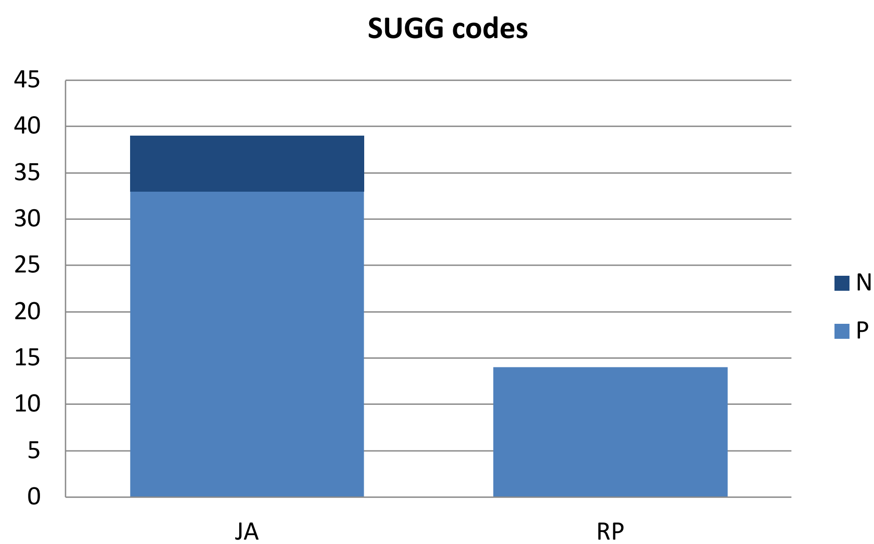


Figure 52. Comparison of SUGG codes from both teacher observation datasets.

Once again, the number of SUGG codes is not necessarily a comparable figure given that the total number of codes assigned to each teacher dataset was not the same. The figure above is offered as a representation of the relative frequency of suggestions by each teacher. RP only offered suggestions 14 times during the 5 classes observed. These were typically in response to students questions and were framed as experiments, i.e. "Well, you could try this," or offered as personal beliefs "It is crucial that you start to think about…" or "You want to start to…" (RP Observation #2).

JA, on the other hand, offered suggestions 39 times during the 5 classes observed. While RP utilized only positive suggestion language JA used both positive and negative language. This does not suggest that JA is negative in tone or timbre only that the suggestions were offered as a cautionary comment, i.e. "You don't want this to be misinterpreted…" (JA observation #2) or sometimes as a comparison, i.e. "You could try something like this (SUGG P)…but not this (SUGG N) because …" (JA observation #4). Most of JA's suggestions occurred in the context of the studio class. When suggestions were made during lecture classes they were typically in reference to the assignments in the accompanying studio class, i.e. "I encourage you to explore beyond this…" (JA Observation #3L).

The DIR code refers to giving directions to either do something (D) or think about something (T). The DIR D code was assigned the 'Do' folk pedagogy because it situates the student as a doer who is capable of performing tasks. The DIR T open code was assigned the 'Think' folk pedagogy because is relies upon the student's ability to think and interpret. Both teachers utilized both codes in varying proportions. Figure 52 below illustrates the distribution of DIR codes for the two teachers.

It is worth mentioning again here that the number of DIR codes is not the focus here, rather it is the types of DIR codes that prompt scrutiny. For JA, 97% of all directions given in the observed classes were task-related, requiring the students to perform some task like reading, pinning up, answering questions, taking a test, etc. Only 3% of all directions were explicit imperatives to contemplate or think. RP displays a more even distribution across the two DIR types with tasks constituting 53% of the directions and instructions to think making up the remaining 47%.

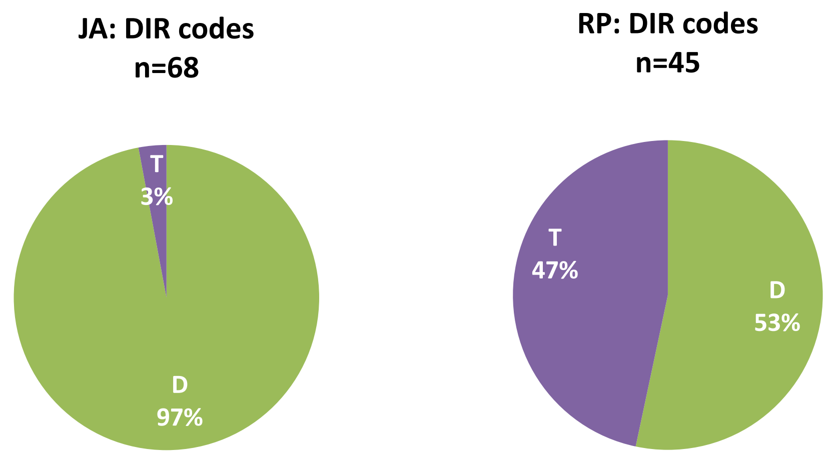


Figure 53. Comparison of DIR codes from both teacher observation datasets.

Once these figures are put into the class context, the results are more understandable. Most (85%) of the DIR codes for JA occurred during the studio classes where the teacher often gave the students instructions about activities in which they were expected to participate (i.e. the critiques). The only two DIR T codes for JA occurred during the lecture class when students were instructed to “think about this as inspiration” (JA Observation #3L) for example.

The majority of the DIR D codes for RP, on the other hand, occurred during the lecture class when the teacher would instruct the students to write down the answers to questions that they were expected to think about. RP often used the DIR D and DIR T approaches together when he would instruct the students to consider a topic or question and then write about it or apply it in some sort of way, i.e. “So take a moment and think about these (DIR T) and then I want you to list your top 3 out of the 8 that I described (DIR D)" (RP Observation #2). Although there was a code ASS used for when the teacher would assign a project or homework task, RP often directed to students to complete activities and report back the results or bring them to class but explicitly stated that the activity was not "for a grade" or "not for credit" so these items were also coded as DIR D.

Though open codes for strategies of presenting examples were not themselves given folk pedagogy codes, the variety of PRES codes (I- Image, A-Artifact, VX- Verbal eXample) between the two teachers offers a point of comparison. As figure 53 shows below, the two teachers utilized two entirely different methods of presenting examples to support course content. JA relied almost exclusively on visual images in PowerPoint slide to illustrate the course principles and concepts. These two-dimensional images illustrated both 2D and 3D concepts and objects and included a few animated images. The PRES A codes below refer mostly to JA's demonstration of student work during critiques when the teacher would hold the object up and point to various parts of it to wile talking about the design, principles of construction, shapes, etc.

Figure 54. Comparison of PRES codes from both teacher observation datasets.

Teacher RP relied almost exclusively upon verbal examples to illustrate the concepts and principles in the observed classes. These verbal examples often led into anecdotal examples (STORY) or hypothetical examples about student's personal or professional real world (LINK RW) and then concluded with a choice of how to interpret the information (PRINC C or PRINC IT). Occasionally images were used to provide visual illustration of a framework or theory but for the most part, the PowerPoint slides contained text and the teacher narrated examples about the concepts therein.

As previously discussed, both teachers utilized stories to frame the delivery of content in their courses. Any use of story was coded as STORY, including the use of quotes and poems, and all instances of STORY were coded as 'Think' pedagogy because of the expectation of interpretation by the student. Therefore, figure 54 below does not illustrate different folk pedagogies, rather it illustrates the different types of stories that the teachers used. Given the higher number of codes overall for the JA dataset (1135 open codes compared to 761 open codes), the number of STORY codes represented here may be indicative of a notable difference between the two teachers.

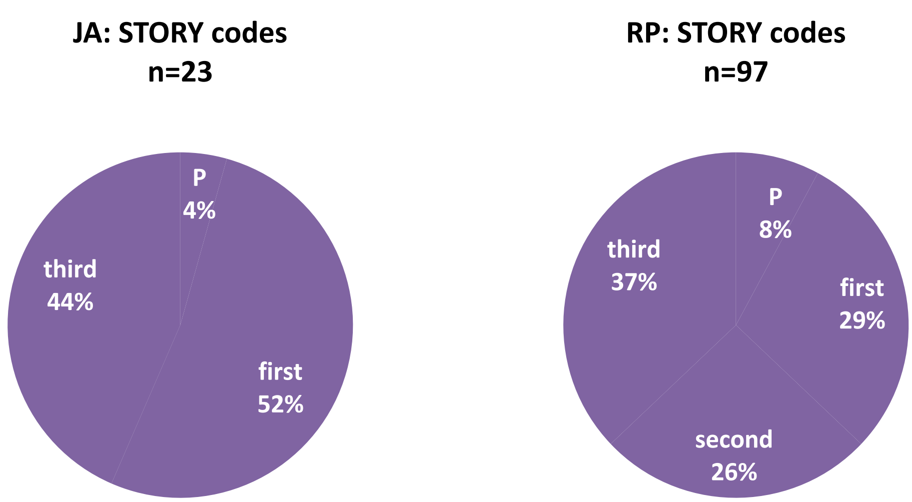


Figure 55. Comparison of STORY codes from both teacher observation datasets.

While observations of JA classes resulted in the identification of 23 instances of STORY, what the figures above do not illustrate is how the stories were used and therefore what the pedagogical intent appeared to be. JA often used personal (first person) accounts from his professional career to complement the material being presented. In fact, over half of the stories used by JA were of this more self-oriented variety. For example, in an effort to help the students overcome some of the challenges of using ellipse and compass tools expressed during a studio critique, JA offered some of his own personal "tricks of the trade", telling them "I used to use a tiny little piece of board to avoid making a hole…" (JA Observation #2S).

JA also used the personal story in the lecture course, again relying upon his own personal store of professional practice experience to complement the knowledge being relayed. While the previous example offered a storied account of improving a mechanical task, the next example offers a narrative of the relevance of a design principle, beyond the classroom and into the real world. JA was discussing the honeycomb shape and form. He talked about a recent biomimicry lecture that few of the students attended and then told a story about how the honeycomb was applied in a project he worked on, "So we had this proposal to develop an electric vehicle…and the opportunity to develop an ultra-light chassis by using this honeycomb… this is the future (of materials) based on these prismatic forms" (JA Observation #3L).

JA also utilized stories told in third person, i.e. about someone else, both in the lecture and in the studio class. One particular story that was told—in fact, it was deliberately designed into the presentation—during a lecture class actually became a recurrent theme and reference for many consequential classes. The initial storytelling occurred in the first observed lecture class and was indicated by a slide with the title "Vern's Grammatical Error." JA proceeded to recount the story of his old classmate Vern who refused to pay the model shop that built his chair design because it was not what he was expecting. Vern then decided to become a "detective" and look at the drawing to determine what the error actually was. In the end Vern discovered that it was his own error with the orthographic drawing that was sent to the model shop. Vern did not pursue industrial design and evidently became a detective instead. (JA Observation #1L).

This story offers an example of a third person account that not only complemented the class content but was actually designed into the presentation to become part of the reasoning offered for why the material was important to understand. The story did not end here, however, and "Vern's Grammatical Error" was mentioned in consequential classes (both lecture and studio) as a reminder of the need for precise orthographic drawings. For example, during a critique JA stated "What if someone gave it to the model shop guy like that? What would that turn out like?" (JA Observation #2S). Here the story not only served an initial purpose of providing a real-world and complementary anecdote about the class material, but it also served as a recurring reminder about appropriate application of the principles and performance of the requisite skills.

RP, on the other hand, demonstrated a number of types of stories including poetry, quotes, and stories in the first, second and third person. RP read at least one poem per day, typically as some sort of 'advance organizer' for the lecture topic. For example, in one class where the topic to be covered dealt with multiple intelligences, RP began with a poem read by Nelson Mandela at his 1994 inauguration that concluded with the statement "As we are liberated from our own fear, our presence automatically liberates others." RP introduced that reading with the story of Mandela (third person account) to provide some context and then read the poem (STORY P) and then asked the students what they thought it meant, "What is Mandela saying?" (RP Observation #2L).

As students answered, the teacher brought the conversation around to the topic for the day and begin to present the slides that accompanied it. This examples not only demonstrates multiple uses of story by RP, it also demonstrates how RP utilizes story to engage the students and orient them to the material before it is presented.

Similar to JA, RP also uses story in the first person, i.e. personal experience from professional or personal life or college experience or childhood, etc. For RP, the STORY 1 code often appears near the delivery of PRINC V and D, vocabulary terms and definitions. In this way the personal story serves the function of illustrating the principle in the context of the lived experience of the teacher, similar to how the personal story is used by JA. For example, during one class the teacher introduced the concept of “the grip” as being the inferior function of the personality. The teacher discussed how “the grip” is characterized in the different personality types that the students had been studying and the teacher offered his own account “You know when I am in the grip because I am the opposite of how I am right now…so like I end up getting really judgmental, now my daughter is really smart so she will…” (RP Observation #4) Sometimes these personal stories led into other stories or into “If/Then” statements of the original principles.

RP also used a number of stories about others to complement the class material, in fact these made up 37% of all the stories he told in observed classes. The third person stories included a variety of protagonists from friends and family members of the teacher to past guest lecturers or other teachers as well as authors scientists and revered spiritual leaders. Stories about others also appear near PRINC V and D codes where the story will follow a description of a specific term or concept as an illustration or example of application. For example, a discussion about distinguishing between ‘talents’ and ‘skills’ included a story about Einstein and his consistent efforts to play with his intelligence and practice applying his skills (RP, Observation #3).

The use of second person stories was not identified in the JA data analysis, however 26% of RP's stories were coded as second person narratives. In this case, the second person refers to the teacher's use of the audience (i.e. students) as the subject of the story. Though a few of these occurred when the teacher spoke directly to a student in the class, they most frequently occurred when the teacher would tell the story as a hypothetical, i.e. "So if I hired you and you didn't work out then the cost of that hiring error would be like…" (RP Observation #2) or when the teacher would illustrate a principle by telling a story situated in the students' own context, i.e. "So, you can see it when you are in a group, that the person who is a 'J' will… and the person who is a 'P' will…." (RP Observation #3). In both cases, the use of the student as subject of the story allows for the student to see the material from a different perspective, i.e. their own.

The last open code that will be used to explore the two teacher cases is the LINK open code, used to signify when the teacher would link the material to something else like previous class material or experience or real-world examples. The figure below illustrates how the two different teachers were observed using links in their classes. Four types of links are presented, the C represents links to class material, the LO represents a link to learning objectives, the IL indicates a link to independent learning (outside of the classroom), and the RW refers to links to real-world examples and experiences.

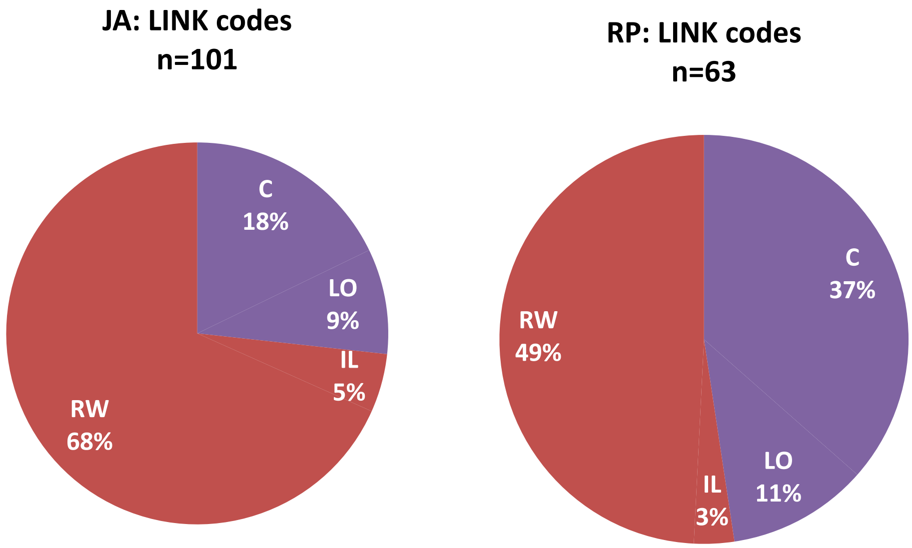


Figure 56. Comparison of LINK codes from both teacher observation datasets.

The LINK code is relevant to look at and to conclude with because it evidences the teacher's efforts to integrate the course materials and contextualize them in a bigger picture beyond the class or studio. While JA has more instances of the LINK code, the two figures represent proportional similarity when considered in the context of their respective datasets of differing size. Only 'Think' and 'Manage' folk pedagogies were assigned to these open codes and how they are distributed across the two teachers offers a point of comparison.

Both teachers demonstrated a substantial number of links to real world examples, for JA this constituted 68% of all links while for RP it was 49%. For JA, 15 (22%) of these RW links occurred in the two studio classes, with the remainder occurring in the three lecture classes. The range of instances for JA was between 3 and 31 for a single class. In fact, one lecture class (#3L) contained 31 different real-world references that accompanied a slide presentation. RP also demonstrated a wide range (R=0-16) in terms of instances of real-world links. The RW open code was assigned a 'Mange' folk pedagogy because it evidenced the teacher intention to situate the object of classroom or studio learning within a larger cultural and historical context.

The next most common linking device observed in both of the teachers was C, or Class where the teacher would discuss a principle or concept by linking it to class material or experiences from current, past and future classes (i.e. “We are gonna talk about that next week”). JA was observed using this approach in 18% of the LINK instances. This was typically identified as the teacher connected concepts from the lecture class to projects in the studio class. RP appears to have used this device a little more frequently, with 37% of the LINK codes given the C qualifier.

RP used the link to choice more frequently (comparatively) in 37% of the instances where the LINK code was applied. For RP the use of the link included many references to class materials as well as experience (i.e. references to events that were common to students and teacher, like a student announcement or a joke, etc.) whereas for JA these links most commonly referred to class material, the content as delivered.

The next LINK code, LO referred to Learning Objectives and was assigned whenever the teacher would link whatever they were presenting to the learning objectives of the course, or class, or module, etc. Both teachers used this technique though not frequently. So, for example, when introducing a critique in the studio JA prefaced by saying “The whole point of the studio is to learn from each other, you are going to learn more from each other … so you have to be able to critique both the good and the bad…” (JA Observation #2S). RP prefaced a statement with “The goal of this class is…” (RP Observation #1).

While both teachers made explicit statements that linked course content to the learning objectives of the course, these statements may have (as above) referred to previously covered material. Sometimes these references actually preceded the teaching to prepare the students for what was coming, or to reveal the teacher's expectations. Take for example, this activity introduction by RP, "How we are gonna do this is I will talk about it, I will read some examples, and I will read some famous ones. Then you will try it" (RP Observation #5). Here it appears that the learning objective is not necessarily content knowledge but rather a procedural knowledge, in that students are expected to learn how to do it themselves by being exposed to a presentation and examples.

The least common LINK code used was that of IL which was applied when the teachers would refer to students' Independent Learning outside of the classroom. Though this did not happen frequently at all, it appeared that teachers did make an effort to connect information inside the class to actions and events outside of the classroom (i.e. the RW references). There did not, however, seem to be much effort to encourage the students to go above and beyond the curriculum and deepen their understanding of a topic that may interest them. In all of the class observations, JA made 5 and RP made 2 references that were coded as references to independent learning.

This section offered a report of the results of data analysis of the teacher observations. This analysis relied upon the application of two separate and sequential coding schemes to the field note data. These results offer a picture of what the teachers did, how they performed their pedagogy in the classroom. This section is a story of theories-in-action. The next section will provide some back story. It will begin to reveal the theories-of-use that shape the intentions and actions of the teachers that we have been watching. The next section is one of listening- listening to the stories of these teachers as told in their own voices.

4.3.2 Results from Analysis of Teacher Interviews. The two teacher participants for this study will now have a chance to describe their pedagogical intentions using their own voices. Excerpts from the four interviews with each participant have been woven together into a narrative account (one for each participant). The resulting stories offer a particularly 'folk' interpretation of the way that teaching is conceptualized in the mind of the teacher.

The format of the narratives below includes the organizing interpretations of the researcher which appear between sections in italics. These italicized interjections explicate the logic-imposing practices of the storyteller (in this case researcher) described by Temple and Gillet (1989) in section 2.8.2. The comments describe results of the analysis and the researcher's efforts to make meaning of the narratives by viewing and ordering them according to the 'bi-focal' lens of both Bruner's folk pedagogies (see section 2.8.4) and Cross's concept of designerly ways of knowing (section 2.5.4).

4.3.2.1 JA: A Manager of Minds. I got a Bachelor's Degree in Design, and it was a unique Bachelor's in that it still incorporated a lot of studio. So it was called a Bachelor's Degree, but I would consider it to be a studio degree, a B.S. degree, kind of like … the way the curriculum was run was we had studio and everything else, so I had basically the same kind of education that—pretty close to what we have here … And then I wanted to do a little bit more technical skills I felt that I needed…I got hired in as a junior designer at a mid-size industrial design firm that represented a lot of foreign designers in Japan, and got a lot of my experience pretty much first-hand. The attrition rate at that circulation of the designers was really quick in that environment, and I found myself going up the ranks within the first year. So I went from junior designer to quickly being interfaced with clients and then quickly being director and directing projects and really managing those projects as well. But it was great because I was my own boss, and I had selection of any kind of work I wanted to do. Because that's kind of how they try to do anything, any kind of design. Even though perhaps it was an industrial design company, they do any kind of job that would come through the door. So if there were graphic identity jobs, packaging jobs, including industrial design, we would take those jobs. So I would get first-hand experience doing some of these other things that were outside of my discipline. So I got on-the-job training in a lot of that. My portfolio basically landed me a vice-president position immediately. I didn't have to work up the ranks, which is normal at a large company like that.

So as a representative of the sponsor, I came in to interact with students, to represent the client or the sponsor in terms of design and what we wanted. And interacted with students and saw their work and saw how they conceptualized. I really at that point realized, yeah, that's where I want to be. This is much more active. I felt really good about the interaction with students, the amount of energy, and just the will to really want to create. The hunger and the passion about design seemed to be so much higher at school than what I had come to know in the last couple years of my career as a practicing industrial designer. Even though I dealt with and managed a lot of young designers, the passion level seemed that everybody's bright-eyed and really optimistic about the future and what could possibly be. So I really like that, and that was the kind of seed that was planted while I was practicing to want to somehow end up in an environment where I was teaching and interacting with students.

I had expected to teach later in my career. I had always thought that I would be a teacher after I retired from industrial design. That in my naiveté, I thought that teaching would be a kind of fall-back career. And then I started, from the first day of graduate school realized—having to immediately teach from the first day of graduate school and to be interacting with some really great teachers in graduate school—really realized that that was really wrong to even think that teaching could be a fallback career. That it could be a really specific choice that I would have to make to really change my career.

1: Designers tackle ill-defined problems

JA gets his very first class and confronts the challenge through problem framing. The freedom to create something completely new requires an understanding of the challenge as JA draws on his own professional experience to shape his approach to the problem. His reference to his mastery of the material indicates a 'Know' pedagogical approach, a belief that a canon of knowledge exists about which he may situate himself as an authority.

Literally, I was given a teaching job even prior to that fall. So I sort of just jumped into the pool, if you will… it was my first curriculum, my first class that I had to really create from scratch. But I loved every minute of it, and I really felt I did a really good job, that the students seemed to really respond to the stuff that I had created. I based it really on my experiences over my career at that time. It was teaching industrial designers about how to present their work using graphic techniques. I felt that I was pretty much a master of that, having done so many. I've lost count of how many client presentations I had done at that point in my career. I felt that I could really teach that to students: how to present themselves, how to present work, how to really get across concepts to a potential client or teacher or audience. But it was always taught differently, and there wasn't really any standard curriculum for it. It was just whoever came into that classroom taught it the way that they did. So that's why the door was left open for me to just teach it whatever way I wanted to. I had nothing to base the class on.
I don't think I would have been able to have created a course like that from scratch if I hadn't had a broad background. I would have taught it from a small, tiny perspective, which I think it had been taught from before. I wanted to sort of take both worlds and meld them into something.

Recalling his own education, JA also begins to frame the wicked problem of teaching through an identification of what he does not want the learning experience to *be like for his students. He rejects some extreme elements of the 'Do' pedagogical approach of the master/apprentice model and the 'Know' approach of the teacher as authority. The story herein perhaps exemplifies a case of these pedagogies in their shadow form- characterized by fear and shame.*

And then I had teachers while I was at Arts Center who didn't respect students at all. In fact, they considered students complete empty vessels, and they had no knowledge. In fact, they had bad knowledge, that anything that came out of their mouths or that they did was bad. And it was up to the instructor to set them straight. And they would whip them straight. Yeah, I had very scary instructors who would burn drawings, or rip them off the wall and step on them, in terms of their critique. And it was purely silent class. There was no feedback at all. It was just the instructor, the master, telling us how poorly we were drawing and how bad things were. It was a sort of reverse, negative reinforcement to get drawing skills up. Sure, we had really great drawings on the board after being in that situation. It was very scary. You didn't want to be the one to have your drawing ripped off or that. So it was this trembling fear that you got everything up and you weren't going to pin up anything that wasn't going to be of highest standard. It was a fear factor. Having gone through that in my career as a student, I didn't want to bring that kind of experience. It felt—maybe the end result could be possibly considered the same because you get improvement in drawing, but the experience alone, for me, seemed contrary to learning.

Now JA discusses a more 'Think' approach to framing the challenge of teaching where students' learning preferences become a variable in the ill-structured problem and tailoring the information to facilitate student interpretation becomes a goal. JA also relies upon a 'Do' belief that knowledge acquisition is assessable in student performance, not necessarily what they report.

…it's also just having a rapport with the student and getting a feel for their rhythm. It's kind of—again, a metaphor—but their rhythm of how they learn. Every student, I've realized, learns at a different rhythm, if you will. It's being able to get into their rhythm and find out where can I fit certain knowledge in that will be best understood? I always try to make the material palatable. And what I mean by that is, is it within their rhythm of learning? Is it within a way to get them to take in the information? Again, I can only know that based off of how that student comes back to me and reciprocates that though their application of material. That's the only way to be able to know. And of course, they can tell me that they've learned a lot and applied it. But seeing face value what they've actually done to be able to show that's how that's reciprocated.

Here JA attempts to tame the problem by negotiating the need for students to perform their understanding of basic principles ('Do' and 'Know') with a desire to allow them creative freedom to construct their own mental models of the task ('Think').

…that's actually something I think is really essential, is to give them artistic license. Say they get a certain level of artistic license to be able to maintain that passion in their projects. I think that goes through all levels. They can interpret it and make it anything they want. They want to create that. I would allow that. I would say interpret it from your perspective. As long as they're covering, hitting the bases, they can have any artistic license. It creates that passion. They're excited about what they do, and it's not being force-fed. It's making the material palatable to them.

In addition to demonstrating pedagogical thinking about curriculum and students, JA also models a 'Think' approach to the problem-framing process by metacognitively considering where these preferences came from. JA demonstrates reflection-on-action as he considers his own student experiences (theories-in-use) that shaped his own theories-of-action. This may also begin to reveal some 'Manage' *pedagogical tendencies wherein JA negotiates his own personal beliefs in the context of his educational context.*

And I think that might have been an attitude that I might have had early on in my education in design. I always tried to see how far I could take something. And I usually was able to get a good grade based off of that, if I did it well. I don't know if I was actually encouraged to do so. The encouragement came from the positive feedback that I got on the grade on the particular thing I worked on. I saw the difference of what I did from the other students who were regurgitating the material. I realized, hey, I've got something. Pushing it can lead to something better if you're persistent. I hadn't even thought of that until just now, explaining why I'm always quoted as saying "push it to the red line." Maybe in my own career as a student I did try to always push it in that sense. I just realized that now.

Again, JA models a 'Think' approach here as he assumes the role of teacher-as-learner, reflecting on his own actions as a teacher and how they respond to the students and the material. The self-questioning illustrated here is common throughout the JA interviews. Also evident in this passage is JA's openness to discussion both with students and other teachers in his iterative attempts to address the constantly changing problem of teaching. There are also hints of a 'Manage' belief about the nature of the knowledge being transmitted, which is subject to change over time.

I should encourage that. And I allow students to play around with certain things. Again, whenever the student pushes the limits and pushes to the red line, it's an indicator to me that I need to adjust the scope of how I teach so it allows more of that to happen, especially if it's something I hadn't seen before. Then I would incorporate that back in and say, well, that's even a possibility now. So I would offer that back to the students the next year, saying, look, a student last year went ahead and even did this.

That's even acceptable. I've been teaching the same course, the first-year course for the past five years now, and it has evolved every year. Only because of these little pushes of envelopes from the students themselves. And it makes me think, well, how far can I push it? It's reciprocal. I see what students can do… Can it go a little bit further? So, it improves the course. I've taken advice from another professor to always go back and re-look at each of your courses, because if you're "delivering the same thing every year (quoting this professor), you're not teaching that. You're not expanding that material if you keep doing that.

Considering more ways to frame the ill-structured problem, JA demonstrates his own efforts of intersubjectivity ('Think' pedagogy) as he attempts to understand what interests reside in the minds and hearts of his students so that he may devise (design) methods for facilitating the learning. JA also describes his belief that, unlike empty vessels ('Know'), the students brings their own knowledge and preferences and passions to the classroom which he attempts to connect the material to (a 'Think' approach).

It's a matter of—the problem is trying to find what gets them going, what wakes them up in the morning and makes them feel like they really want to do this. I think that passion is such an important part of being successful in design. If you don't have that passion, not just about the material, but about what you do and how you do it, and passion about the subject matter, and passion about just being there and learning—if you don't have any one of those passions will do it. If you don't have any passion, then you're really at a disadvantage. It's a matter of trying to find that passion in students. It's possible to find it, even if you feel you don't have it. I don't know if you can learn how to be passionate, but I think you can find your own passion. It's a matter of discovery more than learning. And that's the problem. For me, it's trying to make sure the students can somehow obtain that. And I would say 80 or 85% of the students already have a natural passion. It's just being able to put more fuel under that fire, to keep that passion going and even get it to expand. But it's that 20 to 25% of students, or 15 to 25% of students may have this real issue that they can't find that passion. That's where the struggle is.

Some, unfortunately, end up changing the major because it's just not right for them. That's okay. They need to find that out. And I always tell students, if you really want to make it in industrial design, you've got to be passionate. You've got to be passionate. Again, it comes back to that managerial guidance and rhythm. Maybe part of that rhythm is finding that passion level, too, that keeps that going… Keeps the motivation in learning and discovery and exploration and creativity and all that other great stuff that is associated with the creative field of design. It's, yeah, finding something that gets them going.

Here JA offers a combination of pedagogical approaches. On one hand he speaks to the tailoring of his teaching to the diverse needs of his students (a more 'Think' approach) by employing strategies that are decidedly more 'Do' in their performative nature. This excerpt also illustrates the next element of designerly ways of thinking, that of using solution-focused strategies.

…over time, I began to realize that individuals all seem to learn at different rates and in different ways. Some people I just needed to sit and talk with for a long time and get them to hear it several times. Other people I literally had to demonstrate for them, prove to them in a way that it can be done, or this is how it should be done. And others, I just had to continually manage and say, "Draw me this one. Draw me that one. Do this. Do that." Just have them do a repetitive kind of thing in order for them to learn. So it seemed like a bunch of different strategies based on a bunch of different ways of learning. That's how I came to the belief that there are different ways of learning, and that some people learn better through different techniques or strategies and methods.

Here again JA offers a 'Think' approach to addressing the teaching challenge by employing student-centered techniques and modeling a 'Think' approach through his discussion with another teacher. The emphasis on discussion here is decidedly 'Think'.

I think it's also the teacher has to make the opportunities for the student to voice their opinions. I think I might have just had this conversation with another instructor I mentioned, who wanted to know how they could improve their classroom. They asked me as a fellow instructor, "How can I improve? I want to know more. Can you do some reconnaissance for me?" and I said, "How can I ask your students in your classroom?

You ask your students." That's the best way, is to be straightforward and ask your students, "What can I do better? Am I delivering what you need? What can I do to help you?" And if you don't offer that—I don't think it's just students, I think it's human nature—you just accept the way things are, and you don't think that it could be improved. So the act of people voicing their opinion tends to be not such a commonplace thing in the classroom, unless the instructor makes every opportunity for the student to be able to voice that and get that feedback. By providing that environment to get that feedback, you're learning how to improve your teaching. So it feeds back into the system.

Another attempt to address the wicked teaching problem is JA's designation of different roles in the classroom. The teacher role in this description seems to indicate both a 'Think' approach (teacher as colleague) and a 'Manage' approach (teacher as consultant).

I think my role is to be honest and straightforward about the material, and then to provide—depending on the level of student—to provide that interaction. That's my role, to provide that opportunity, that sort of communication between the student and the instructor. My role is to really facilitate that subject matter.

The inefficiency of the 'Do' model is a concern for JA and he frames this element of the teaching challenge as an obstacle to be overcome by clarifying roles. The emphasis here is, again, upon communication ('Think') and a belief that multiple perspectives exist and should be explicated in the teaching approach, a more 'Manage' approach to knowledge creation and exchange. This allows the teacher to more easily manage the continually changing variables of the 'teaching problem'.

I spoke of that traditional master/apprentice role. I think that needs to definitely—that's the baggage from the past. But I think in those terms, it's sort of negative baggage. I think that's one of the obstacles of teaching. I think that's actually working against teaching today in the arts, that master/guild mentality. I think it has to be much more equalized in the roles. The roles still have to be clear, but I think they're different now.

Of course, the curriculum. I think that's really important in teaching. Having a clear understanding of that curriculum from multi perspectives. If I just take a teacher's perspective of the material, it may be very, very different. But if I can take both a teacher's perspective and a student's perspective, then, I think that's going to make the curriculum all the more strong. And when I see student perspective, I have to really think of multiple perspectives. Because as I've mentioned before, every student learns differently, so you have to be flexible enough to be able to look at your material from multi perspectives. Some course material is given, and a teacher has to just take the material the best way possible and teach it because that is the given curriculum for a specific program or unit. But I think how that material is actually creatively taught is another issue. I think I would say communication is the main thing. And it's two-way, definitely.

They always want to say, "Okay, that's all the curriculum. We know the plan of the semester. What's your expectation as an instructor?" And when I was first asked that, I thought it was so strange, that they're asking for your expectations. Because I had been a pretty self-driven student in my education. But I realized, yeah, as a student, you want to see how you reflect in the eyes of your professor, your instructor. So, I came to realize how students are really concerned about expectations. Regardless of the rubrics. Personally, you as the instructor, from a one-to-one level, what's your expectation of me? The more I communicate with the student, the more I can understand what the needs are. And I think the needs are always changing because the generation's always changing. But I'm seeing how the students' needs change over time.

2: solution-focused strategies

Here JA discusses some of his goals for a curriculum redesign collaboration with other faculty, a 'Think' approach. The identification of learning objectives illustrates a solution-focused attempt to shape the design of the class as well as an effort to inform the students, via rubrics, about what 'solutions' (i.e. knowledge and skills) they are expected to master (a possibly 'Know' approach). This begins to hint at another combination of pedagogies between the continual practice in the studio ('Do') paired and the 'Know' and 'Think' use of a rubric to explicate student learning objectives.

I wanted to make sure that, having taught the second semester course, that I covered all the bases so I wouldn't get those people who fall through the cracks. Even though they took the first-level course, still didn't get some of those basics that are required for the second semester course. So I made sure that students followed the curriculum. I worked with other faculty to develop the curriculum for that course to make sure that—because most of the faculty who teach the first semester, of course teach the second semester course. So it wasn't like bending arms to have to make changes to that first course so it made our job easier the second semester. So we really got strict and cleaned up and really organized that first semester to make sure that students are getting what we felt they needed to have in terms of those hard skills… it really depended on who was teaching the course at the time, who would emphasize certain things. Because it was loosely structured. So basically, it came down to making sure that each of the assignments had very specific rubrics on how it was going to be graded, and what were the key essentials on that project. What was the pedagogical justification for that project? What was the learning from that? If it was going to be perspective drawing or freehand drawing or composition or line quality alone. Those kinds of things, those would be the initial justification for that particular project, and then we would develop the rubric for that to make sure that students understood what they had to achieve for each of those projects… each assignment is very clearly written out so that there's no question as to what the assignment is, what media they're supposed to use, what the deliverable shape and format is.

So it's all laid out. It's also, again, the rubrics are given to each student so they are from the onset given what they are going to be graded against, so they know exactly what they have to have in that drawing, because they're going to be graded on that. So they know it right off the bat. That's pretty much instilled in the materials of the course. And then in terms of that studio, it's not only reading that and reiterating that to the student, but also emphasizing a lot of rough drawing and critiquing of that. So we may have, before the final assignment is due, in-class twenty, thirty-minute quick drawing sessions that apply to that final project. They have to do a lot of rough sketchwork before they actually complete a final drawing. So a lot of these in-studio, quick little exercises are to help to build skills to quick-draw and create some of those rough sketches that they need to build their final drawing. And then we do those quick sketching exercises and we get them to pin up on the pin-up board, and then we do critiques.

Teaching objectives like interaction with students and feedback (to students and from them) become conjectures for how to flexibly approach the teaching process. The student-centered approach and preference for interaction reveal 'Think' tendencies.

I think it needs to be an editing or balancing job. I'm realizing that every semester. It has to be that, depending on the number of students. So that we can maintain not only what we want to cover, but also ability to be able to balance out that feedback and interaction in the class. Because if it were just all assignments and no feedback and just a grade, we could probably keep it constant. But I think it's important to have that feedback and interaction so students can not only learn from the instructor, but learn from each other. That would be a tragedy to lose too much of that in a class, if the curriculum alone was your basis to decide that. If it had to be this number of projects regardless of how many students in a class, then you're going to probably compromise a lot on feedback. And it just means a lot of effort has to be placed on the curriculum to be able to be flexible… We felt we had it all perfectly fine-tuned. And then the sheer double number of students more or less threw all of that out the window, and we had some tough times to try to get through. Again, some hardships in class. Some complaints and some obstacles because of the sheer numbers of students. That's now part of the equation, now that I know that. That has to be dealt with. Whereas in undergraduate, we have a certain fixed number of student capacity per studio. So we can regiment it and make sure everything will be the same number of presentations, the same level of interaction, regardless.

Harkening back to his own learning experience, JA identifies possible solution states that result from a trial and error process of learning. This description of the cognitive experience of learning illustrates 'Think' practices of metacognition as well as the integrative component of applying knowledge in order to understand it, a decidedly 'Do' belief.

When I look back, for me, learning was first of all being exposed to certain theories and topics, and then learning was being able to explore them. But it seems like learning has to be a combination of being exposed and then absorbing that knowledge, letting it incubate, if you will, and then letting it out, applying it in some way. and I guess once you start that applying process, then it's reflecting and looking at it. Adjusting it, modifying it, going back and thinking and then coming back. And then I guess it is a process out of all these activities put together in a process that you learn. Something sticks or something makes you say, yeah, it works. It really is what they say it is. Or I understand it now.

Through reflection-in-action JA is able to diagnose and treat problems in the classroom, a sort of 'monitor and adjust' approach that is negotiated through internal, as well as external, questioning by the teacher. The pedagogical combination here is between the 'Do' notions of performing mastery of skills and concepts plus the 'Think' practice of reflecting on student understanding and personal pedagogy.

It was kind of, to me, I thought I was so clear. I had them ask questions. They confirmed. Does everyone understand? Does everybody get this? Even if I had done examples on the chalkboard and said, "This is how you do it," and demonstrated. I was in shock to find that even if I felt how thorough—I couldn't be any more thorough in explaining and demonstrating it, and yet I realized after 30 or 40 minutes, it still wasn't happening. There wasn't this confirmation that they understood what was being taught to them. At that point it was a quick realization that I have to manage this on a one-on-one. And when I did, I realized, oh, this student is thinking of this and that's why they had a hard time. Or they were only looking at this. So, it's kind of seeing the world through their eyes, their lens, and seeing why they can't focus on the material as well. It has to do with what their lens is that they're looking through.

I could see the improvements. It sort of confirmed in my own methods that I needed to do something like that. I realized that I had to take an active role, rather than just sit up there in front of the class, which I had been somewhat accustomed to in my own education. And I still saw that in other instructors, young and old, that I had been exposed to in teaching college. And it wasn't until I heard from another instructor, "You do that. You walk around and you help people. That's what I do, too." Or, "That's what this other instructor doesn't do." And that's when it dawned on me: oh, I do that. It wasn't something I was really aware of, that I was actually doing something that was purposeful in that sense. It just was a natural thing that happened in the classroom.

JA models here his belief in experimentation as he discusses both what he expects of his students and how he approached his efforts to teach them. This 'Think' approach to iteratively framing and solving the problems (i.e. mistakes) that are confronted during the learning process is fueled by the feedback loop between student and teacher.

It's a higher order of understanding the theory. And then it has to do with experimentation, exploration, rather than trial and error. Because with trial and error, it's just a mistake. The more mistakes you make, the more you learn. In fact, I just talked about that in studio just this week. I had to introduce our next project, which was to build a bridge. And I was saying, "It's not about the bridge and how beautiful a bridge you make." Because we have to test those bridges by putting lots of weight until the structures fail. And it's like the broken bridge is really where you're learning.

Because you're teaching based off of your own personal knowledge of teaching. So part of that prevention—what's preventing the learning, maybe, is that instructor's own lack of knowledge or misunderstanding or preconceived notion about some aspect of that teaching process. It's just becoming aware of that over time. I'm exploring things, too. And sometimes, I know things don't work. So I've had to sort of experiment. I realized I had to get through all the material, I had to give feedback to each student. But I had to find more creative ways to be able to achieve that and still maintain that positive studio critique experience for the students.

Every critique your fellow students were being critiqued is just as much learning as if it were yours. But by doing a really active kind of critique, a completely different kind of construction or creative way of looking at it, it really did work. So there's this experimentation that's actually going on. And I'd like to continue more of that kind of experimentation, because then I can see the effect and see that, wow, the students are really up and energetic. And then afterwards, I asked them, "What did you think about it?" And they were like, "More! We want more, JA!" So that's what I realized that I needed to do more of, that sort of hands-on experimentation to figure out what works and what doesn't work. And finding out from the students, too.

I mean, I've taken graduate level teaching practicum courses, and I've had many discussions with other tenured, long-term, very experienced educators. So that has helped along the way. And then I have colleagues and other fellow instructors that have given me a lot of information over time regarding some of the basics.

JA discusses his own reflection-in-action, his ‘Think’ approach to intersubjectively understanding the perspectives of his students so that he can creatively experiment with possible solutions.

…in the lecture I can see through the eyes of my audience. I can see their reaction, their body language. I can see even in real time, during my lecture, which part of my lecture is making them fall asleep and which parts suddenly get them sitting up. Yes, there’s a dry definition on the board. They just copy it down and go back to sleep. And then when I show the next slide, which shows some example of the actual principle or whatever, that’s somehow interesting to them. Then they wake up. For example, I know students are into gaming. So of course, that’s going to be one of my avenues into showing them some of the principles. If it’s fitting. So I’ve shown some—basically, what’s one-point perspective and two-point perspective, and how does that create depth of vision or depth of space on the 2D? So it’s like teaching, maybe, is being creative. Creativity from the teaching point of view.

3: ‘constructive’ thinking and pattern recognition

JA reveals here his pedagogical intentions through a description of the constructive and generative nature of the learning progression through the entire program. Foundational skills of drawing and design principles create the starting point for the generation of design knowledge via a combination of ‘Do,’ ‘Know’ and ‘Think’ pedagogical practices.

I think those are the core foundation skills that they need to build on. So it’s a building process. So the first-semester freshman student gets hit by really drawing and trying to accomplish a certain level of drawing skills. Then they move on to understanding a certain level of complex conceptual principles of design and applying those in a make situation, actually building things. And then of course drawing in addition to that. And then, further on—and I don't teach second-year students—but the second year is where they just hone in more on those exact same things, but get introduced to other media, like electronic media, different types of software, different types of drawing media like markers and other types of sketching techniques. So they move from basic pen and pencil drawing to those kinds of media in the second year. The very first point is drawing. Well, it think because drawing is such an essential element in industrial design. In any design, total, but specifically industrial design, you need to be able to communicate your ideas to yourself and to others. The only way to do that is through the skill of drawing.

The application and exchange of knowledge via the critique process contributes to the students' growing content and procedural knowledge. These interactions reveal the 'Think' practices of negotiating students' theories of mind through collaborative discourse as well as a reliance upon a 'Do' expectation of students demonstrating 'know how' via the performance of specific skills. JA also reveals here is proclivity for a 'Manage' approach to consulting with the students as the construct their knowledge.

A critique would basically be each student pins up a drawing that they've done in class. And then I would first of all ask the students to—based off of the printed-out criteria of how they'll be graded—to use that same criteria to select on the board which sketch they feel most fulfills that criteria that they're given. So they vote on which of the sketches in class their fellow students have done by putting a little push-pin next to the sketch they felt does that. Then I ask each student who's voted to explain why they selected who they selected. I go through that to get them to talk about the rubric. Now why did you select that? Was it because of line quality? Was it because of this? And then they try to answer—I get them to explain as clearly as possible using the language that we set up in the materials. So, it's again re-emphasizing the support of the material itself.

And they begin to get used to using those words that describe those rubrics and the goals of the project. After the students all go through their own points of view on how they would have critiqued the work, then I go from my point of view as the instructor, that I would critique each individual sketch on the wall. I try to do that as quickly as possible. I don't want to maximize too much time in-studio, because they really have to spend a lot of time drawing. But I really try to balance out between drawing and then giving them feedback. So, the critique really is sort of feedback and reiterating the concepts, the principles, the criteria, the rubrics, so they understand what they're being judged on. And to start to develop an understanding of what is good, what is appropriate, what is effective drawing techniques.

Sometimes we don't vote, sometimes we choose the one that's the least effective, rather than the most effective on the wall. And that's to discuss how to make that better. And again, it's just to break down the barriers. First-year students often feel really shy about making any kind of comment to their fellow student. They don't want to diss any of their fellow students. So, they're very shy about giving their opinions and they don't really feel that they have knowledge. But even on the first day when I ask them to select which one is the best on the wall, they have enough knowledge built up to be able to make the right decision. I would say 99% of the time, they're choosing the best drawings on the board. So they know. And it's really just trying to hone that in and get them comfortable, really solidifying what they already have in their minds. Really honing in on that and making them see things that they perhaps didn't see to really re-emphasize that. I think the critiquing is very interactive and again, it's slightly free-form in terms of yes, I'd like to let the students guide it. And where I feel things are missing, then I would add to make sure that it's full. I feel that the students learn more when they're able to voice things on their own. It helps to build their own confidence and their knowledge that they already have, as I mentioned. I believe they do have a certain amount of knowledge coming into the classroom. It's just giving them the confidence and again, that regimen to be able to get that reflex, if you will, to become sort of common. So that they're constantly relying on and re-affirming that knowledge. I think they generally are correct, it's just the scope and breadth of what they're able to critically look at is smaller.

In the following statement JA rejects 'Know' notions of the student mind as empty vessel through the acknowledgment that existing knowledge and skills must be integrated into the learning process. JA also takes a 'Think' approach to the collaborative interchange of the critique where students must explore alternate methods for applying their knowledge and identifying patterns of acceptable execution. JA also models here the 'Manage' concept of questioning historically situated beliefs through his critical examination of his own critique experiences as a student.

They are getting feedback from me, but again, I feel that it's based off of knowledge that they already have. It's re-emphasizing, oh yeah, that's right. In their minds, they understand that. I'm basically reflecting back to them what they already somewhat maybe know innately or have some sort of experience to. It's re-emphasizing that, and then strengthening it, so that it becomes real for them, rather than assuming they are completely empty and any knowledge they bring should be thrown out from my knowledge. That doesn't work. It doesn't seem to me—it didn't feel right to be taught that way. So I didn't want to teach that way. And the observations of other faculty, how they taught, didn't seem to be that way either. So I felt that that definitely wasn't the way I wanted to teach. That in fact, to really turn the tide the other way and get it interactive. Because the one thing that I felt was that I didn't want students to feel shy. I didn't want students to feel that they couldn't stand up and express themselves and say, I don't think that's correct. I think it should have been done this way. and to get them to self-critique, as well as to have the courage to critique somebody else' work.

There's a bit of a jump. It's easy to be able to critique your own work, because it's your own work, but there has to be a transformational step that a student has to take to be able to apply that same knowledge to somebody else. Because now it's affecting somebody else. It's putting my knowledge as a student on line. It's opening up to criticism. I'm stepping on the line to be able to say something. But it's getting the student to cross that line and say it's okay. Have confidence. If you can make that same criticism to yourself, you can make it to others. That's how it is in practice. For me, being in large design studios with many designers, we throw up design ideas on the wall and we critique them on which ones are most effective and which ones aren't. And nobody's hurt by that as long as it's critical and constructive. That's how I felt it should be taught in the classroom as well. Give everybody credit for what they put up on the wall. There's always a silver lining. There's always good parts. It's not all trash, not all something that you burn or step on. Never, ever do that.

I want to make sure that it's constructive, that it's not like what I had to experience, where I saw students who were at the brink of tears. It's the appropriate language so they get from this personal point of view to more of a personal intellectual point of view, so they're actually using their knowledge rather than their personal tastes to make judgments. All the materials help to emphasize that and give them the tools to be able to hone in on those skills.

The constructive nature of teaching is evidenced here in JA's description of the advanced level of graduate students. Even at a different level, JA still describes a 'Think' approach to intersubjective interchange with student interests and how that *must be negotiating with the fundamental principles that the students must learn ('Know').*

It's just on a much higher intellectual level at the graduate level because they come in with their own interests, their own specific research agenda. Many of them have either a very specific research or very specific agenda in terms of what they want to study or what they want to look at. So it's respecting that. And then working within their interests to help make the curriculum palatable. Maybe in that sense, the difference is working within each student's understandings or interests or area in order to make that material more applicable or palatable to them. We're teaching at this point, rather than fundamental principles of design and drawing, it's fundamental principles or design research. So it's getting them to do hands-on projects as well as of course writing and reading as part of the skill set in developing skills and knowledge about research and design. It's also getting them to apply that by actually doing small and large scale projects, in-class exercises, and things like that. It's very similar, I think. It's just on a higher level at the graduate level.

The reciprocal relationship between teacher and student fuels the development of the teaching/learning experience, which is iteratively constructed over time. The teacher must ensure that each students is being appropriately challenged and encouraged ('Think') and provided with exemplary demonstrations of alternative perspectives('Do').

I think if I were to look at my students' work, I would say what I would want out of them is their understanding and embracing of the material and being able to apply it. Again, to be able to fulfill those needs, and to see them actually being fulfilled is probably part of my needs. If I can see the improvement, that yes, they do understand perspective intellectually, and they were able to apply it in this particular context that really worked for them, then that is satisfaction to me. That yes, I see how far what I've taught can go. And it's going to be different levels with every student. I get back whatever I can get back, and that's in terms of what gets pinned up on the wall at every critique, and the end of every project. I can see how much influence I've had in terms of how much they've embraced the topic or subject matter. The feedback is what's pinned up on the wall, how much they've actually been able to demonstrate and what level of knowledge they have, or ability to understand that principle, that particular subject. Yeah, I would gauge it to each of the students… most students want the bar raised, but it's unfair to raise the bar too high, depending on the student. Because then it becomes unrealistic, and then it's unfair. But the bar has to be raised. It's just to what level. And that's sort of gauged by each student, and their own ability to reciprocate that relationship. But generally, I think the bar is generally raised with every student. It's just what degree.

Yeah, it think there's a lot more feedback in the third year because they've already accomplished many things, they already have quite a lot of knowledge accumulated, and they're already beginning to form how they're going to use that information. That becomes an asset because you're building on that knowledge, but it can also become a challenge, because sometimes they may have already decided on how far they're going to take certain things, and they've already made decisions on how they're going to use certain principles, or how much they believe in certain principles. So part of the challenge with the third year is to break down some of the particular decisions they've already made about certain subjects if it gets in the way of providing that broader perspective. Sometimes it's a matter of yes, you already have some ideas about what this is, but I ask you to put those aside and maybe even crush them, bring them down and build them up again, even though we're learning about material, perhaps, that they've already been exposed to. It's a matter of getting them involved and again, teaching by example. Everything I would have done in the first year done the same in the third year, just the fact that the material may be more advanced.

The construction of design knowledge is conceptualized as the tandem development of both procedural and content knowledge through demonstration ('Do') and discussion ('Think').

Well, for example, if it was perspective in first-year, then third year may mean something more like design process and problem-solving, and perhaps use your research and things they haven't done before. And then of course trying to teach them approaches and show examples of how to approach a particular project or problem. Teaching through example. Making it so they can understand it intellectually, but also understand why it's being done. So giving them multi perspectives. And it helps to give them the rationale on the importance of the principle, and how it can be broadly applied.

Here JA describes the role of teacher evolving from demonstrator/craftsperson ('Do') through to colleague/collaborator ('Think') as the students gain experience and advance their own understanding of the material. JA also describes a 'Manage' approach to facilitating student's abilities to critically question the knowledge presented to them.

I think first year, they want to see actual demonstration of these principles, so I literally have to go up on the chalkboard and draw in perspective. I have to draw using certain things. So I've actually found I have to do the projects myself and show them how I would approach it. So I'm still demonstrating… I'm actually still showing by example, actual physical demonstration. But I think it's also balanced with a lot of discussion. I find that the theoretical—when you get to those other types of knowledge in the third year—you need more discussion. There's so much personal opinion and rhetoric that's necessary in being able to discuss these things that the discussion is probably what

would be different in third year. There would be, yes, a little bit of that same demonstration, but also really balanced—almost overbalanced with the discussion end of it. The real theoretical discussion where students get to open up and talk.
I find that that actually motivates them more, when you have that kind of open discussion and question and answer situation. I challenge the students to look at the material and say, do you really believe that? And some may be for it, and some may say, well, what about this thing? I'm not really sure about that. And then I play devil's advocate and say, yes, if we were to take that point of view, can we challenge these ideas? So they can get sort of a perspective from both ends. Because when you get to that theoretical thing, it's rhetoric. Everything's debatable in that sense. It's no laws like they are in perspective, where you can't tweak perspective and still call it perspective and change those rules. There's certain rules that are laid down. Whereas, when you get to that broader, theoretical knowledge, it's really sort of open for discussion. It's more of an exchange, where we're going to say, based on your current knowledge and perspective, how do we use this? And yes, that may be a valid perspective, but have you considered this thing? We constantly play devil's advocate with each other.

Advanced knowledge construction involves the negotiation of different types of knowledge, i.e. canonical laws ('Know') and a theoretical understanding of the principles that underlie them as well as how they can be applied ('Think'). Here again, the questioning of certain concepts reveals a 'Manage' approach thought the authority of earlier concepts is a decidedly 'Know' belief.

With laws of perspective, I'm on the side of perspective. We're talking about those laws that exist in perspective. So I'm going to be the authority in terms of that. There's no challenge to that, and if there is a challenge, I'll provide examples on why it is the way it is to get them to understand that principle in the first year. But if it's in the third year and more theoretical material that can be challenged, then it's a matter of making sure that the student understands multi perspectives of that. Because this type of theoretical material can be looked at from different perspectives. And I think that helps broaden their views and helps them to understand that, you know, there's a perspective to everything. And it helps them to really understand the material more broadly, rather than lay down dogma, laws. Because I don't think that can actually exist when you're talking about these more theoretical, complex levels of design in the third and, of course, the fourth year.

The constructive process of teaching and learning is explicitly referenced in the description of knowledge accumulation and building by graduate students. This occurs through interaction and discussion ('Think') as well as demonstration ('Do'). JA also reveals here a pattern belief that the 'Think' approach is more valuable in later knowledge construction.

The graduate level student is going to have a lot of knowledge already built up. You're building upon that. But I think all things still have to be demonstrated. You still have to demonstrate to the students. And then you still have to have that open discussion about the subject matter, because again, there's no right or wrong way. It's just a balance of perspective … it's going back into perhaps my own work, or the work of my business partner, and bringing that into the classroom. And saying this is how research has been done in this particular context, and we used these particular methods. Maybe we could have done this and that. And explain it that, again, it's not dogma or laws we're giving, but it's to show examples of how it could have been done. How it was done in this case. And then showing examples of how it shouldn't be done. On the graduate level, you really need a lot of discussion.

I try to encourage students to make appointments so that they can further have a one-on-one discussion on these materials, and any questions they have. It just adds more. Because again, it's not dogma. People are nodding their heads when you're explaining something, but you're trying to get them not to take it for face value. That there are many other challenges to these materials. There's probably a polar opposite perspective to everything. It's trying to get them to understand that and to think critically about the material.

Discussion, I guess, is needed regardless. I don't think discussion is as critical in the first year, because again, we have these laws and principles. And as long as I demonstrate and show examples of these things, then the student will be able to, I believe, take in the material.

The notion of the student as 'expert' demonstrates a 'Manage' approach to pedagogy which is further evidenced below by the description of the consultant role played by the teacher. This excerpt also implicates the concept of mastery in the solution-oriented approach.

I think that's where really the learning happens, when they're able to take command of their own material and feel that they are, in one sense, on the graduate level, a master of their own destiny. It goes from being able to choose your own topic of drawing and passion to having the ability to be able to express yourself and give your own interpretation of the material to really being focused on your interests in the graduate level, being able to pursue what you want to pursue in the Master's. And then oh, by the way, along the journey to your destination, here is some important information we need to exchange and look at.

Teaching, according to JA, involves constructing learning upon a foundation of knowledge inherent to the student. This process of negotiation is catalyzed by the *teacher's introduction of multiple perspectives to the student's continually evolving mental context ('Think').*

I'm a firm believer that everybody has a certain amount of knowledge they bring to the table in the classroom. The mere act of coming to class, I believe it's to be exposed to these concepts, knowledge. Either the knowledge is reinforcing that preconceived notion, or it's conflicting with it. And there has to be some sort of negotiation between "I always thought it was this way. Well, no. The teacher's saying it's this way. That's nothing I know or have been exposed to." And that case, there has to be negotiation. In either case, whether it's confirmation of a notion or in conflict with a notion, there's still learning that happens in that process, I believe.

With the graduate course, the hand-on work actually happens outside on projects. But that hands-on demonstration or interaction has to be done outside of the classroom in the office hours. And then the interaction and hands-on demonstration and reinforcement and the "a-has" and negotiations, all of that occurs in the office. I wouldn't say it's necessarily a different kind of learning, but it's at a different level. Because again, I think it goes back to how much knowledge the students have, or preconceptions, that are even harder to negotiate on the graduate level because "I learned it to be this way. So there's always going to be this negotiation.

There's a sort of energy that happens where the instructor's testing their students. I mean in a metaphorical sense, not necessarily an actual test, but you're finding out, feeling out what's out there in the classroom. How much knowledge there is and how the students—what the students believe to be true or false. Because again, on the graduate level, there really isn't necessarily a right or wrong way. It just depends on your perspective and your point of view. You can make an argument from any different theoretical point of view, especially. That's where that interaction becomes even more critical in terms of managing, because of the conflicts that can occur. And they're not—I don't see those conflicts as negative. I see those conflicts as part of the learning process on the graduate level. It depends on the student, but students tend to see the world more in black and white on the undergraduate level, especially in the earlier years. And it's just through exposure and other types of knowledge that their minds begin to be broadened. They begin to see there are other colors on the spectrum. There are other ways of looking at things.

JA identifies three levels through which learning proceeds, a generative process that relies in the beginning upon imitation ('Do') and evolves towards a higher order of creative mastery unique to the learner ('Think').

Success is when I see that the student has not just regurgitated the material, but has somehow been able to make that material their own. And to have added some of their own knowledge, their own creativity to that process. Again, there's varying levels of success. Perfect regurgitation is one level of success, to me. Because they're able to understand and execute the knowledge. And then, on a very minimal level, but they're able to regurgitate that knowledge. So I've confirmed that yes, they understand the knowledge. Then there's this second or third level where they're really, really proficient at it…and then going beyond that to execution and then a unique perspective. That creative way of approaching the problem or the solution. Just a really unique performance on that product. Three orders, but a varying spectrum between all of them.

The teacher constructs the learning experience so as to facilitate the evolution from fundamental to advanced levels of understanding. Here JA offers the cognitive reasoning behind his curriculum design which proceeds similarly to the product design process with various stages of prototyping or making ('Do') and testing or reflecting ('Think'), vacillating between the big picture and the details.

I have to look at the entire material, but then I have to also perhaps give a little bit of a hierarchy to say, okay, here's the order of the material. I may even mention that to the students: if anything, you remember from today's class, I want you to remember these three things. So, I have to first of all overview the material and think of the take-homes which rank the material, and then think of some sort of strategy, if you will, of how to approach that…it's the overview. What has to be taught. And then of course it's in what order. What's the best way of being able to—what's the most natural way of being able to get the information to student? Because knowledge is built on knowledge. So there's a certain amount of juggling that has to happen. So, learning that, again, going through the semester a few times to realize, you know, we really gotta change that. And then spending the energy.

So, I pitched to the rest of the faculty, saying, "Look, we need to pull this project ahead of the last project and make this big model-making project the very last project of the semester." And it was just my observations in classroom. It was also feedback from the students, saying, "Gosh, I wish I had done this project before the last one." And when you hear that enough from students—it's not just a couple oddballs saying that—it's like "I wish I had that knowledge before. I could have made that other project so much better." Then maybe you realize, yes, we've got to do it. It may be pulling teeth. It may affect other courses—because I teach a lecture course that's matched time-wise and week-wise with the studio course. So making this seemingly simple change in the studio meant that I had to re-work all my lectures to fit the week changes. So yeah, I feel like I shot myself in the foot by giving myself a heck of a lot more work to re-work all the lectures. It's just sort of a logistical nightmare to change those two projects. But it was worth it in the end, and now we've got a smooth-running semester. In the product development process, you validate as early as you can. You test prototype, you test things. And you realize, you know, we were walking down that path and it's not working.

4: 'codes' to translate abstract to concrete

While designers utilize codes (i.e. 2D representations) to symbolize designed elements, the design teacher, as described by JA, relies upon other kinds of codes, like learning objectives, to translate abstract expectations of knowledge and skill into concrete language that is understandable by the student. In some ways this approach signifies a 'Know' approach to standardized and assessable outputs of the learning process.

One of the little things we instill in the first year, and I think also in graduate level, is on the rubric, we have them sign their name on the rubric sheet. It's not just to put their name on it, but with the assumption, the idea that with them signing that document means that they've read it and they know exactly what was on that sheet. It doesn't always turn out that way. A lot of students just sign it because they have to sign it. But the idea is that by physically signing that sheet, they have actually read it and of course we tell students to read the rubric and be aware of it. And some students check off exactly what they've done and some students, unfortunately, don't read it. But that's depending on the student.

Abstract principles that form the canonical foundation of design learning ('Know') are codified into concrete examples through teacher demonstrations ('Do') and presentation of examples taken from the real world where the student is taught to interpret the principles in the context of the example ('Think'). In other words, the 'what' is to be known is concretized through 'how' and the 'why'.

I think that it really depends on what year we're talking about. So if I were to speak in terms of the first year, the role of the educator/teacher is to really be able to show by example in terms of some of the hard skills that are necessary, that are emphasized in educating. And I think it's the role of the educator to try to make those fundamental principles as palatable, as understandable as possible from that student's point of view. What I mean by that is, as I mentioned, a lot of these students don't have understanding of design, or even certain basic principles, and so it's trying to make those basic principles real to them by using personal examples, by common sense kinds of explanations of why things are the way they are. Maybe it's so that they don't just take them for face value, but they understand why they are the way they are. They're not just the laws that are laid down, but why these exist, and examples of how they exist in reality. So simple things like how to draw in perspective, you know.

It's kind of the role of the educator to be able to not just explain the basic principles of perspective, but to actually show them how and why by showing them how to draw, and them showing them great examples of where perspective is actually used in drawing and designing. And then they can see the bigger picture—like oh, I see. It's not just some skill. It's sort of a context of how it's going to be used, and then where it's going to go to. I think so many students, even in school, they think, "I'm never going to use that. Why do we have to learn that?" And then if you actually show them, well, this is why you're learning it, and this is what you're going to be using in the future, so you will use it. Giving them that broad perspective helps them understand the value, and it gives them more interest in really trying to take command over whatever that subject may be.

In JA's discussion of more advanced students, he describes the creative tension that must be navigated between abstract principles and the multiple possible approaches to realizing them in a concrete form. This process of experimentation moves between making ('Do') and interpreting the results, reflecting ('Think') on the *outcomes of that translation process. JA's discussion of skepticism leans towards a 'Manage' belief that students should question that which is put before them.*

I think even in the third year, at this point, they've already got a command over a certain amount of principles and understandings. They've already actually in their own minds made up their mind about certain things. And when you're trying to introduce other, new types of material or different applications of that material, sometimes you have to work against the knowledge they've already put together themselves, if it's wrong or if it's not broad enough. If they've boxed themselves into thinking this is the only way I'm going to be using this, you might have to teach them how to say that's one way of using it, but then there are these other ways of using these same things. Again, opening up their eyes and broadening their scope in terms of a particular topic. And then again, ways of being able to do that is showing by example, by giving them not only the intellectual rationale for what it is we're studying, but also giving them examples, show them how these things exist in the real world. I think students generally should be skeptical about everything. That's one of the true things. But they should also be curious, and they should also be—their role is to try to embrace the material and to see it not only for what it is, but for what it could possibly be and applied in a lot of ways.

Simple thing like perspective drawing. It's one thing to know intellectually about how to do a perspective drawing. It's another to be able to use perspective to show off an idea in design, and what perspective would you use based on what idea you're trying to communicate. It's making that leap from intellectual understanding perspective to really using perspective as a tool to really be able to achieve something. That's where the role of the student is. They need to be open-minded and to be curious and to be skeptical and to be exploratory in being able to absorb that material. I think the only way that those two, the student and the educator, can meet is where they're fulfilling each other's needs. That you're not just teaching a bland principle of perspective, but you're trying to feed their curiosity, feed their need to explore. Also, feeding them the information so that can subside their skepticism about certain things.

Perspective is seen here as both a topic of teaching (i.e. the laws of perspective) and a vehicle for transmission (i.e. presenting multiple perspectives). These efforts to expose students to diverse viewpoints and methods of translation ('Think') represent a teaching code, whereby the teacher relies upon tangible artifacts to signify embodied alternative approaches.

I'll show them multi perspectives. I'll show them previous student's work, the same project done by three completely different people, completely different interpretations of it. And they can see that: possibilities. This is a possibility. So is this, so is that. Some are really drastic. You'll see that when you initiate the project. Everybody comes out with the same thing in the beginning. They all look exactly the same, and they look at each other like, "Oh, God, I look exactly the same." And then you show them, okay, look at everybody on the wall. Everybody's exhausted these things. Now let's try something completely different. And then I'll show that in lecture, show them examples from multi perspectives so they'll be able to challenge themselves. And I think when they look at each other's work in the studio and they see how much they're similar. First tries are all the same. Then they realize, I really have to think about this myself, and I want to be different. Because I think, generally speaking, most students want to be different.

JA moves from an authoritative discussion of laws ('Know') towards a reflection upon the reciprocal relationship between teacher and student ('Think'). Here the teacher describes a metaphor code used to coax the students towards experimentation and discomfort in pursuit of creative ways to apply their knowledge.

But in the first year, those rubrics are pretty similar with every project. The basic elements are all the same that we try to emphasize. That's true with everything they draw. Those are again those basic laws that haven't changed in terms of what makes a good drawing.

What's intriguing is when you start to see that reciprocation, when they are not just regurgitating that material back to you and giving you the textbook response, Yes, they've not only taken that knowledge, but they've applied it in a very specific context that shows what they've really learned. They've pushed it. I'm quoted as always saying "take it to the red line". But in terms of saying that school is a time for you to explore. Push it to the red line. What I mean is, when you're testing an engine in a car, you don't know what it can do. You have to find out how fast it can go. So at some point in time, you need to rev the engine, get it to rev beyond to the red line. You don't want to red line the whole time, because the engine's going to break. But you have to be able to push it to a certain degree to be able to know what the limits are. So I tell the students, what I give the students in the first few days is that if you're not feeling uncomfortable, then perhaps you're not learning. That means that everybody's got their own comfort zone, and they don't want to push it to the red line. It's a matter of how far are they going to be able to push themselves to be able to apply the material. That's intriguing to me, when I get that back and it's very evident that they've hard lined. That's intriguing.

The translation of abstract concepts into practical application is another coded exchange that continues throughout the learning process. Here JA explicates the difficulty in assuming imitation alone ('Do') to be sufficient in ensuring the intellectual understanding of theoretical concepts. Rather, learning requires a recurrent reciprocity between the making ('Do') and the thinking about the making ('Think').

You have to introduce some kind of theory at some point in the studio. And then after that point, then it is demonstration and sort of learn by doing. But I think at some point there's still some of that theory that has to be brought into it. It's not necessarily the main or the largest part of the studio, but I think an integral part of the studio. That theory does have its place.

It's sort of a combination of the two, where they have that background theory that says, oh yes, things have to foreshorten. And then they have they're basically doing—where they have an item, a cube, for example, set in front of them. And they have to draw that first-hand. Sort of an application of the theory, in one sense, but it's an actual doing. They've got to draw what they see. So they have to sort of apply that. Now, drawing what they see without any kind of theory in the back is very difficult, I think. For them to just automatically look at something and say, "Draw what you see"—most people don't because they have some of these preconceived notions of what that object is and it becomes very distorted on the paper. I think providing that theory a little bit ahead of time improves that.

I would say that, that it's iterative. It's not necessarily chronological, because at any point in time you can bring in theory to support what's being learned, the process. Even during application or reflection any of those things can take place. Yeah, it is some sort of inter-relationship between those. It could actually even be it's not even necessarily linear in that sense. It could be very organic. Those seem to be the essentials of how learning takes place in the studio.

The reciprocal interchange between concrete making and abstract thinking must traverse the distance of two course curricula. The studio emphasis upon production and practice ('Do') is complemented by the lecture class emphasis upon presentation of principles ('Know') and illustration of their possible application

('Think'). JA raises here the possibility that this translation process is interrupted by constraints related to class size.

…it's really important to be able to physically show them, either by drawing on the board in real time—you can't just show them end-product and expect them to understand some of these principles and have them be able to perform. It's part of the studio experience. They have to be able to perform and take that knowledge and apply it. Literally, physically, real-time. So that demonstration, that hands-on tends to be a very important part of that studio environment. Whereas the lecture, you still need to demonstrate, but I'm… not necessarily every lecture—in fact, probably out of all the twenty-something lectures I do this semester, I only have maybe four lectures or so that I'm actually demonstrating something, actually physically, real-time demonstrating how it's done. That tends to be more something I would do for a studio. And the lectures tend to be basically talking about a principle and then showing examples of existing things, but not the process. Not the process of how those things necessarily came to be. I mean, we're talking about 70 to 100 students in my lectures. To be able to negotiate, to be able to confirm that kind of knowledge on a one-to-one is almost impossible with that number of students.

The studio and lecture are parallel. They are taken together. They're required that they are taken together, primarily because we have to introduce that theory on a very heavy level, and then see how that theory is actually reinforced and applied in the studio. So in a broader sense, that's how the course is developed. It's the introduction of theory and the application of that theory.

Unspoken agreements between teacher and learner constitute codes that guide classroom behavior. JA espouses abstract expectations of responsibility utilizing a *sport metaphor and finally settling upon a concrete percentage. The concept of a relationship between teacher and student indicates a 'Think' pedagogical orientation.*

I think the responsibility is definitely shared. I mean, the student walking into the classroom, by reason of doing that, is signed into a contract, if you will, of learning. They've come with the understanding that they are here to learn. So it's part of their responsibility to learn, in other words. It's part of that relationship. On the other hand, as the instructor in that classroom, it's my responsibility to make sure that I do whatever I can to facilitate that learning. I think it's a shared responsibility. They kind of become part of that unspoken contract. So they've taken on the task of learning that knowledge. I'm taking on the responsibility of teaching that material. It's initiating, from my point of view. I'm the first one to serve on the tennis court. I have to take the initial responsibility, and if we were to go with percentages—it's hard to say—but maybe it is a 60/40.

Practice is the code that carries the message from abstract to concrete, it is the mechanism through which ideas find form and skill is progressively developed. Progress, as JA describes, relies upon the learner's ability not only to perform ('Do'), but also to reflect on those performances in order to improve them ('Think'). The cognitive ability to question oneself and analyze one's behavior is a reciprocal counterpoint to the making. It is evidenced in the coded progress of skill development and capacity for critical reflection.

Practice, as they say, makes perfect. In any given situation, they're still able to apply the theory of perspective, regardless if it's an organic shape or a very rectilinear shape. They can still perform in terms of perspective. That would be on a regurgitation level. And then, as they negotiate through this spectrum, if you will, then as they spend more time and they become more proficient at it, they've drawn several different objects from varying types of shapes in perspective—then over time, they become very, very proficient and their execution level goes very, very high. And then, let's say they take it to the next level, where they draw something that's very, very unique shape because they've created something that's very beautiful on a creative level, something that doesn't exist, necessarily. That they're not drawing from some object that's sitting in front of them. They're drawing from their imagination, for example. But they choose a very unique perspective and a very proficient way of expressing that perspective that actually helps accentuate that particular idea or that particular design of theirs. That would be on that ultimate end of success, where they've actually demonstrated something they've taken out of their own creative mind and are able to execute that in wonderful perspective. So maybe it goes from initial really trial and error to repetitive exposure and accumulation of knowledge. And then it goes toward this level of, now can I not get hung up on the technique and let my creative juices flow and be confident that I can apply the knowledge I have appropriately for the situation? What helps best improve my creativity? I guess that would be how they have to negotiate that. They have to come to that realization. Get confident enough with the material so that it becomes second nature, so that it doesn't become a hang-up. So they can go toward bigger and better things.

5: 'codes' to read and write in object languages, metaphoric appreciation

Here JA links his teaching efforts to his industry experience through the coded language of professional practice. JA speaks through the metaphor of teacher-as-manager to communicate how he conceptualizes his student's learning. This manager language reveals JA's beliefs about the teacher as a guide and facilitator, a "Manage' approach.

I like to really see myself as kind of almost a quasi-educator, quasi-manager of a design firm so I begin to refer to them as industrial designers from the freshman year.

For me, it puts them on the track toward becoming that. And if I treat them as such, then they will feel they are as such. I'm there to guide them and teach them these certain things, but also let them find themselves through the material. I'm there as sort of, I guess in one way kind of like a manager. That's how I personally see my role. And that's only because I base it off of my experience in practice for seventeen years. I've managed teams of designers and felt that's how I approach them. It's a mutual respect.

Part of my philosophy is that students aren't empty vessels, even if they are in freshman year and are pretty close to being empty vessels, that they're not. It's not just a matter of filling them with knowledge, but it's a reciprocating kind of relationships, that they have to show that they can grasp the material, then demonstrate it, then see if they cannot just regurgitate the material, actually apply the material in unique ways, depending on the context. The manager role in me is to be able to see how far I can get them to do that without unfairly raising the bar. That's where managerial skill needs to take place: to build a relationship with each student and knowing where they are based on their performance in class and on the projects. Knowing my approach and how to be able to see how far I can raise that bar. If I raise the bar uniformly throughout the entire class and base it on the best student, that's going to be very, very unfair, because everybody learns at different rates and everybody has a different amount of knowledge coming into that class. So it would be unfair, I feel. It takes more time as a role as a manager to be able to understand these relationships with each student and try to gauge yourself.

It's much more complex than just taking a less effective student and a more effective student and just putting them together. It's more of a combination. That's going to take a little bit more knowledge and managerial knowledge, to be able to say, this student's really good at this thing, and this student's really good at that thing, and maybe together, they can create something even better. Or their personalities may be very similar, or their approaches may be very similar. And it's not just going to be their level of understanding of the material that makes them a pair. I have to start to think about those things in terms of creating an optimum learning environment. So that's kind of my role. And I think that's pervasive from first-year all the way. It's just how I have to deal with each student. On the graduate level, it's more a one-on-one management kind of a thing, whereas probably on a first-year, it's more a general classroom management.

I would define manager as—again, it's my personal belief—my interpretation of manager is somebody who is a steward, a guide. Someone who has knowledge and a broader understanding of the big picture but is not someone who is necessarily forcing their will on somebody. That the managing, even to me the term "managing" is being able to guide and see the flow. Guiding the flow of that knowledge, rather than necessarily pushing it, or turning it into something, forcing it in a specific way. So that's how I would define the manager role. As the teacher, yes, it's this idea of respecting the student's level of understanding, respecting the student's amount of knowledge they bring, regardless of what level, and being able to guide through the process in the integration of new knowledge and the application of that new knowledge. Whether it is hard skill or theoretical.

The manager metaphor also allows JA to describe his efforts to manage the minds of his students by engaging and interacting with them both as a class and as individuals. This process of monitoring student understanding and adjusting teaching strategies appropriately is, again, indicative of a 'Think' approach

I think that relationship really actually needs to be understood and somewhat managed by the instructor, the teacher. Being able to do that is another thing, because you need to really understand what's in the minds of your students. I guess that's where it comes down to trying to understand your student on an individual level, because you need to know how to help them negotiate certain things if there's a negotiation, or help to reinforce the knowledge if there's this confirmation, if you well. That "yeah, I was kind of thinking that was the way it was." Well, let's do it more and demonstrate it more and really become intimately knowledgeable about that particular thing. Really reinforce the knowledge they have. Yeah, there's this relationship that's sort of necessary that the instructor be aware of to sort of guide or help along the way. Improve it.

Everybody learns at a different rate; everybody learns in a different way. It's being able to kind of manage that. I've had to learn that on my own as an instructor. I had thought before, in my naiveté, that you could just take a piece of information, a process or some fundamental principle, and just dump it into the classroom and everybody was going to absorb it at equal rate. And I realized quickly after the first few days of teaching that that wasn't so. When I would take questions, or I would see that it wasn't actually happening on the projects. That the principles I was supposedly teaching wasn't really making it all the way through into their knowledge, that they weren't applying it, I couldn't see any indication that they understood the things that I may have lectured or talked about for a long time. Then I realized over a period of time that I needed to take a little bit more active role in making sure that each student basically does understand that. One of the ways I did that was to—rather than standing in front of the class or just doing critiques—that I would individually walk around the classroom. Not in any orderly fashion, just organically through the studio, and looking at students' work and discussing with them, on a casual level, particular things. Looking at how they're drawing something, for example, and then making comment. Asking them why they're doing what they're doing and finding out more. Trying to find out—again, surveying, if you will, what knowledge they have in terms of what that particular topic was, and how they're negotiating or confirming themselves with that particular topic for the day. I had to be able to be more interactive, because I felt that the students would be learning more.

JA also uses the metaphor of teacher-as-learner and adopts the language of learning to describe his efforts at teaching. This reciprocal relationship reveals an intersubjective exchange that is decidedly aligned with the 'Think' pedagogy, as are references to discussion, and student-centered approaches to the design of content delivery. The notion of assisting the students in situating their learning within a historical context is more aligned with the 'Manage' pedagogical approach.

I think teaching is just as much about learning as it is about teaching… in order to be able to teach, I had to really be able to perform myself, and to really understand. So, I had to perhaps re-learn the material so that I can be able to teach it better in a way. I guess just trying to understand what works and what doesn't work in the classroom and learning from that. I guess it's—for lack of a better word—it's a little bit of trial and error, where you try something and see if the student responds to the material. Finding ways to get students involved in a discussion, to spark their interest and to get them talking about something. When I guest lecture for other courses, too, I spend extra effort to really make that lecture an event. I have really learned how to do that. So again, it's a matter of trial and error. Spending energy. Try something, and if it doesn't work, I try something else the next time. And then I try to take notes on the projects so that the following year, when it's taught again, I can apply some of that knowledge. But I try as much as possible to relay what I've learned the previous year to the next year of teaching. So asking the students. "Did that work? Did it work? How did it not work? What would you prefer?" And getting them to think about giving me information. In one sense, getting them to help design the class.

I can't just teach directly out of the book without providing some extra context to that knowledge, I feel personally. So the relaying part is the actual information that's relayed, for example, from textbook to student. And the conveying is being able to take that knowledge and putting it into some sort of context and delivering it in a way, so that it actually gets there. It's one thing to put a slab of food on a plate and just shove it into someone's face. And it's another thing to present it in a way that it's palatable and enjoyable. It may have the same nutrients as the slab of food that's just sort of shoved in the mouth, and yet it's going to have much more effect in terms of enjoyment. Motivation—I have to learn from the student what motivates them. So yeah, context is a big thing.

It's several lectures twice a week, these packaged lectures I've designed for the past several years. But each time I give the lecture, I preview it the night before and spend a few hours trying to revamp it to update it and re-look at the material, even though the material is fixed from the textbook. That's stuff I've had to search for and create slides for, get them to understand, well, here's the textbook definition of what 3D is all about. And here's some examples of real machines that do that. To show them that, rather than just the basic definitions, makes them understand it and puts it into context and makes it palatable. It conveys that, rather than just relays that information.
But to get them motivated about in the future, what do you think this is going to mean? And everybody's excited about the future, I think. Especially young students. It's all about their future. Their education, what they're learning is all going to impact their future. So showing them glimpses of what could possibly be in the future. Especially in design. We're designing for the future anyway. And I think bringing those little tidbits in to get them motivated really helps to make that—creates value in what's being taught and

what's being learned. It's throwing in a little bit of art and a little bit of science and a little bit of fantasy in there to get that motivation to learn.

Stories represent another coded language of the classroom where the teacher relies upon the student's ability to interpret the meaning and relevance of anecdotes ('Think'). It is also evident here how JA is reflecting upon his own learning experiences and the impact they have had on his pedagogical preferences.

It's not somebody who's just saying, "I'm the master and I'm teaching you and this is how it is. This is what you should be learning." It's making it seem like, look, we're all learning. We're all humans. We all experience these things. I was a student, too. Yeah, I bring in experiences from when I was a student. I bring just daily experiences and human aspects of the learning. It just makes it more real to people. I think it makes it seem more human. I think you can identify. It's like when you watch a movie. If you can't identify with the characters in the movie, you lose interest pretty quickly. If there's not that human element in teaching, then I think students lose interest rather quickly. And I think everybody can relate better, too, when those anecdotes and little stories come out. You make that sort of connection, and it just so happens to be a human connection and a connection to the material, so you win on all levels. And suddenly they learn. Maybe it's something that you remember. And I think there might have been episodes like that that existed in my own education that made me remember certain things. And maybe the reason I remember certain things like that is because of that human connection.

One of the first reasons why I think I really said industrial design was going to be that career for me, was in industrial design studio, which was really an upper-division studio to design a product, And I saw this little documentary and I said, "I want to be that guy. I want to do stuff like that." And it made me connect with material. That semester was like, make me do any project. I'll do it now. Because the beginning of the semester, I got to see a glimpse of what it could be, and what I'm toiling away in studio could possible lead to.

Another metaphorical reference illustrates the pattern language that JA uses to communicate parallel challenges in teaching and managing. Speaking through the metaphor, JA once again reveals his student-centered approach to teaching and belief in adapting the teaching (or managing) style to the individual ('Think').

The assignments have to be reasonable and fair. Grading criteria has to be fair, too, from that same perspective. It's one thing to raise the bar. And students love it when you raise the bar. But if you raise it unrealistically, it de-motivates the student and demoralizes them, makes them think that they're not worthy and they can't achieve it. And then you've defeated your purpose then. In raising the bar to create excellence in the classroom, you can also be shooting yourself in the foot and de-motivating and demoralizing your students. I felt that as a manager in design, too. I had certain employees that were really proficient in other areas, but maybe less proficient in other areas. I couldn't expect that same level from every employee. I had to, again, gauge them by the knowledge they possessed

Relying upon the anecdote as linguistic device, JA describes his own motivation in teaching and connects his feeling of satisfaction that learning has occurred to the feedback of students. This story reveals that a symbol of successful learning is preparation for professional practice and the student's awareness of it, thereby codifying successful learning in terms of successful application of acquired knowledge.

I think for me, it's just am I making a difference? I think that's what it comes down to. It's a very personal thing. It's one thing to get through the semester and say, yes, I got through the final module and we're done with the semester and yay, pat on the back. I did another semester. It's another thing to say, did I make a difference this semester? How can I create an environment that's going to facilitate more of that? Is the material and the way I taught it in such a way that's going to give me some sort of indication that I made a difference? That the student is different from when they walked into that class to when they left it?

I had a student who pushed back one semester. But then he was a good student, so he forced himself through learning the vocabulary, learning how to talk about his design using this vocab. And I could tell he was really skeptical of the material, but he did a good job, went through it. He ends that semester, and the following semester he has to go get an internship, and he gets an internship at BMW Design Works, which is all elite designers…and he emails me right in the middle of the summer. "John, you know I gave you a lot of push-back on that vocabulary stuff, but I want to thank you right now. I want to eat my words. Because I'm sitting down at lunch with these designers and I'm able to hold my own." And he's able to be right in there with that discussion, holding his own and not flustering. And he says, "I'm glad I learned those words. And if any other student in the future every acts up like I do, let them know that those words mean something and you need to have them." And to me, that was like better than any compliment that any student could give me, was that I made a difference. It helped them. It wasn't just me blowing steam and making them do an endless treadmill. They were actually doing something that was going to impact their future. And it's those little tidbits that you get every once in awhile that just re-affirm to me that's what I'm here for. That's what I need to do. That's what I'm trying to get out of that teaching. Get some indication that I've made a difference.

JA once again refers to the manager metaphor and acknowledges its relationship to his own professional work. He speaks through multiple metaphors in *order to communicate his learner-centric approach to teaching and his belief that the process can be enjoyable for both learner and teacher ('Think').*

I've used the metaphor before of the teacher as manager. I guess it really has to do with my career in the past. That how I managed teams of designers on projects and then in the classroom, I feel like I'm managing the minds of the students. As a manager of minds, you have to know the minds of your students. You have to know how to manage the process of the learning. You have to be kind of like a chef. You need to—it's not just a matter of putting nutrition on a plate and expecting the client to just eat it, take it in, absorb it. It's a matter of putting that finesse, designing that plate and that meal. And the course. What comes first? What's in between? What's the context of all of that? The design and the display, how it's presented. Presentation. All of that is part. And then the enjoyment of that meal. It's all the more enjoyable when it's presented and designed and created in the kitchen in such a way that may still have the same nutrients as that slab of nutrition on that plate, and yet it's all the more enjoyable. And if education can be enjoyable, then you've touched on the golden way of being able to get your message across. So teaching is like being a chef.

In these concluding remarks, JA offers advice to his students. He speaks through a new metaphor to communicate the iterative nature of knowledge construction.

Advice to my students. Learning happens best when…. I think there's a certain amount of giving in to the material. And This sort of zen-like experience with learning and teaching and design. One of the metaphors I usually use is that students want to jump from hammer and nail directly to the nail gun. But I say to the students to go back to that original hammer and nail that's been around for thousands of years. And I think there's some sort of zen-like relationship between the hand and the nail, the nail and the hammer. And it's understanding those basic relationships. And then you can build with that. You'll get there. You just need to take your time and be open to the material. And in a zen-istic kind of way, let yourself open and take in, absorb. Be one with that hammer and nail, if you will.

4.3.2.2 RP: A Magic Mirror. I have a BFA in photography/design. I have a Master's in counseling/psychology, which was taught in the Education Department. Then I have a PhD in clinical psychology that was taught at a Fielding Institute, which is a professional school of psychology. And then I have a post-doc in mind/body medicine from the University of California Berkeley. My area of study was two: was mind/body integration and healthy adult development, or the normal adult developmental cycles. The work of Luddens and Erickson and Carl Jung.

I came to teaching—the old dean of the College of Fine Arts, and the director of the School of Fine Arts, asked me to develop a class for art students to kind of help them look at what their future could be. They knew that I was developing it in my doctoral work. And Jules was fascinated by it. Because I interviewed him for part of my dissertation. I had it all outlined. It was huge for me. I mean, it was like fifty students. And I had it outlined, but then I made it up as I went along. I had some ideas about what needed to be in there— clarification, decision-making, writing a vision statement. But the actual material did not really exist in a real form. So I made it as I did it. For twenty-six years, I just taught one class a semester. And I just kept refining it and playing with it and letting it develop almost on its own till three years ago when Viz Com asked me to come on full time.

Well, Architecture asked me to teach the Creative Environment class, which was called Creative Building. And I started that probably seven years ago. And that was to explore the creative process and get them to work in groups. And so I started that I guess six, seven years ago. Yeah, it's re-named Creative Environment. Finding Purpose is to give students an opportunity to explore and reflect on where they're at in their life and how does that connect with their purpose and talents. Creative Environments is to really look at the creative process and also get them to have a group experience of the creative process. There's a different intent in both classes, even though both classes are reflective in nature.

I teach a third-year both-semesters graphic design, or visual communication, and I teach that with two other instructors. And then I teach an architect graduate studio with two other instructors. My role is to help develop team and collaboration within the studio. So I come in as a psychologist and collaboration expert and help. Because both of those have teams—both studios are team-based studios. So the other two instructors do more of the design education part of it, and I do more of the emotional intelligence part. So both are trying to develop emotional intelligence.

My area of expertise is the teaching of emotional intelligence, understanding adult development, especially with young students, like what they're going through. Then, you know, twenty-five years of working with companies to help them be better collaborators within the company. Disciplines are not vacuums; disciplines are interactions between people. And emotional intelligence is about one's knowing of oneself, and also of one's interaction with other people, whether that's fellow collaborators or clients, whatever it is. So, it's connected because there's people in both.

1: ill-defined problems

RP attempts to frame the wicked problem of teaching and learning by identifying the different stakeholders.

The teacher's responsible, the student's responsible, the administration is responsible, the school is responsible. I mean, each person, if you decide to be in that game, is responsible.

In the studio courses he coteaches, RP addresses problems as they arise and frames his contribution in terms of the student's needs ('Think').

I'm not a designer. So even though I have studied design in undergrad, I haven't practiced as a designer. I practice as a human behavior person, a psychologist. So it's an adjunct to the studio. And I didn't set up the curriculum, I didn't set up the schedule. I more fit into what the system is, which is interesting. My learning objective is to help them work as a team. When I see a team struggling, I address that team, or when I see individuals struggling, I address that individual. The objectives aren't clearly defined, what it is I'm doing, but yet, I have a role within the studio.

For RP, the challenge of teaching does not require an authoritarian ('Know') approach, in fact he resists that role. Rather, he tries to explore learning problems with his students through hypothetical frames that are an inherent part of his therapy work.

I think [the use of if/then statements] came out of me being a therapist, because you do a lot of if/then when you're doing therapy. To get the client to look and reflect on if we do this, then this is going to…. You want somebody to really look at and see what they're doing. If you do this, then this. That's part of the therapeutic. So I'm just wondering if that's just wired in the way that I work.

Oh, I don't believe in should-ing people. Because it goes right into their top dog/underdog battle within people. "You should do this." Whenever you should, people usually do not do the behavior. Should is a binding idea. It binds people. It's also, I think, shame based … if I tell you you should be doing this, you're going to feel shame, I think. So I try not to do that. And I want people to explore and try it. I don't want to be prescriptive.

In order to understand the nature of the ill-structured problem of teaching, RP also identifies 'rules of engagement' that frame the interaction between teacher and *student. He rejects the 'Know' concept of teacher as one who pours knowledge into students' empty minds.*

If the teacher is on some kind of monologue, he's not really respecting that there's beings out there to have an interchange with. I have seen some teachers hold students in contempt, almost. So that's on the teacher's side. On the other side, I think it's kids doing nine things at one time while the teacher's talking. Texting, instant messaging, surfing the Web. Not only is it not being focused in the present moment, but I don't think it's honoring the space of the pedagogy.

For RP, the ill-structured nature of designing learning is met with a loosely structured approach to teaching that allows the teacher space to roam into other topics as he sees fit and dependent upon the situation and moment ('Think'). RP also relies upon a tacit understanding of the class's receptivity to perceive and create the learning environment.

But what I like to do is go off of and wander from the slide. You always use it as a centering device: to come back to it and then to wander and then come back to it. So that there's some consistency in what you're trying to get across. You're not just wandering all over the place. But that there's a way to wander and come back, which I think is a wonderful way to bring spontaneity, and at the same time, a consistency to what you're teaching, or a coherence. I think teaching can happen when there's one person there. That one can teach oneself something. So I think it's setting up a field of receptiveness. I guess how teaching happens. The student has to be receptive, the professor has to be receptive. But it's to set up that field of receptivity.

One thing I do is I meditate at the beginning of class as a way to create people being there and being ready for the experience. And I think that's more of why I do the meditation, is to create that field of receptivity. And I think that it's quite successful in doing that. When I don't meditate with a big class, there's a different field of—I don't know what to call it. But you can just feel it. Students have a harder time getting into that space. But if you give them five minutes—you only have to give them about three to five minutes to focus on their breath, to focus on the room they're in, to bring them into that space. That, I think, the receptivity. To take that moment of transition, of rushing to class and rushing from another class, and just kind of sitting there centering themselves for the learning. So I would actually think another class where it's not part of the content would be a way to get students to really engage in the class. And I would say—I'm comparing when I didn't used to do meditation every day—that the classes are more engaged when you do the meditation than when you don't do the meditation. Yeah. And I think behaviorally, you could see it. You can see that the students are there, present. There's a few that talk and text or whatever, and we'll ferret those out eventually. But you can tell. You can sense a class that is engaged. And you go into a class where they're not engaged, you feel it. It is a felt sense.

Attempting to address the ill-structured problems of teaching, RP identifies challenges that must be confronted in efforts to reach the learner. He also demonstrates his own efforts at learning and bringing that learning into his pedagogy ('Think').

With this generation is this addiction to being online when they're doing anything. Walking down the road, they're texting. They're just not in the moment. I see them walking into things and ignoring their environment as they're walking along. That to me is really disturbing. And I'm not anti-technology. I think technology is a wonderful tool…they have to go online to do the survey every week. They have to do Flickr, which is to take photographs and post them. I know other teachers, I think, utilize the technology much more. My focus is more on the human touch. High tech needs high touch. You know, Nesbith, who wrote Megatrends, that as we get more and more into technology, we also need that human connection. So, I'm more focused on the human connection part of the equation than the technology.

The essence of RP's approach to teaching are found in this mantra below. It focuses on the learner and the relationship between student and teacher much more so than it does upon the course content ('Think').

Receptive/reciprocal as a mantra. Mindfulness. Being present. Being fluid. Being flexible. Being generous. I think it's just a recognition that students have different ways—and people have different ways of processing information. So it's that balance of trying to not be all things to all people, but take into account that you need to give the information in different ways.

I would say I'm a guide. I am an encourager. I think I'm a model. You know, I think we learn by modeling. That's what I would say. In what I teach, there aren't really any facts. It's not like I teach a physics class. And if we look at physics 50 years from now, the facts will be different from what we're teaching today. Because if you look at science, things change. So, I think facts change, depending on the evolution of the learning. So, I can't get too dogmatic about the facts. Because they change.

In response to the uncertain challenges of teaching, RP frames the problem according to the roles of the participants and emphasizes the shared responsibility that each bring into the learning exchange ('Think').

I think it's the learner's responsibility to know how they best learn, and then to explore that. So I think the learner has to take responsibility for supporting and expanding their learning style. I mean, can you imagine if learners took the responsibility for discovering how they best learn, and then setting up their pedagogy, their exploration from that perspective? They may know it on an unconscious level, but I try to make it conscious, like "How do you best learn?" And set it up to learn that way.

2: solution-focused strategies

One particularly solution-focused strategy employed by RP involves assigning the students the grade they aspire to, their ideal 'solution' state. RP also reveals how he has experimented with different methods (conjectures) regarding grading ('Think').

This semester I approach it where they all have an A, and their task is to keep the A. So assignments will have a certain point value, and if they nail it, they keep that point value, they keep their A. If they're missing aspects of it, they get deducted so that the grade will be minus five, minus ten points off of their A. It's a task of sustainability. They have to sustain their grade. I would say in a smaller class, the grading had a more subjective feel to it, in the sense that there wasn't objective criteria as much. They had to turn it in, they knew there were so many points, but this is broken down so the TAs, as they grade it, and I grade it, have something in which to make the assessment. The Creative Environment has a looser form in grading. I'm more interested in them—because it is a smaller class—of having them have the experience of play. And there's not as many assignments and it's a group process and the group grades each other. So that is one way that I keep the groups more alive, is that forty percent of the grade is done as a 360 evaluation of people in the group.

What they do is they say what they're going to do to get an A in the class. I have them write a learning contract at the beginning of the class. And they sign it. What are they going to do to get an A? I took that out of Zanders' The Art of Possibility, where when he taught, he just says everybody has an A, but just tell me what you're going to do to get that. And they sign it and I sign it….and I kind of left that for awhile, and I brought that back in just to see, does it increase the level of engagement, or do people just want to skate through the class? What does that do? The graduate students do not want to skate.

You can tell they want to be there. They want to get something out of it, and it's fun. I've done it different ways

When discussing course objectives, RP reveals a solution-focused attempt to incorporate interaction and discussion into the learning experiences in the class ('Think'). RP also mentions the importance of learning from experimentation through reflection ('Think').

Again, course objective is reflection time. There's a real component on meditation in that class. And the relationship between meditation and creativity. There is an intention of having them play. Explore. Especially in their groups. There's an intention of getting them to have dialog with each other about it, and so allowing them to be changed by that dialog, I think, is really crucial.

Receptive/reciprocal. That I learn from them and they learn from me and we all learn from each other. There's a collective wisdom when you have students in front of you. I think part of a teacher's task is to get them aware that they have a collective wisdom. It's really one of the roles of a teacher, to help students find their strength. And also to teach them how to learn from their mistakes. To really look at a mistake, analyze it, see what worked, what didn't work, and really grow to the next. Versus not making mistakes or repeating the mistake over and over again.

In addition to content as a 'solution,' RP focuses on the relationship between teacher and student as an orienting context. The dialogue and questioning reveal a 'Think' pedagogical orientation.

...receptive, reciprocal, both for the student and the teacher. I think the teacher's job is to create a space for learning. I think the student's side of it is to be present when they come in to that space. Teacher also to be present. To encourage dialogue around whatever it is you're teaching. Create curiosity, or encourage curiosity to ask questions. I think it's the teacher's responsibility to be prepared. Not just on the fly, but to go in and really have an idea of—at least an intent of what they'd like to do. And then let things happen.

In this reflection-on-action, RP reveals an emphasis on experiential and experimental activities, a more 'Do' orientation. This focus on the student experience as a goal state guides RPs efforts in preparing and teaching classes. The use of the questioning strategy to get students to think about their thinking is a 'Think' approach.

And have them do an experiment after meditation with the sense of touch or sense of taste or intuition. So ,each class, there's more experiential activities within the class, versus just the lecture where kids are taking notes. So, the lectures are—never thought about it—but are more experimental, getting them to do something. Or experiential.

What experience do I want the students to have? I usually work backwards. I usually think of what, at the end of it, do I want them to come out with, and then work backwards to put that together. There's a content part, of what content I want us to explore. There are techniques. And then I think about what experiences, what experientially do I want them to have in the class? I make a little outline, and then when I get into the classroom…today my one intent is I wanted the class to talk more, to share more, to engage more. So I did a meditation that is more to get them to talk. And then I wanted to go over their midterm, which was a thirty-three question thing on creative process. So I asked questions: "How did you answer this question? How did you answer that question?" And then really got them talking. Then I'll go with what is happening in that moment. That can be a slippery slope, though, for not preparing or not being present. I think it's important to have some structure so that you can come off of the structure. I think if you go in without structure, the students feel the chaos in that. but I think students feel my structure, and yet they know that I will go off of it, improvise from it. But that I have a structure, loose as it may be. But I think they sense it. I'm not tied to the structure, but it's there. It's like a backbone.

Again, RP emphasizes the process of experimenting and performing as part of the learning process. This combination of questioning, doing, and questioning (reflecting) appears to be a combination of both 'Do' and 'Think' approaches.

I would say mentoring. I would say modeling. Model is one of the best ways to instruct. You know, walk your talk, do your dance. I would say having the feel for learning, having the sacred space of learning, where this space is designated for learning at this moment in time. So that's the focus. And I think a willingness on both sides.
I think learning is modeling. A child watches an adult or a parent and what they do. They see it and then they try it, and then they see it and they try it, and they refine and learn that skill or way in the world, whatever that is. So, I think learning is about modeling behavior. I think learning is about exploring and having curiosity about the world. I think learning's about asking questions. Really dumb questions. And then seeing what that exploration is. I think learning is dynamic, and a creative process.

Here RP describes successful learning and frames the 'solution' state that is preferred in the learning interaction. This flexible approach does not distinguish itself as one particular pedagogy, however it seems to not align with the 'Know' approach.
Successful learning's like being on top of a mountain and just having the flow and the technique to be able to ski down the mountain with grace and fluidity, and adapting to the changes as you go.

3: 'constructive' thinking, pattern recognition

Teaching experience, as described by RP, improves confidence and helps generate, over time, an ability to respond to teaching situations with less explicit *cognitive activities and more tacit understanding. This reflection on teaching is a metacognitive utterance that illustrates a 'Think' practice.*

It gums it up for me if I start to think too much. I really trust that because I know the material, that what I'm trying to focus on is being in the moment and letting that material come out. If I think too much, it gums it up. And when I start to think, for me, it gets gummy. I mean, I don't watch myself like that anymore. I did that when I was younger. That's one of the gifts of getting some years behind you, is I don't doubt what I'm doing. I think you need to look at what works and what doesn't work, but that's not judgment. That's like looking at something and saying, okay, what worked here and what didn't work?

In describing a class curriculum, RP tells a story of knowledge generation that is constructed sequentially over time and also how that sequence is impacted by student feedback ('Think').

In Finding Purpose, all the lectures are sequenced to allow the student to do reflection on getting to know who they are. So, there's lectures on adult development so we can have a context in which to put themselves. It's a sequential kind of knowing yourself and coming up with some kind of kinesthetic experience in order to bring that home, something they have to do and experience in order to learn. I had an outline, and then I let the class kind of inform me. That sequence is in there, because I think it's important, it's tried and true. How I deliver it gets changed. I'm using a method called Triangle Square Circle, it's having the students once a week do a reflection on the class online that we then put into a document that I read every week. And that lets me know how and what the students are getting from the class.

Here RP discusses the concept of plumbing learning, a more 'Know' pedagogy, versus a more student-centered approach to building knowledge, a more 'Think' approach that involves connecting with the students.

I think you put out something and then it becomes its own entity as the student and teacher explore it together. Or the student brings it in and reflect on it, that it kind of has its own organic process. Versus just bringing in a fact, putting it in memory, and then spitting out that fact. I mean, that's one type of learning, you know. As Rumi the poet talks about, that that's plumbing learning. You take in the facts and you spew out the facts, and you get graded on how well you do that. Versus synthesizing, bringing stuff in and learning how to reflect on it, make sense of it, and allow it to inform you, is, I think a different type of learning. And then I think, as Rumi would say, there's also a knowledge that's already inside of you. And learning has to tap you into that knowledge, into that wellspring of you, yourself.

The connection between the student and you, the knowledge and you, the knowledge and them. It's the connection. That's what I find most—and also that it's really rewarding. It's really rewarding to watch someone grow, to watch somebody find their voice. To watch somebody develop their talent. That's really rewarding.

Here RP embraces a decidedly 'Do' pedagogical approach with the concept of the master/apprentice model. The emphasis in this case is on the practice as the vehicle for learning, for creating a voice.

I'm wondering about the old apprenticeship model, where the master would work on it, and the student would assist the master in the working on it. And then eventually start to be able to, from doing that, learn the skill or the craft. I'm just wondering if, in studio classes, if that's an important part of the learning, that students actually see you approach a problem and solve it and watch you and assist you. I think the apprentice will develop their own voice. And that takes some time. And you need to learn the foundation of your profession, you know. And then you develop your own voice once you've learned that. I think it just happens by doing it, by practicing it. You know, you get to a point where it no longer is your master's voice, but it is your voice. But it takes time. It takes doing it and practicing, no matter what that area is. I think that's what real learning is.

The constructive nature of knowledge gets explored here in terms of the levels of learning that students progress through over the years from undergraduate to graduate studies. The concept of teacher as guide appears here as a 'Think' approach.

I would say undergraduates are learning the foundation of their field. I think that's what the structure is, that they're learning what the field is. And at a certain point, they have to start making it their own. And I think that happens either when they leave school or when they go to graduate school. Yeah, I would say undergrad is the general knowledge of the field, and then when you get into graduate school, there's some general knowledge, depending on like in architecture, where the first year is they're finding their voice, but they're still learning the field of architecture. I think their thesis is to come up with their own voice with it.

I think to teach from the freshmen all the way up how to approach a problem creatively is important, but creative freedom can be a quagmire. I mean, I think it's important to have structure, and have creativity within a certain boundary, so they can learn to work within that. To just give them creative freedom, I think they crash and burn, usually. It's not just complete creative freedom, but it's how to be creative within the boundary.

At the beginning is to help guide them on how to do it. You know, if you watch, I taught less and less and less, if I'm not doing a guided meditation, as the semester goes on. I let them have longer periods of following their breath, of actually being in the experience and then we'll come back into it. And I don't have a chart: "Well, today I'm going to go five minutes." I witness them meditating. I look at who is not doing it, who's doing it.

The constructive nature of knowledge is evident in this description of student becoming master and teacher. The inversion of the roles of teacher and student indicate a more 'Think' or 'Manage' pedagogical approach where the role of the teacher is to facilitate the student's evolution into expert.

Well, graduates, I think it needs to be a lot less structured, and you need to let the graduate students teach you. Because they have a lot of knowledge. Their task is to become a master in what it is they're doing, and what better way than having them teach you something? They'll become a master very quickly in that. You can assist them with that, but it's really to pat them on the back and let them go for it and get out of their way. I think undergraduates, it's much more structured. Just because they're not there yet. They just haven't had the experience yet.

4: 'codes' to translate abstract to concrete

In this discussion of how to engage larger lecture classes, RP discusses a technique that creates a feedback loop between student and teacher. This translation process allows the teacher to review the abstract concepts under study in the concrete reflections offered by the students. The dialogic process represents a 'Think' folk pedagogy.

When you have a big class, it's like really teaching to the whole class, in terms of space. You make connection with people in different areas of the class. Because it's really easy to just teach to the front three rows, and I think you can lose the people in the back. I break them into groups to talk to each other. I think that's important so that they have.... Something I'm doing to facilitate it is going through the reflections and picking questions that seem to appear a lot or are interesting. Addressing that in the next class so they see that the activity they're doing, that somebody is actually reading it and responding to it.

As the size has gotten bigger, I have had to get much more organized. I've had to have a system in which to keep track of everything, which you have to do when you have that big of a class.... you have to keep track of attendance, assignments, the pulse of the class. I think with the big class, it could be really easy to—even though it's a bigger energy—it could be really easy to lose track of it. Because there could be an indication where you're not having an interchange with that class, you're more just spewing stuff out to this board that somehow re-spews it back. If there's anything, I've tried to be really vigilant in not doing that. Of making the interaction to be reciprocal in a big class. I think the method of that is to engage the class. That's where that Triangle Square Circle really comes in handy. It's a nice tool to help you gauge where the class is at. Then when you're teaching, you can address that. And I believe that students feel they are in a process of engagement that they may not get in other, bigger classes. So I think the assignments haven't changed, but how I approach the assignments, how they get graded, how they get recorded, has all changed because of the size.

The organic process of teaching described here illustrates a willingness to learn from the students and to modify and evolve the teaching approach in response to such learning. This reciprocal relationship is primarily 'Think'.

I think energetically, when they're engaged, it motivates me. I think their curiosity I find fascinating, when somebody's really curious about stuff. And curious in the sense that they really want to know, they really want to learn something to the depth of it. I think the freshness of youth at times is invigorating. I learn new things about music, about just different stuff that I wouldn't have had without that relationship. And they bring their experience. Some of them have had some incredible life experience that they bring into the room. Because it's an organic process, teaching. It's not just…thinking about it over the 25 years I've been teaching, I think there's been certain things that have been constant. Like engagement with the students and trying to create an environment that is present. I think I've always done that. And I've developed as I've gone along. Especially teaching larger classes and learning the reflection tool. That's been really helpful. So that lets me know how the students are taking in the information.

The interaction between student and knowledge is a coded exchange that results in reflections on learning that the teacher can then 'read'. This emphasis on student processing of information is reflective of the 'Think' pedagogy.

Teaching is dialogue. In its best, it is helping the student tap into their inner knowledge and setting up a situation that they can do that. Sometimes you've got to do the plumbing learning, as Rumi would say, where you're giving them information. But the intent of that, I believe, should always be to get them to find their own. Plumbing learning is like you give them knowledge or facts, they record it, they give you the facts back. The classes I teach really aren't fact classes, so I don't put too much energy into that. I mean, I'll give some facts. But I'm more curious with their reaction to it, their interaction with it, how it strikes them.

Here RP identifies patterns that relate to good teaching and good learning. The coded exchange of stories and feedback inform the process of sharing and generating knowledge and skills.

Good teaching is present-based. It's in the moment, so that there is an aliveness in the moment. Good teaching has contact in it, contact between teacher and student, student and teacher. Good teaching has dialogue, whether that's an internal dialogue of the student with the information or dialogue with each other. And good teaching creates receptive/reciprocal relationships between teacher and student, where the teacher is learning as much, if not more than the student. And realizing the knowledge base. I think good teaching is you realize the knowledge base of what's sitting out in front of you. Even though they may only be twenty years old, but there's a lot of knowledge out there. A lot of stories out there of overcoming things that, you know, would blow you away, I think, if you knew about it.

A learning community ensures it. Like a classroom is a learning community for that particular moment in time. I think it's to encourage the exploration by being interested in it. You know, creating the space for it. I think that's part of the teacher's role, especially in studio….we set up the environment to encourage collaboration. The class encourages people getting up and going around and talking and showing their work. Letting them know what's important. It's important to go show your work to people. It's important to get feedback. Since most of us will be working in some sort of team when we leave school, to have that experience and learn how to do it, I think, is really important.

RP makes reference here to teaching as performance, which may be interpreted as a more 'Do' orientation. The emphasis on reflection and synthesizing processes, however, is decidedly more 'Think'.

I think I've become much more entertaining. Because it is. It's like putting on a performance. As the classes have gotten bigger, and with this group of students. My classes have never been that much about the information. But it's really getting them to really synthesize information has been what's been changing. And the importance of that. The importance of reflection. Even though it's been in the class, it's a real focus for the classes now.

Because you can go online and get the information. You know, in the old days, the teacher had the information and they would impart the information to the student. The student has probably more access to information than I'll ever have now. They know how to surf and find stuff and get into things. So the actual information is, I don't think, that important. I think what's important is to teach them how to synthesize it, how to reflect on it. How to apply it. But the actual information, I think that's an old method that's really not that valid anymore.

Here again RP emphasizes the importance of the process of making sense of learning- of the translation from abstract to concrete, coding one's learning process ('Think') according to four unique and intertwined elements.

Curiosity. The ability to, I think, keep track of your learning. To track your learning, I think, is really important. Having made sense of it and being able to record making sense of it, so you have some kind of system to organize it all. I think students that don't, I see them really struggle with the synthesis part of it. So I think how we— especially with the inundation of all this stuff coming at us, how we organize and synthesize it is a really crucial part of learning. Curiosity, organization, synthesizing, reflection. Somebody teaches you something, you reflect on it, you make it your own. I don't think you make it your own unless you reflect on it. And to me, successful learning is taking something and making it your own and having it impact you. That you understand it. You synthesize it for yourself. You understand its context within your world and the field you're learning about.

5: 'codes' to read and write in object languages, metaphoric appreciation

Here RP describes the theory-of-use behind his approach to teaching with narratives. These stories are codes that RP uses to communicate meaning to students *that they must decode. The connection between student and teacher also represents a 'Think' approach to the student-teacher relationship as collegial and intersubjective.*

You know, you tell a story and people listen to a story with imagination and they start to form images in their head. A good story gets people thinking imaginatively. That's when new things come out. New ways of being in the world come out. I think a story taps the imagination. To me, that's what you want to tap in people: their imagination for themselves. What's possible? And stories, I think, do that better than anything. And I think it's—as part of that connection—powerful that students know your story. Just when you make a first-person statement about your life. Because that's who's out there. That's right there. It becomes a human interaction. It becomes humanity, it becomes connection, it becomes knowing a little bit about that person. And that's where I think magical stuff happens.

If you tell them a story, and then they tell you a story, and then you tell them a story and they tell you a story, it's a way to facilitate all the things I said up above. And I think the teacher is much more engaged when they're telling a story than when they're just doing a Powerpoint presentation. Because I think it's more dynamic. You know, there's a beginning, a middle, and an end in a story. Or it could be a story that goes on and on and on. But there's something dynamic about a story. You know, the Sufis in the Sufi tradition taught by stories, which allows whosever hearing it to start to internalize it and reflect on it.

Here RP describes the importance of modeling though not exclusively in terms of student imitation, rather in terms of creating a trusting relationship where learning can occur. This is likely a more 'Think' approach.

You cannot teach anything you're not doing for it to really have impact. I mean, you can teach it, but I don't think it has impact unless the teacher is doing it also. And since we communicate non-verbally, I think it's communicated very clearly if you do it or not do it. Students know if you're walking what you're talking, and they know it right away. I think I'm more of a frequency holder. I create a safe space for people to explore in. They trust the relationship, and I think that is something that I bring.

The use of story as code for communication medium is again discussed here, however this time the approach is more about the use of metaphor and a more 'Manage' approach to getting students to think critically.

I think stories are an important way of teaching. They create metaphor, and I think there's an understanding in a metaphor that helps the student understand the concept. It's another way of delivering not information, but teaching, or having students look at something. Their imagination gets involved when you tell a story. I let them make that leap. I know some teachers talk about metaphor. I think the only thing I ever say about metaphor is the picture is worth a thousand words, and a metaphor is worth a thousand pictures. And I think that's about the only definition of a metaphor…it's for them to reflect, and to tap their imagination. I think that's where the real learning comes in, when they have a chance to reflect on what it is they've heard and how does it affect them, and where are they at with that information? You know, it gets into they really think critically about what they're hearing.

Here RP describes his teaching approach using the coded metaphors of magic and coaching. Unlike a 'Do' or 'Know' approach wherein the teacher is considered a master and authority, this metaphor reveals a more 'Think' or 'Manage' belief that the role of the teacher is to guide and facilitate student learning.

…a puzzle, there's certain pieces you put together. Mystery unfolds. It unfolds in the moment. So that would be my metaphor, that my teaching's a mystery. And I don't mean a mystery like a sleuth. It's just a mystery. You're exploring a realm and the imagination gets tapped—or hopefully you tap it in them. And something magical happens for them and for you.

…and I think there's a coach in me in there. Well, to coach somebody into their potential. A coach believes in the athlete that they're coaching, or it doesn't work. And so there's that metaphor in there.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

Redesigning industrial design education to meet the changing needs of the profession requires a reexamination of predominant modes of teaching and learning—a clarification of the pedagogy problem. It appears that the industrial design profession is attempting to turn its own methods upon itself to design a preferred model of pedagogy. Unfortunately, little empirical or theoretical knowledge exists to inform the framing of the pedagogy problem. Without critical and reflective insight, the profession of industrial design may continue its bipolar pursuit of reactionary solutions. In response to an identified need for a collective action research agenda aimed at framing and addressing the industrial design pedagogy problem, the following research question was developed to shape this inquiry:

What do reflections by industrial design teachers and students reveal about existing and preferred design pedagogies?

As previously described, this question has been operationalized into the three following questions to frame the research design and discussion of results:

1. What are the existing and preferred folk pedagogies in industrial design education?
2. What do design teacher's folk pedagogies reveal about designerly ways of teaching?
3. How might understandings of folk pedagogies and designerly ways of teaching inform the (re)design of design education?

The research study reported here was designed in pursuit of answers to the above questions. As previously described, multiple methods were employed to generate and analyze data. An effort was made to provide breadth to the inquiry (by surveying industrial design students and teachers) as well as depth (through case studies of two teachers).

The online survey instrument was designed to generate both existing and preferred beliefs about industrial design pedagogy. Different question types were utilized to facilitate respondent reflections about perceptions of design pedagogy as it is (existing) and how it should be (preferred). Given the potential for incongruence between theories-of-action and theories-in-use, an additional survey section was included where respondents were asked to 'perform' their pedagogy after reflecting upon their preferred state. Survey data was divided into two datasets, one for students and one for teachers, to allow for comparison between teacher and learner.

Based upon findings of pedagogical preferences among students and teachers, two teacher case studies were undertaken. The two cases were chosen according to various common and distinguishing criteria and it was hypothesized that both would represent, to some degree, all four of the existing and preferred pedagogies identified in the survey. Teacher case studies involved interviews with teachers to identify theories-of-action and observations of teacher behavior in the classroom/studio in order to document their theories-in-use.

Data analysis included the generation of multiple open coding schemes generated by the different types of data. Bruner's four folk pedagogies were operationalized as four distinct codes which were then applied to the open codes. The application of the folk pedagogy codes rendered comparable the results of the various data collection and analysis activities. The interview data from the teacher case studies was subjected first to a folk pedagogy analysis and then synthesized into a narrative account of each teacher's personal folk pedagogy. The final narratives were framed by Cross's five aspects of ‘designerly ways of knowing’ in an effort to demonstrate how ‘designerly ways of teaching’ might be described.

The challenge of framing an inquiry into industrial design pedagogy is herein addressed through the lens of three separate yet interrelated theoretical frameworks. First, the concept of ‘designerly ways of knowing’ by Cross provided a foundational understanding of the cognitive processes of designing based upon empirical and theoretical explorations. Cross clearly describes five major aspects of designerly ways of knowing that include addressing ill-structured problems, relying upon a solution-focused mode of problem solving, a constructive mode of thinking, the use of codes to translate abstract into concrete, and the reliance upon unique languages for communicating through such codes. Given the previously described shift in design practice from form giving to meaning making, an understanding of the cognitive processes of design teachers through this lens offered the potential of exploring ‘designerly ways of teaching’ by employing ‘designerly ways of inquiring.’

The nature of pedagogical content knowledge and its access is couched within the framework of reflective practice and narrative inquiry. In reflective practice, theories-of-use constitute mental models constructed to explain behavior and are often what individuals can explicate when asked (what individuals believe that they do). Theories-in-use represent patterns of behavior that may or may not be congruent with theories-of-action (what individuals actually do). Both types of theories are developed through the iterative processes of reflection-in-action, which occurs during an activity, and reflection-on-action, which typically occurs sometime after an activity. Strategies for nurturing reflection were considered during the design of research instruments in an effort to generate reflections to represent both theories-of-action and theories-in-use.

The third theoretical framework that shaped this inquiry is that of folk pedagogies by Jerome Bruner. According to Bruner folk pedagogies constitute mechanisms of explanation that are indicative of how teachers and students conceptualize the relationship between mind and knowledge. These pedagogical notions directly reflect beliefs and assumptions that teachers hold about the learner's mind. Bruner describes four distinct folk pedagogies that are referred to in this document as 'Do' (teacher as craftsperson who performs skills that the student must imitate), 'Know' (teacher as authority who exposes student to canon of knowledge that must be comprehended), 'Think' (teacher as colleague who collaborates with student who must interpret and develop beliefs), and 'Manage' (teacher as consultant who manages the student process of translating information into critically constructed knowledge and expertise). These four pedagogies constitute the 'codes' that enabled the translation of abstract beliefs and behaviors generated through reflections into the concrete and observable phenomena which have been subjected to scrutiny in this inquiry.

As described above, this design and execution of this research study embodies 'designerly ways of inquiring'. The research problem represents an ill-structured problem that is impossible to exhaustively analyze and is unlikely to result in a 'correct' solution. The 'solution-focused' strategy of the research study involved iterative cycles of data collection and analysis that generated new understanding of the problem space and boundaries. The 'constructive' mode of thinking is evidenced by researcher efforts to generate new knowledge about industrial design pedagogy through identification of patterns and synthesis of results. The folk pedagogy 'codes' provided an ordering principle for data analysis and facilitated the creation of newly designed understandings. These understandings were communicated via the language of folk pedagogy codes and the concept of 'designerly ways of knowing.'

5.2 Conclusions about Research Questions

The previous section summarized the background and context of this study. It also described the design of the study undertaken in an effort to respond to these questions. This section offers a discussion of the results of data collection and analysis within the context of each research question so conclusions about the overarching research problem can be discussed.

5.2.1 Existing and Preferred Folk Pedagogies in Industrial Design Education. The first question that framed this inquiry was: What are the existing and preferred folk pedagogies in industrial design education? The response to this question can be found in results from both the online survey and the teacher case studies. In short, there is no one clear Folk Pedagogy that emerged as the definitive example of existing practices.

Students and teachers overwhelming agreed that elements of all four Folk Pedagogies exist across contemporary curricula. Design learning is described primarily a 'Think' experience where the pedagogical goal is not necessarily the acquisition of skills (which teachers ranked second and students ranked fourth) but the acquisition of mental models that frame cognitive activities. The 'Think' approach seems most prevalent with a particular emphasis on the concept of 'acquiring personal beliefs' as an essential learning objective for design education. This may relate to the inherently personalized nature of design style, or creative voice, that is an important aspect of demonstrating competence in design. For teachers, the acquisition of skills came in a distant second which is no surprise given that this orientation likely aligns with their own studio training and professional practice.

Skill acquisition (i.e. hand sketching, model making) is most reflective of the 'Do' approach and indicates an experiential mode of learning by doing which develops over time and through continuous practice. It appears that 'Do' activities may bridge the gap between the lowest scoring 'Know' approach of learning *what* the principles are (i.e. propositional knowledge) and the most commonly cited 'Think' approach to understanding *how* and *why* to apply this knowledge (i.e. procedural knowledge. This depiction of the current state echoes the findings from Liu's (2005) study where the key markers of student design expertise were evidenced in the portfolio (an artifact of 'Know'ing the right principles and 'Do'ing things the right way) along with the uniqueness of the student's creativity (being able to 'Think' for oneself).

Students and teachers aligned around the concept that the role of the students is to 'imitate'. This is surprising when considered in the context of the previous statement about design learning where both datasets represented agreement with the 'Think' pedagogical response. It is difficult to resolve expressed beliefs that design learning is about 'acquiring personal beliefs' if the task of the design student is primarily to replicate the actions of the teacher. It is not, however, surprising when considered in light of the shared belief that the role of the teacher is primarily that of craftsperson. Here a tension emerges as a dysfunctional, or at least polarized, relationship between the master/apprentice model and the students' expressed resistance to being "forced" to design like their teachers and have their creative breadth constrained.

Students and teachers also agreed about the current need for design education to prepare students to shape much more than objects and aesthetics. As expressed by Van Patter (2020), Manzini (2015) and others, the design professional holds the potential shape culture and the power to construct societal systems. Today's industrial design classroom invokes the 'Manage' approach as student learn to be responsible for transformation of the world outside of them through the practice of mastering the construction for their inner worlds. Here again lies an inconvenient inconsistency between the current role of teacher, perceived as 'craftsman' whose primary role is to present information and demonstrate skills, and the requirement that design students acquire the complex aptitude of shaping culture transformation.

The implications for today's design educator, who is responsible for designing the delivery of required knowledge in a format that it is digestible by students, are many. There is clearly a relationship between the content (what students need to be learning), the pedagogic approach, the and the student level of skill development (i.e. Freshman, Senior). Today's design educators already demonstrate a designerly approach to using all four Folk Pedgaogic approaches in their efforts to diagnose and design for the needs of the user (i.e. student), content (i.e. course materials) and context (i.e. class type). How each folk pedagogy manifested in the data can be seen in the figure below. As the nature of required/expected learning content for the industrial design profession evolves, it will continue to require adaptations to the body of pedagogic content knowledge utilized by teachers who seek to prepare future professionals.

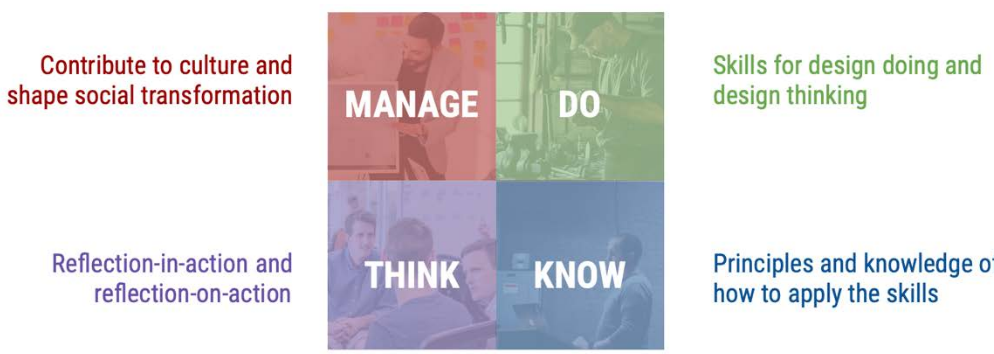


Figure 57. Folk pedagogies as pedagogic content knowledge for industrial design education.

Just as it was impossible to identify any one folk pedagogy as the primary example of the *existing* state of industrial design education; it was equally difficult to find any single Folk Pedagogy that captured the essence of the *preferred* model of industrial design education. Instead, what emerged is a suggested relationship between all four Folk Pedagogies that can best be described as interdependent, cyclic in nature and creative in potential application.

The statements most reflective of the 'Think' and 'Manage' folk pedagogies overwhelmingly solicited the strongest agreement in the survey responses. Those statements reflecting the 'Do' and 'Know' approaches received the least agreement. These results reveal a general belief (already articulated in the previous existing approaches section) that knowing *how* to do something doesn't necessarily equate to knowing *why* and *when* to do it.

The most agreement emerged about the importance of discussion and collaboration for the learning experience, both for the impact it has on the student and the teacher. This sentiment was summed up in the teaching tip "Learn how to facilitate discussion, and to deal with it when it fails. Dead air in a classroom can be a killer." This sentiment potentially reinforces Manzini's assertion that the designer's role is that of a "mediator (between different interests) and a facilitator (of other participants' ideas and initiatives)" (2014, p. 65). It also echoes the growing notion of the designer as a "facilitator of multidisciplinary innovation projects" (Minder & Heidemann Lassen, 2018). The essentiality of conversation for developing personal beliefs via metacognitive reflexivity about how such beliefs came to be and evolve also resonates with the notion that designers (and , thus, design teachers and learners) are reflective practitioners à la Schön (1983).

These reflective practices of moving between action and thinking about action contribute to the learning goal of 'acquiring personal beliefs' a key element of the 'Think' pedagogy. This is exemplified by teacher study participant JA during an interview when he expressed

> …learning has to be a combination of being exposed and then absorbing that knowledge, letting it incubate…and then letting it out, applying it in some way… once you start that applying process, then it's reflecting and looking at it. Adjusting it, modifying it, going back and thinking and then coming back… out of all these activities put together is a process that you learn.

Here JA also reveals an example of how he weaves together 'Do', 'Know' and 'Think' pedagogies throughout the learning process. This cyclic relationship among different folk pedagogies was also observed in the other teacher case and expressed explicitly by RP as a mechanism by which students develop their personal beliefs.

The cyclic relationship between multiple folk pedagogies shows up in how students and teachers navigate the tension between the importance of teaching/learning fundamentals of design (i.e. principles, basic skills) while also encouraging dissention and critical questioning of the message. In this case, the cycle often begins with a principle delivered via presentation, a 'Know' approach, which is then challenged by the teacher, via a 'Think' provocation, and resolved through students' examination of the nature and value of the concept, a method to 'Manage' information.

In most instances (observed and reported) the reflection step, a 'Think' activity, is essential for understanding what taught, i.e. a concrete 'Know' concept, or experienced or produced, i.e. a 'Do' activity. This debriefing activity, what Schön would describe as reflection-on-action, is deepens the designer's relationship with the design process (or the teaching and learning process) and how it exists in relationship to the culture that it contributes to, a decidedly 'Manage' way of situating knowledge.

There is potential for including all four folk pedagogies in varying orders depending upon students, content, and context. Although Bruner described these pedagogical approaches as distinct and unique, the presence of all four together in a single learning design begins to suggest connections to (or at the very least, pedagogical support from) Kolb's Experiential Learning Theory. The figure below illustrates how the four folk pedagogies may map to Kolb's cycle. As such, this begins to suggest one possible sequence of the folk pedagogies. It is important to note here the existence of other possible sequences and combinations as evidenced in the teacher case studies.

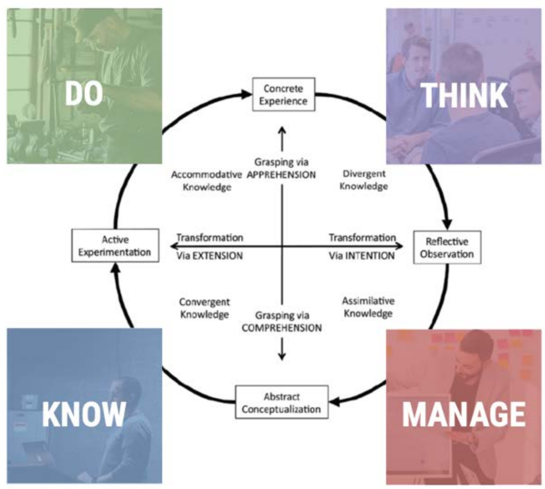


Figure 58. Comparison of Kolb's Experiential Learning Theory and Bruner's Folk Pedagogies.

Fortunately, both teacher participants in the case studies evidenced all four pedagogies in their theories-of-action (during interviews) and theories-in-use (during observations in class). Each of the four folk pedagogies will now be discussed in light of teaching tips and the teacher case studies to offer concrete examples of how these mental models of learning might be embodied in the classroom and studio environment.

- the introduction of multiple perspectives
- a one-to-one consulting relationship between student and teacher
- the concept of the teacher as a consultant
- use of critical reasoning to situate knowledge in historical, cultural, and professional contexts

- demonstration of skills
- proximity to professional practice
- industry partnership

- discussion and communication
- emphasis on critical and reflective thinking
- collaboration
- emotional intelligence
- learner-centered strategies
- reciprocal relationship between teacher and student

- the authoritative role of the teacher
- clear predetermined objectives
- required foundational principles
- presentation of examples

Figure 59. Examples of how the Folk Pedagogies Appear in Industrial Design Education.

The 'Do' folk pedagogical model is the most historically engrained in the industrial design studio context. However, its prevalence and pedagogical underpinnings seem to be losing support from both teachers and students who both expressed criticism for the master/apprentice model. There were also suggestions of a preferred approach-one where the roles of the teacher and student are less superior/inferior, more parallel.

Teaching tips offered by both teachers and students echoed this sentiment and revealed three key elements of the 'Do' folk pedagogy that should be included in a preferred pedagogy. These four elements included: demonstration of skills, proximity to professional practice, and industry partnership. There was also a clear desire, particularly on the part of the student respondents, to eliminate the expectation of imitation of teacher's style (which, of course, is inconsistent with survey results that indicated 'imitate' to be the existing belief about the main task of the design student).

The role of the teacher as demonstrator of specific skills is clearly an important part of the industrial design studio experience. While the traditional master/apprentice model relied heavily upon this model, results from this study reveal that new paradigm of demonstration has emerged where demonstration does not only reside in the practical hard skills of the teacher, but also in the teacher's ability to demonstrate possible alternatives and multiple perspectives. In lieu of the one master approach (which may offer the students only one possible approach), it appears an evolved 'Do' pedagogy situates the teacher as a demonstrator of skills and a purveyor of inspiration and multiple perspectives. In the teaching tips offered, students expressed a desire to learn through exposure to multiple examples of both products and processes."

Demonstration is acknowledged as a vehicle for catalyzing student performance and development of skill. It also provides the notable impact of generates reciprocal respect, a more 'Think' approach to the teacher/learner. This coupling of 'Do' and 'Think' pedagogies is another example of a potential 'happy pedagogical marriage' for teaching industrial design.

A second potential remnant of the 'Do' pedagogy involves proximity to professional practice. Both teachers and students cited the need for industrial design educators to remain actively connected to professional practice either through their own professional work or through allegiances with and study of industry. While the traditional apprenticeship model involved learning by imitation of the master, a mutation of this approach involves the apprentice learning not just from demonstrations by the master, but from their body of work, body of knowledge and body of experiences as well.

Students and teachers advanced the belief that teachers must remain active participants in the professional community. Most student expressed a need to remain connected to industry, though there were less imperatives for actual practice than in the teacher respondent tips. This belief was evidenced by theories-in-use from JA, in the teacher case study. He described how, for his lecture class presentations, he would actively seek out examples of principles in real world professional contexts so that the students could see concrete application of the laws he was trying to convey. He also described how, in both undergraduate and graduate courses, he would bring in positive and negative examples from his own professional work to illustrate application of concepts being taught in class. In fact, JA's first experiences with teaching came during his professional practice when he would guest lecture or lead sponsored projects for his company, an experience that he now facilitates from the teacher side.

Although there was little overall preference for 'Know' pedagogical approaches, there are many key insights about the nature of canonical knowledge in industrial design education. Similar to what was seen with the 'Do' results, teaching tips reveal that certain elements of the 'Know' folk pedagogy are still considered valuable though in a modified form. The four key aspects of this folk pedagogy that were preferred by teacher and student respondents, and evidenced by teacher participants in the case study, include the authoritative role of the teacher, clear predetermined objectives, required foundational principles, and presentation of examples.

The desire for the teacher to maintain some sort of authoritative role in the classroom was evidenced in the language of many of the teaching tips. Many tips began with phrases like "Make them…," or "It should be required…," or "Enforce…," or "Force them…," which all reveal an orientation to the teacher as an authoritative or dictatorial presence in the classroom. These statements were often couched within the context of establishing disciplinary expectations.

Students also indicated a preference for rigid control in certain aspects of the teaching approach. For many of the students these tips were contextualized as preparation for the world of work, where they would eventually be answering to a higher authority. This association with an authoritative understanding of course material was also evidenced by teacher participant JA who described his approach to designing a class by relying upon his own experiences as a design manager.

Another element of the 'Know' pedagogy that remains preferred by both teachers and students is the concept of measurable learning objectives that are clearly communicated. In the original description of the 'Know' mental model of learning, facts and principles are propositional knowledge acquired by the learner and easily subjected to assessment. Teacher tips often discussed the need for objectives as a strategic aid to teaching, whereas students often expressed the value of clear standards as an aid to learning. This structure is akin to the design brief and may also provide a 'Do' experience of imitating professional work for clients.

Both teachers and students also evidenced a marriage of the 'Know' concept of clearly defined learning objectives with the more 'Manage' belief that students should also consider the reasoning for their learning. The concept of providing reasoning for class exercises is indicative of another possible pedagogical coupling between 'Know' and 'Manage' pedagogies where specific foundational knowledge is required, yet the authoritative stance is tempered by presenting learners with underlying justification for such expectations so they can consider the objectives in a broader professional, historical, or other context.

During the interviews JA discussed the use of rubrics in the studio classes he teaches. Based upon observations of JA's classes, it was also noted that rubrics for each assignment, which are delivered when the project is initially presented, must be signed by the student and turned in with their project. While the use of a rubric certainly indicates a more 'Know' approach, the sharing of responsibility for understanding and meeting these objectives through an almost contractual ritual reveals possible 'Think' tendencies.

It has been made clear through the results of this study that there are certain fundamental principles that constitute core competencies in professional design practice. While it has also been asserted that this canon of design skill may need to be reconsidered, this section will consider how such foundational concepts are pedagogically situated. Most students and teachers indicated a need for a 'constructive' approach to knowledge generation in design which begins with certain principles and theories that are then applied and, through practice and interaction, mastered.

Although evidence of adherence to the traditional canon of 'hard skills' in industrial design education was present, other skills and abilities were discussed that echo the results of the Liu (2005) study results where 'problem solving skills' were considered paramount. Some of these 'softer skills,' including critical and creative thinking, were also mentioned by teacher respondents as important and reflect similar pedagogical orientations to those described by Friedman (1997) as analytical and logical skills and by Giard (1990) as the 'whys' of design practice. One teacher, for example, wrote, "Skills alone, without reason, analysis and understanding of context are useless." Another stated, "teach creative thinking, skills can be acquired later." This sentiment was also asserted by student respondents, as in the following statement, "Design-thinking process is as important as making attractive objects."

This expansion of emphasis by design pedagogues to include more analytical reasoning skills was also evidenced by teacher participants. JA, for example, maintained an allegiance to the laws of perspective but negotiated this pedagogically with a student-centered approach. He explained, "I know students are into gaming. So of course, that's going to be one of my avenues into showing them some of the principles. If it's fitting. So

I've shown some—basically, what's one-point perspective and two-point perspective, and how does that create depth of vision or depth of space on the 2D?" Here the basic laws are situated within an example that gives the students an opportunity to consider the new knowledge within their own personal context.

RP revealed far more 'Think' tendencies in the education of the 'soft skills' that actually constitute the core subject matter and focus of many of his courses. He also situates the notion of canonical knowledge within a modern world where technology enables access to information once only held in the minds of the teacher. For RP, the propositional knowledge that is the cornerstone of the 'Know' pedagogy has changed. In fact, it seems that there is a canon of knowledge according to RP but it is a procedural knowledge, an ability to find and synthesize information rather than the information itself, which constitutes the canon.

One interpretation of the 'Know' folk pedagogy as described by Bruner includes the concept of presenting examples to students. While this in and of itself does not seem to exhibit 'Know' pedagogical allegiance, the concept of the teacher as presenter of information that students must comprehend does. The challenge in applying the 'Know' folk pedagogy code in this research relates to the pedagogical intention of exposing students to such examples. Were the examples to be considered as part of the core canon of knowledge, i.e. commonly held to be exemplars of the 'correct' method for designing, then this would imply a 'Know' orientation. However, in most observed instances, the use of examples was typically intended to provide students with multiple perspectives and inspiration. In other words, rather than filling students' minds with examples of the correct way to design, the examples were used to illustrate many possible ways to interpret and approach designing. In this way, the examples acted more like vessels for a 'Manage' pedagogical approach.

Students indicated a relationship between examples and inspiration. So even though the notion of a 'right' way to apply knowledge is indicative of a 'Know' pedagogy, the belief that students might be able to critically consider their own understanding of appropriate procedural knowledge through viewing both good and bad examples reveals a 'Think' and 'Manage' orientation. Students also revealed various motivations for wanting to see examples of the teacher's work indicating that use of the teacher's own work as an illustrative example may have valuable pedagogical ramifications including establishing mutual understanding and respect between student and teacher (more 'Think' than 'Know').

Visual and tangible examples tend to be most common in design education, as observed in the teacher case studies, however they are usually accompanied by discussion and/or explanations that clarify why, in fact, they are considered exemplary. In this way the example alone does not carry the pedagogical intent (i.e. of a 'correct' way) rather it serves as a medium for contextualizing the learning in a historical, real-world application (more 'Manage') and encourages the students to consider how and why they will use their knowledge (more 'Think').

Verbal examples were also common tools utilized by both teach participants. JA introduced a story during a lecture course that became a recurrent reference by both teacher and student for multiple classes whenever discussing a specific principle. Stories were the preferred modality employed by teacher participant RP who often used stories to communicate fundamental principles.

For RP, stories are metaphoric verbal examples that encourage students to think critically and reflectively about the information being delivered. This pedagogical intention is more indicative of a 'Think' approach though the medium, the verbal example, may have the potential to be a more 'Know' approach.

Both teacher participants paired the ‘Know’ practice of providing ‘correct’ examples with other pedagogies. The authoritative stance that might be taken when providing exemplars is tempered, therefore, by the inclusion of ‘Think’ strategies like metaphoric narratives and ‘Manage’ strategies like situating learning within a historical, cultural, and professional context.

The ‘Think’ folk pedagogy, which was a common preference across all data sources, aligns with the design 3.0 and 4.0 models of design practice outline by Van Patter (2009) given the reliance upon discussion and collaboration in the learning process. The criticisms discussed by Friedman (1997), Giard (1990) and others also reveal a desire to move towards a more ‘Think’ pedagogical approach where cognitive practices of designing constitute an explicit part of the industrial design curriculum. The six aspects of a ‘Think’ pedagogy that revealed patterns of preference and promise of adoption include the use of discussion and communication, emphasis on critical and reflective thinking, collaboration, emotional intelligence, student-centered strategies, and reciprocal relationship between teacher and student.

Teachers offered a number of statements regarding the need for discussion not only with students, but also with colleagues. They offered support for the idea that discussion is vital not only for teaching practice, but also for reflecting upon teaching practice through conversation with other teachers in efforts to learn how to teach better. One teacher connected the concept of discussion to the concept of learning from students with this statement, “Do listen and learn from the students. It can make for much more interesting conversation.”

Teacher tips emphasized discussion in the classroom and the value of communication as a skill that students should obtain, “‘Artistic talent’ is not a requirement in a design student; communication skill is.” Others emphasized the importance of communication in general, still others focused on strategies (both formal and informal) for generating discussion among students. The use of questioning as a specific strategy to facilitate conversation was also mentioned as a teaching.

Communication between student and teacher, communication among students and communication among teachers were all suggestions for improving the learning experience. Students also highlighted the need for teachers to communicate across the curriculum in order to understand the student experience and provide consistency and workload balance.

During interviews, both JA and RP described their efforts to generate classroom conversation. For example, JA discussed the use of questioning during a voting critique in the studio which encouraged interaction among students. He stated,

> Then I ask each student who's voted to explain why they selected who they selected. I go through that to get them to talk about the rubric… I get them to explain as clearly as possible using the language that we set up in the materials. So it's again re-emphasizing the support of the material itself. And they begin to get used to using those words that describe those rubrics and the goals of the project…So the critique really is sort of feedback and reiterating the concepts, the principles, the criteria, the rubrics, so they understand what they're being judged on. And to start to develop an understanding of what is good, what is appropriate, what is effective drawing techniques.

Here JA illustrates how the use of a critique facilitates discussion which, in turn, facilitates a deepening of the students' understanding of the canon of principles and skills that they are expected to acquire. In this way the use of 'Think' strategies here supports the advancement of a 'Know' agenda to establish a curricular canon of mandatory learning.

RP uses discussions in smaller groups as catalysts for intersubjective interchange around the class material. He explains, “There is an intention of having them play. Explore. Especially in their groups. There’s an intention of getting them to have dialog with each other about it, and so allowing them to be changed by that dialog, I think, is really crucial.” In this case the emphasis is on discussion as a tool for playfully exposing alternate understandings of the material. In both cases, and in both types of classes, discussion emerges as a strategy for bringing a ‘Think’ pedagogy into the learning experiences.

A second element of the ‘Think’ folk pedagogy that was evidenced by the data is the importance of critical and reflective thinking in the teaching and learning processes. The teaching tips included examples of how this type of thinking is beneficial to students through constructive feedback. Also interesting was the inclusion of more reflective remarks from the teachers about the teaching experiences. For example, one respondent offered, “Don't take criticism personally but do reflect on it.”

Students indicated a preference for inclusion of critical and reflective thinking skills in industrial design education. Sometimes this support was evidenced in comments directed at the teacher, i.e. “Be very critical because it only helps the students improve.” In other comments it was directed more towards the development of these skills within the students, as seen in these comments, “Do encourage students to develop a vocabulary for evaluating their own and their classmates designs critically”.” Reflective thinking was encouraged in remarks that specifically called for it, i.e. “Do encourage students to reflect on their methodologies and problem-solving skills, and in remarks that emphasized the importance of the how of learning over the what, i.e. “Do encourage students to value learning process more than grades.”

A preference for critical and reflective thinking in design education was also evidenced by teacher participants. RP, for example, utilizes a weekly online reflection tool that required students to reflect upon their learning each week. These reflections are then aggregated and reviewed by RP, who discusses what he has read with the class. He uses this tool to keep himself informed of the students' progress but also to demonstrate for the students that these reflections have value. For RP, reflective thinking is not only a learning process, it is also a learning product, a skill that they must practice and refine.

Both teacher participants offered methods for incorporating critical and reflective thinking strategies into the lecture and studio classrooms. These methods align with the purposes for teaching reflection outlined in Chapter 2. In particular, the use of reflection to empower students, to facilitate their self-development, to encourage reflection on the process of learning, and to aid in the resolution of uncertainty were notable examples from the teacher studies. Techniques employed by both teachers also evidence potentially tacit understanding of the strategies to consider when developing reflective learning opportunities as described by Moon (1999. JA offered implicit examples of the use of reflection as a conversation with the design process and explicit discussion of how reflection aligns, in his own approach, with the learning dialectics described by Kolb, Baker, and Jensen (2002).

A third 'Think' pedagogical element that indicated a preferred pedagogical approach was that of collaboration. Group projects generate opportunities for students to learn from each other and are considered similar to professional practice where designers often work on teams with other designers or professionals from other disciplines. Collaboration between student and teachers was framed as a mechanism for empowering the students to take an active role in shaping their learning. This may reveal a shifting perception of the role of teacher from authority to collaborator

Teachers discussed the value of collaboration in their classrooms and in their own approaches to collaborating with other faculty and professionals. No team projects were observed during this study, however each teacher case study participant discussed efforts to promote teamwork and skills related to collaboration. For RP, the value of collaboration was at the heart of his role as a co-teacher for two studio courses where he primarily offered 'collaboration consulting' to the student teams. JA also discussed his own collaborative efforts at curriculum design for multiple classes that constitute core coursework for the industrial design curriculum of his program.

References to what will be referred to here as 'emotional intelligence' also emerged as an important element of the teaching experience. 'Emotional intelligence' refers to one's knowledge and understanding of one's self and one's ability to situate that knowledge and act upon it within a social context. Both teachers and students offered tips that support the idea of emotional intelligence as a valuable part of design education. Interestingly, these tips were most often directed at the teacher rather than the student. Teachers focus on the personal experience of teaching (likely based upon their own experiences in the classroom) and offered encouragement, accountability, and recognizing the role of the student in shaping the teacher's own understanding, i.e. "listen to your students. they will all teach you a little something about design and yourself." Students emphasized the learning opportunities for the teacher in the shared classroom. They also communicated the value of their own potential to develop emotional intelligence skills through these interactions.

The teacher case studies revealed an emergent theme of emotional intelligence as both a personal practice and a learning objective for students. For RP, emotional intelligence is part of the course content and the classes are structured to facilitate the development of these skills. He described it this way,

> My area of expertise is the teaching of emotional intelligence, understanding adult development, especially with young students... emotional intelligence is about one's knowing of oneself, and also of one's interaction with other people, whether that's fellow collaborators or clients, whatever it is.

RP relies upon a combination of both fundamental principles (a 'Know' body of knowledge) as well as an experiential curriculum of doing and reflecting to facilitate student learning about emotional intelligence. He offered this description, "It's a sequential kind of knowing yourself and coming up with some kind of kinesthetic experience in order to bring that home, something they have to do and experience in order to learn."

JA discussed how he has negotiated his own understanding of his role as a teacher through the experience of being in a classroom and, in so doing, expanded his own self-knowledge and social awareness.

> I had thought before, in my naiveté, that you could just take a piece of information, a process or some fundamental principle, and just dump it into the classroom and everybody was going to absorb it at equal rate. And I realized quickly after the first few days of teaching that that wasn't so.

Here JA describes his own transformation from a 'Know' belief into a more 'Think' approach. While RP provides an observable example of how to approach the teaching of emotional intelligence, JA embodies the emotional intelligence of a teacher who is able to reflect-on-action and, through this process, consider an incongruence between his own theories-of-action and theories-in-use.

The statement by JA also evidences the fifth element of the 'Think' folk pedagogy under discussion here, the student-centered approach. The 'user-centered' approach to design has been around since industrial design professionals emerged from their

Modernist confines. It is indicative of the design 2.0 approach described by Van Patter (2009) and common practice for many of today's most well-known consultancies and corporations. It is no surprise, then, to see elements of a student-centered approach arise in the preferred pedagogies of both design students and teachers.

Many students and teachers revealed a preference for teachers to get to know students both personally and professionally (i.e. in the context of their professional aspirations). There is an educative purpose that such knowledge has for the teacher and their ability to bring content to the students in a digestible way, i.e. through understanding them as individuals as well as understanding their collective needs as a group (i.e. a generation with particular ways of learning, doing, communicating, etc.). The need to broadly understand and seek to empathize with the "student" was also balanced by suggestions to make an effort to interact 1 to 1 and develop more personal connections with each student. For the teachers, this allows for a deeper understanding of how students experience the course and for students it offers a quality time experience that feels nourishing and empowering. Both general consideration and more personalized attention represent experimental acts of teaching and reflecting, a 'monitor and adjust' approach.

The final preferred element of a 'Think' folk pedagogical approach evidenced by the data is the concept of a reciprocal relationship between teacher and student. The 'Think' folk pedagogy situates the teacher in the role of collaborator who is considered a colleague in the student's journey of learning, interpreting, and acquiring beliefs. Many teacher comments emphasized the value of respecting students. One teacher wrote, "Make sure students know that they will be working very hard - just as hard as you work to teach them - develop mutual respect for one another".

Students desire a respectful relationship with their teachers and reveal a preference for being considered aspiring professionals and being treated as such. These types of interactions foster a sense of empowerment, pride, potential and genuine mutual respect. The concept of a collegial relationship between student and teacher was also identified in the teacher case studies. RP often articulated his belief that the student/teacher relationship was a reciprocal one. He described the relationship as "Receptive/reciprocal. That I learn from them and they learn from me and we all learn from each other."

JA also evidenced an evolving understanding of the relationship between student and teacher. He described the relationship between teacher and student as analogous to the manager/designer relationship (similar to the one he experienced in his professional career).

> …As the teacher, yes, it's this idea of respecting the student's level of understanding, respecting the student's amount of knowledge they bring, regardless of what level, and being able to guide through the process in the integration of new knowledge and the application of that new knowledge. Whether it is hard skill or theoretical.

JA reveals here both a 'Think' approach to the relationship between teacher and student, as well as a 'Manage' approach to the role of the teacher who also serves as something of a guide, a consultant for the student's process of acquiring and negotiating new knowledge into their existing understanding.

This leads into the final folk pedagogical model under consideration, 'Manage.' Four essential elements of the 'Manage' folk pedagogy emerged as preferred by both students and teachers, including the introduction of multiple perspectives, a one to one consulting relationship between student and teacher, the concept of the teacher as a consultant, and the use of critical reasoning to situate knowledge in historical, cultural, and professional contexts.

The concept of including multiple perspectives in design education aligns with the 'Manage' pedagogical assertion that students should understand the difference between their own personal beliefs and those held commonly by society as well as the professional community. Evidence in support of this approach was offered in various tips provided by teachers and students. For example, one teacher wrote, "Show the value of ranking your ideas from multiple indicators, i.e. innovation potential and marketability." Additional suggestions include bringing in outside professionals and other relevant guests for classrooms experiences, especially critiques, to share different perspectives.

Suggestions for exposure to multiple perspectives generally fell into four categories: product, process, performance, and people. Product variables include different types of products (i.e. multiples example of a running shoe or electronic razor), different solutions to the same problem, diverse materials and manufacturing considerations, similar products designed for different users, etc. Students also liked to see different process artifacts to help them imagine a variety of ways to arrive at a final design solution. Similarly, seeing varying levels of performance, i.e. demos of both good and bad efforts and outcomes, helps students conceptualize a range of possibilities and aspirations. It is also helpful to get exposure to products designed by and for different people to understand how style and brand impact the experience of a design, and how different users require different features, etc. These categories may be helpful for teachers exploring a range of examples to share with students.

A second element of the 'Manage' folk pedagogy that emerged as a preferred pedagogical approach was that of the one to one consulting relationship between student and teacher. The majority of tips that involved individualized instruction and feedback came from the student respondents rather than teachers. Given the logistics involved with meeting with students individually, and references made by teacher case study participants about the challenges of growing class sizes, it is possible that personal attention is an difficult objective. One student, did however offer the following potential alternative, “Hold small-group meetings weekly with a smaller group of students for more individualistic instruction.”

The use of one to one feedback sessions was common practice in JA’s studio course. Class sessions were alternatively dedicated to introducing class projects, critiques of student work (both formative and summative feedback), and ‘work days’ when the students would work on projects at their desk and the teacher would move from desk to desk, offering individualized instruction.

A third aspect of the ‘Manage’ pedagogy that emerged as a preference for design education was the concept of the teacher as a consultant. This role was also described as manager, coach, mentor and guide with all references implying that the teacher’s task is to assist the student in their pursuit of knowledge and skill generation. In this way the teacher becomes both, as Bruner describes, an information manager and, in the words of participant JA, “a manager of minds.”

Teacher tips that reveal a preference for the teacher as consultant often included the term ‘manage’ and referred to skills of project and time management. The importance of modeling desired behaviors was considered a good way to show these skills. One student suggested that “Design professors should think of themselves as project managers, not clients.” Teacher participant JA often utilized the metaphor of teacher as manager when describing his pedagogical beliefs and practices. He attributed this orientation towards his students to his years of professional practice as a design manager. Here he clearly explicates the formative roots of his own pedagogical content knowledge:

> I guess it really has to do with my career in the past. That how I managed teams of designers on projects and then in the classroom, I feel like I'm managing the minds of the students. As a manager of minds, you have to know the minds of your students. You have to know how to manage the process of the learning.

According to JA, the teacher/manager is not only responsible for managing the information in the classroom but also the cognitive process of the students who are attempting to internalize it.

The final example of a 'Manage' pedagogical approach that was preferred by both teachers and learners involves providing reasoning and justification for presented information. This concept is related to the 'Manage' ideas that students should scrutinize commonly held assumptions, question what they are learning, and consider evidence behind beliefs in the field. Efforts to justify class material and explicate reasoning practices are therefore interpreted as 'Manage' approaches to knowledge management and construction. Inherent within this belief is the potential for alternate opinions and the power of choice.

Various teacher comments revealed an evidenced-based approach to content delivery. Justification of knowledge presented in the classroom was also presented through the lens of teacher experience, i.e. "Make sure they know that you have been where they are and understand that some things don't make sense now." Teacher also explored the value of allowing students to choose their own application of knowledge so they could arrive at their own answers and build their own understanding and reasoning through first-hand experience.

Student comments that related to theme of reasoning and choice focused on the role of the teacher in encouraging student questioning, i.e. "Do encourage your students to ask questions," and "explain thoroughly when questioned." They also emphasized contextualizing knowledge through historical referents, i.e. "Do give historical references" though with caveats, i.e. "History is history, it is to be learned from and not copied but improved." Students also indicated that teachers should offer justification for criticism, "don't criticize without reason" and allow students to make the final choice in light of any teacher critiques, "Don't suggest changes by saying 'you should do this.' Offer suggestions but in the end the student needs to make the choices."

What the above discussion reveals in response to the original question regarding existing and preferred folk pedagogies in industrial design education is this: there is no single definitive answer. In other words, it is not possible to assert that individual folk pedagogies are existing or preferred. Rather, this data reveals that existing and preferred folk pedagogies in design are a composite of all four folk pedagogies. Distinguishing between existing and preferred hence becomes a matter of clarifying what curricular goals and pedagogic intentions are and then identifying which combination of folk pedagogies might best facilitate teaching and learning. These combinations are discussed in the following section as illustrations of how designerly ways of teaching might be described.

5.2.2 Folk Pedagogies and Designerly Ways of Teaching. The second question that framed this inquiry was "What do existing and preferred folk pedagogies reveal about designerly ways of teaching?" The results section provided a narrative account of the teacher interview data storied through the lens of the theory of 'designerly ways of knowing.' This section will use the language of folk pedagogies previously presented to frame the discussion of what designerly ways of teaching might look like and, perhaps most importantly, how this coded language might be used to catalyze a discussion of them for purposes of both reflection and action.

Cross (2006) identified five elements of designerly ways of knowing. These elements include addressing ill-structured problems, utilizing solution-focused modes of problem solving, utilizing constructive modes of thinking, using codes to translate the abstract to the concrete, and employing codes to read and write in object languages. Each of these five elements will now be discussed in light of the previous discussion of folk pedagogical models in industrial design education. Given the presence of all four folk pedagogy models in both existing and preferred industrial design folk pedagogies, the purpose of this discussion is to offer a response to the above research question using a new language, folk pedagogies, for describing mental models and practices of teaching that are designerly.

5.2.2.1 Design educators tackle ill-defined problems. It has been illustrated in the results of this study and the previous discussion that the challenges involved in designing industrial design pedagogy are wicked indeed. There is no 'correct' method for teaching design and the unintended consequences of efforts to educate are only identifiable (if at all) once an effort to teach has been made. In other words, the appropriateness of any pedagogical approach (action) is only assessable via reflection during (reflection-in-action) or following (reflection-on-action) the teaching occurs.

The wicked nature of teaching design was expressed by the participants in this study via an identification of the evolving nature of design practice. Design education is intended to prepare future design professionals for practice. However, the nature of design practice is changing and pedagogic models that were once deemed appropriate and effective are being reconsidered. Given the 'Do' pedagogical belief of design learning being primarily about skill acquisition, teaching is problematized by uncertainty about which skills should, in fact, be taught.

This evolution of design practice also challenges beliefs about what constitutes the canon of knowledge and skill in industrial design, which is necessary for employing a 'Know' pedagogical approach. If learning objectives are uncertain, assessment of the student's ability to perform those skills becomes a wicked task. Furthermore, the blending of theory and practice, which in the 'Know' model is mastered through comprehension and application of theory, becomes increasingly difficult. The cumulative nature of knowledge within the 'Know' model is also difficult to negotiate within the parameters of predetermined curriculum and program pedagogy, the consideration of which must be made when attempting to frame the problem of teaching specific elements of that curriculum.

The changing nature of design practice is paralleled by the changing nature of the design student, as discussed by both of the teacher case study participants and many of the survey respondents. The structuring of design teaching according to a 'Think' pedagogical model requires an understanding of the student and an effort, on the part of the teacher, to collaborate with the student in the development of personal beliefs. New generations of students bring not only new understandings of the nature of design learning, but also new personal and cultural contexts that are negotiated intersubjectively within the classroom and studio. The ill-structured nature of design teaching is characterized by the challenges inherent in attempting to facilitate collaborative interaction, conversational learning, and interpersonal reflection, all elements of the 'Think' model of teaching and learning.

The practice of teaching design also involves a process of interpersonal development through metacognitive activities wherein the teacher assesses their own teaching efforts in light of student response (both via direct feedback and indirect demonstration of understanding through performance on projects). In this way, design teachers must continually frame and reframe their understanding of the pedagogical problems that they are attempting to address. The uncertainty surrounding pedagogical practices can only be negotiated in light of the certain results of student output and performance.

Situating design learning within an historical context is yet another of the wicked challenges facing design educators and is related to a 'Manage' folk pedagogical practice. Reliance upon historical precedent for understanding the evolution of the industrial design profession is as important to knowledge construction as is the critical questioning of the assumptions generated over time that frame current understandings. The design teacher must often assume the role of information manager who not only delivers knowledge to the student but also aids them in developing tools to scrutinize and either accept or reject it.

5.2.2.2 Design educators utilize a mode of problem-solving that is solution-focused. The use of conjectures to clarify problems is unique to designers. Rather than focusing on clarifying a problem state, designers tend to posit possible solutions and, through reflection upon the results, generate a deeper understanding of the problem. This process of action-reflection-action-reflection (and so on) is iterative and requires a degree of comfort with uncertainty and risk.

The teachers in this study (both case study participants and respondents to the survey) described iterative approaches to teaching in both macro (i.e. semester or program) and micro (individual student and interpersonal) contexts. In a decidedly 'Do' approach, the studio context provides opportunities for teachers to demonstrate alternative solutions to students in real time as they diagnose specific problems, offer alternative solutions, and monitor student progress. Within the lecture classes modeling is more difficult given both course content and often size, yet teachers are able to demonstrate possible solutions to students via visual and verbal examples of real world applications. Teachers also indicated that it is common practice to modify the courses they teach from year to year illustrating how the conjectures of one syllabus reveal opportunities for further improvement based upon the results.

The teacher's clarification of course learning objectives through this iterative process illustrates how a solution-focused strategy supports a 'Know' pedagogical approach by generating assessable outcomes. Many established, canonical standards are conjectures themselves, i.e. the NASAD accreditation requirements for industrial design programs, which assert certain solution states in the form of required competencies. Compliance with these standards situates the educator in a position of authority over the design student and establishes a learning environment where a desired solution state is delivered from the teacher to the student.

Many approaches to course and class design by industrial design teachers reveal 'Think' approaches that are solution-focused. For example, required reflection activities facilitate student consideration of the learning that occurs as well as providing the teacher with immediate feedback for their own reflection upon the effectiveness of teaching strategies. A 'monitor and adjust' approach to teaching is another example of the iterative nature of design educating. Personalizing project themes and topics for students also illustrates a speculative attempt to make course materials more "palatable" for students. Emphasis on in-class discussion and collaboration which are often facilitated by the teacher exhibit a 'Think' approach to both the process of teaching and learning as well as a product, i.e. communication skills as a potential learning objective.

The concept of teacher as consultant/coach indicates a 'Manage' orientation to pedagogical practices wherein the teacher posits a particular role as ideal and then tests its viability through interactions with students in the classroom. Many references were made to the use of historical and present day examples (both visual and verbal) which can be interpreted as efforts to couch student learning within a historical and professional context. In considering these examples as inspiration or triggers for critical discussion (rather than unquestioned exemplars), the teachers reveal a 'Manage' approach to helping students construct their own knowledge via a conjectured approach to learning through questioning and scrutiny. Exploration of multiple perspectives are also aligned with the 'Manage' folk pedagogy and reveal a solution-focused approach to preparing students for real world experiences where they will undoubtedly confront diverse points of view The preference for a one to one relationship between student and teacher also reveals an ideal solution state that situates the teacher in a 'Manage' role.

5.2.2.3 Design educators use a 'constructive' mode of thinking. Design activity is generative. It produces not only new artifacts (in various forms), but also new knowledge and understanding of how to frame and solve problems. This repertoire of pattern languages evolves over time via a cycle of action, analysis, and synthesis. Design teachers also demonstrate a 'constructive' mode of thinking in the mental models they create to guide their pedagogical practices.

Both the propositional knowledge (i.e. foundational principles of design) and the procedural knowledge (i.e. how to apply this knowledge via practice) that constitutes the content of industrial design education have been described herein as a generative activity. Design teachers consider the process of skill 'building' over time when considering course design and agree that continuous practice, or doing, is the key to evolving the hard skill set required of industrial design graduates. Demonstration of these skills by the teacher, a 'Do' approach, is a standardized mechanism for introducing students to the abilities that they are expected to imitate. These skills change over the course of a four year curriculum as do the exhibition styles of the teachers. Early skill building may rely upon teacher demos of drawing and rendering while in later years students may witness their teacher modeling the use of language and critical reasoning during critiques or class discussions.

Curriculum and course designs often employ a sequencing strategy that reveals a 'Know' approach to presenting a predetermined course of progression through knowledge acquisition. The teacher (and program or textbook) are therefore situated as authoritative figures in determining the ordering of student learning. The common practice of lecturing to students is a 'Know' approach to presenting information where successively more complex concepts are moderated by the teacher. The generation of clear learning objectives and rubrics towards which students are expected to aspire is a 'Know' approach to regulating and assessing the accumulation of knowledge and skill.

Design teachers evidenced an iterative approach to class and course design that reveals their own pedagogical praxis, a cycle of action and reflection that is 'Think' in nature. As design teachers assess the results of their teaching efforts and revise their teaching approach in consecutive classes and semesters, they are constructing new knowledge, at once personal, departmental, and professional. Design teachers also rely upon intersubjective interchange in the classroom via discussion and collaborative work as students work collectively to share and create knowledge. The concept of students and teachers learning from each other is a 'Think' approach to participatory learning. The 'Think' use of questioning strategies to get students thinking about their own learning is yet another method for aiding the student in a process of forming personal beliefs that is generative.

The goal of learning in the 'Manage' folk pedagogy is the critical construction of knowledge that will provide the student a skill set for contributing to the cultural store. As design teachers challenge students with progressively more complex problems and contexts of design, they act as consultants to the students who attempt to apply their knowledge and learn from the results. The one to one interaction between teacher and student facilitates the generation of student-specific talents and skills wherein students learn to distinguish their own knowledge and skills from that of others. Additionally, the practice of teachers providing and requesting reasoning and justification for design decisions helps build the students' repertoire of design language (both abstract and concrete).

5.2.2.4 Design educators use 'codes' to translate abstract requirements into concrete object(ives)s. The kinds of codes that designers use in the design process are somewhat different than those employed by design educators, though both use multiple types of codes. While designers may rely upon visual and prototyping languages and established principles (i.e. perspective) for translating the abstract into the concrete, design educators employ a different type of code. Design teachers rely upon both visual codes as well as verbal and metaphorical codes for translating abstract learning requirements into concrete learning objectives.

Similar to designers, design educators demonstrate the use of design principles (i.e. torque or perspective) via visual demonstrations. Concrete examples are in the form of physical demonstrations by the teacher of certain activities (i.e. drawing or rendering) as well as the demonstration of application of principles in finished products. Teacher may rely upon 2D examples to illustrate 3D concepts as well as 3D examples to illustrate 2D concepts. Verbal descriptions also provide a language for describing and teaching the practice of designing. The translation from theory to practice is coded in the presentation of abstract principles (a 'Know' approach) and the application of principles in the doing and making of assigned projects.

Much foundational knowledge in design is theoretical and established in a canon of required knowledge. The presentation of these concepts via textbooks, PowerPoint presentations, and lectures all represent a 'Know' orientation. Abstract concepts are coded in the visual, textual, and verbal descriptions presented by design teachers. Even cognitive practices like problem solving are coded in visual diagrams, verbal descriptions, and textual accounts. Creating rubrics to assess student learning is a 'Know' example of how abstract requirements are translated into concrete, assessable learning objectives that students are expected to comprehend and demonstrate. Curriculum and syllabi are also coded representations used to communicate abstract expectations.

Design teachers offer many examples to their students. These examples often require a level of translation on the part of the student in order to deconstruct the principle or concept that they are meant to illustrate. Images and artifacts are coded vessels that embody the application of abstract principles. The use of such an example and the inclusion of multiple possible examples for the same principle is a 'Think' approach to design teaching. When design teachers use metaphors and stories to illustrate abstract concepts they are also exhibiting a 'Think' approach where abstract lessons are embedded within tangible narratives. The 'Think' approach to discussion and collaboration provides design teachers another coded vehicle for transmitting such theoretical concepts as communication and teamwork.

When the design teacher plays the role of design manager or consultant, the student/teacher relationship becomes a coded interchange that facilitates student understanding of an intangible interaction. This 'Manage' approach allows the design teacher to communicate abstract elements of professional practice to students via concrete questioning, guidance, and discussion. Embedded within critical discussions and targeted questioning approaches are the theoretical understandings that design teachers hope to explicate. Inquiries about the credibility of historically or professionally held knowledge become concrete conversations that elucidate abstract critical reasoning and scrutiny of 'objective' knowledge.

5.2.2.5 Design educators use these codes to 'read' and 'write' in object languages via metaphoric appreciation. Designers rely upon various visual and verbal codes for communicating design solutions. These codes allow the designer to make tangible cognitive artifacts of the design process. Design teachers also exhibit a metaphoric appreciation for reading and writing in object languages though the languages are somewhat different in the academic context.

Probably the most common language that design teachers use is the demonstration, a 'Do' approach to communicating an expectation via performance. In this way the design teacher is able to tell a story about the ethereal conversation between designer and designed through action and often explication of cognitive processes during action. Design teachers also communicate in a language of objects and images which become codified artifacts of their expectations. For example, in showing a finished rendering or portfolio, the teacher uses the language of image to communicate standard (or levels) of success.

The 'Know' approach to clarification of learning objectives and use of rubrics represents another coded language of the design teacher. These performance metrics refer to intangible concepts that must be tangibly generated. For example, the metric "must support 20 lbs of weight" is not itself the objective, rather it is a linguistic construction utilized to translate abstract implications of making and thinking during the design process that must be performed and realized to demonstrate competency.

Much of what is currently considered the canon of knowledge in professional design practice is coded in the language of requirements by accreditation institutions and program curricula. These authoritative linguistic devices represent a language of competency that is assessable via outside observation of activities and artifacts.

Design teachers also rely upon assigned projects as codes for learning objectives. The project itself is not the learning objective, it is the language used to communicate the learning objectives. A drawing or model is not itself a learning objective. Rather the deliverable is a coded representation of skill and mastery. Project languages, i.e. assignments, are often complex languages which contain multiple meanings and interrelated concepts. A single project may be the language with which a teacher communicates numerous learning objectives including cognitive problem -olving capabilities, methods of inquiry, hard skills of drawing and rendering, theoretical concepts like perspective, as well principles of visual communication and possibly teamwork. The student must then decode this language and respond utilizing the appropriate linguistic mechanisms in order to evidence comprehension and mastery.

As described earlier, the use of story represents a 'Think' approach to speaking in a coded language where actual meanings are embedded in narrative accounts. The story of a designer's mistake is not itself the meaning that is meant to be transmitted (i.e. the teacher will not likely test students on the plot of the story), rather it is the lesson from that story that lies beneath its surface that must be translated by the student in order to facilitate understanding of the principles under discussion. Likewise, discussions and intersubjective interchange among students and teachers are coded transactions wherein meaning making occurs. These conversations are not necessarily the object of learning; rather they become a vehicle through which learning about other concepts occurs.

Metaphor is also a mechanism by which design teachers communicate both with students and with themselves. Teachers may use metaphor to demonstrate similarity. For example the concept of biomimicry is a code for exploring how designing can mimic nature. Teachers also rely upon metaphors to conceptualize their own role in the classroom, i.e. as a 'coach' or a 'manager.' These analogous references communicate an understanding a provide a language which the teacher uses to negotiate their own understanding of their teaching objectives and practice.

Aligned with the 'Manage' approach is another metaphoric language of 'teacher as devil's advocate' wherein the teacher performs a role that is meant at once to demonstrate and to facilitate the student's learning. When a teacher asks a question from the devil's advocate perspective, the learning objective is not necessarily that students will imitate the exact performance, but rather that the students will translate the intentions of the performance and critically examine their own performances. The use of use of critical reasoning as a coded language for scrutinizing commonly held beliefs demonstrates a 'Manage' approach to teaching students to question assumptions and reasoning as much as it is about the verbal act of doing so.

This section utilized the language of folk pedagogies to demonstrate how the practices of industrial design educators may be read and interpreted as 'designerly.' Designerly ways of knowing represent a cognitive orientation that is unique to designers and evidenced in their practice. The results of this study therefore reveal that both existing and preferred folk pedagogies in industrial design evidence ways of thinking, teaching, and thinking about teaching that are designerly.

5.2.3 The (Re)Design of Industrial Design Education: Designerly Pedagogic Praxis. The final question posed in this study was "How might understandings of folk pedagogies and designerly ways of teaching inform the (re)design of design education?" The results of this research reveal the potential for pedagogical praxis in industrial design education. That is to say, the identification of incongruence between existing and preferred pedagogical models confirms that there is, in fact, a design problem inherent in design education. Fortunately, this research also points to the possibility that design teachers, as practitioners of designerly ways of knowing, are well poised to address this design problem. The response to this question is, therefore, a call to action.

5.2.3.1 Action research and the (re)design of industrial design education. As described previously praxis is involves the creative, emancipatory efforts of self-determined individuals in pursuit of critical consciousness. Praxis involves iterative cycles of action and reflection. Praxis is, therefore, a process of action research, a social practice that is both individually and collectively undertaken to achieve "historical self-consciousness." Given the bipolar reactions that have characterized the evolution of industrial design practice and education, the response to the above question is more appropriately described as a call to action research by industrial design educators.

Dorst (2008) offered a critique of current understandings of design practice and expressed his belief that the design profession appears to be in a period prior to a scientific revolution through which new paradigms emerge. He offered two new potential paradigms for research in design, one of which involved the study of design practice as it occurs within its professional context. This study introduces a tangential area of inquiry, that of the design educator who has yet to be adequately studied in the professional (academic) context. Dorst calls for more participatory research efforts in order to generate co-created frames for understanding design expertise. I call for more participatory action research by design educators in order to cultivate collective consciousness about folk pedagogical expertise and future practices.

Critics of the current state of industrial design education described an evolving professional discipline for which adequate curricula have not yet been developed. Giard (1990) identified the need to establish a distinct body of knowledge in design with emphasis on the 'whys' of designing over the 'hows.' Friedman (1997) cited a need for more analytical, logical, and problem-solving tools- what he refers to as the intellectual tools of the knowledge economy. Most recently, Van Patter (2009) offered a treatise on the evolution of industrial design practice that situates the designer in a new role as facilitator of social transformation. These criticisms were echoed in the results of this study by teachers and students who identified preferred pedagogical models that support critical, reflective thinking, collaboration, and conversational learning that support the consideration of multiple perspectives.

Unfortunately, these results reveal more questions, such as "Who will redesign industrial design education to adequately prepare future professionals?" and "How will it be done?" In lieu of concluding this document with a solution proposed by one lone researcher, which would likely be reactionary and inherently authoritarian (as it would be authored by only one), I propose instead that the only response to the questions above is: design educators are best equipped to redesign design education and they can do it through participatory action research.

If designing is, as Schön (1983) described, a reflective practice, then the reflections contained in this study offer catalysts for action. Schön framed designing as a reflective research endeavor wherein the practitioner operates in a constant conversation between action (generation of data) and reflection (analysis of that data and conjecture about how to act upon it). He also stated, "...the exchange between research and practice is immediate, and reflection-in-action is its own implementation" (p. 309). Designing is a dialogue between existing and preferred situations and the designer, in this case the design teacher, navigates this discourse with a series of experiments and assessments that generate new knowledge.

Perhaps the redesign of design education is an appropriate topic for a design project framed as action research. Action research is a practical methodology that addresses a socially-situated subject matter. Industrial design education is a social activity and involves many stakeholders including students, teachers, administrators, and professionals. Action research involves equitable and collaborative participation by these stakeholders. Any efforts at reform in design education must necessarily involve the many participants it impacts. Action research projects involve iterative cycles of planning, acting, observing, and reflecting that are systematically documented. Designers, as Cross and Schön have concluded, use designerly ways of knowing that parallel the processes of action research.

Moreover, Kemmis (1993) described educational action research as a process which places control of educational reform in the hands and minds of those who it touches. He offered three types of educational action research which all offer implications for the present study. The first, technical action research, focuses on effectiveness of practice and typically proceeds according to an outside agenda. Practical action research involves improving practitioner's understandings and practice. Emancipatory action research, the third, involves the assumption of collective responsibility for emancipation from restraints imposed by a greater system. Industrial design education would likely benefit from all three.

A technical action research agenda might be proposed by an industrial design program or an accreditation agency like NASAD that could explore the effectiveness of various teaching practices for purposes of developing standards. A practical action research study might be organized by a cohort of educators or a single teacher in an effort to improve teacher understandings of their practice. An emancipatory action research agenda would require the collective engagement of the design education community (including those stakeholders described above as well as many others) in search of a new paradigm of design education pedagogical practice that liberates the current system from its historically bipolar constraints.

The concept of validity is reframed in a constructivist light in participatory action research. Any such study (regardless of scale) would likely be subjected to the following three criteria outlined by Schwandt (1996) and discussed in section 2.9.1: the generation of knowledge via multiple perspectives with the aim of complementing rather than displacing any one part, a practical approach focused on nurturing critical awareness in those involved, and ability to facilitate learning of "human judgment" and/or "the capacity for practical wisdom." These criteria may also be applied to the present study which attempted to collect wisdom from both teacher and students as well the critics and professionals who participate in disciplinary discourse. The purpose of this study was to increase awareness about folk pedagogies and designerly teaching practices for the benefit of those whom are impacted by these perceptions and actions. The results of this study include a framework that is meant to facilitate a pedagogical praxis via iterative, experimental cycles of action and reflection by design educators as they develop practical wisdom about their teaching efforts.

The framework-cum-tool referred to is a simple one that emerged from the results of this study. It is as a generative device that aids in the design of design learning. The patterns of preferred folk pedagogies reveal multiple possible intentions within each of the four folk pedagogical orientations. Because no single folk pedagogy emerged from the data as the most preferred, there are multiple possible combinations for constructing curriculum and lessons through the selection of one method from each folk pedagogy. This tool is offered as a catalyst for participatory action research in industrial design education.

Figure 60. Examples of how the Folk Pedagogies Appear in Industrial Design Education.

5.2.3.2 Action research and folk pedagogies in industrial design education. The figure above illustrates a simple framework with powerful implications for action. While the results of this study indicate that the items above are preferred pedagogical strategies for industrial design education, the results also reveal that these strategies are not always part of the existing paradigm. The figure above is therefore conceptualized as a tool for action, a mechanism that design teachers may utilize in the design of their classes and courses in order to reconsider the learning experience of various topics.

The tool can be used in a variety of ways but is primarily intended to help design teachers experiment with their teaching approaches, to provide new actions upon which to reflect. By selecting one strategy from each folk pedagogy (either purposively or randomly) the teacher can create a new frame for designing their teaching approach. For example, a teacher considering the redesign of an industrial design upper level studio course might randomly select the items ‘industry partnerships’, ‘teacher as authority’, ‘collaboration’, and ‘multiple perspectives’.

Once one item from each folk pedagogy is selected, the proportional prioritization of these items can be modified. One possible prioritization is where pedagogical intentions are focused primarily on industry partnership while collaboration and multiple perspectives are given equal, though lesser, weight. Finally, the role of teacher as authority is minimized to demonstrate the least pedagogical priority.

The next task for the teacher is to configure these strategies in a way that supports the content of the course, a project-centered studio course for advanced industrial design students. The framing of this problem, i.e. the combining of these strategies in a way that satisfies the teacher’s objectives, is a designerly task. It is ill-structured with no certain ‘correct’ response, it requires a conjectured solution course plan which will be constructed by the teacher and therefore generate new knowledge about its effectiveness, and it will likely require the design teacher to utilize a coded language and metaphoric appreciation to develop and implement.

One possible solution to the example offered is the generation of a studio course where projects are determined by an industry partner. Students from various disciplines, i.e. design, business, engineering, etc., collaborate in teams to share their knowledge and expertise from multiple perspectives. The teacher remains the authority in the class, perhaps there are multiple teachers, by operating in the capacity of presenter of content and project manager. This example, though initially randomly conceived, is actually representative of many studio courses in programs throughout the United States.

To understand the multiple possible pedagogical approaches that might be generated from this tool, another brief example is offered. A teacher must provide a lecture course on industrial design history. This teacher randomly selects 'demo of skills', 'clear predetermined objectives', 'discussion and communication', and 'one to one consulting relationship' from the four pedagogies.

These four strategies are then prioritized.

Once the approaches are prioritized the teacher sets out to design a history class in a new way. One possible resulting pedagogical approach would be the establishment of clear learning objectives for the class which include comprehension of major historical movements that shape the evolution of the industrial design profession as well as the ability to interpret and apply this knowledge. An emphasis on discussion might be embodied in the formation of small groups that are assigned the task of identifying an object category from each era and tracing its evolution through history, i.e. a chair or houseware. Each group member would become responsible for researching an era and identifying the major elements which are manifested in the design of the group's object.

The teacher might utilize virtual social media to facilitate discussion among all students in the class who would be expected to post resources as well as critical thoughts about each era and each object. Teacher participation in these online discussions would demonstrate critical reasoning abilities and model for the students the participation and thinking that constitute course objectives. An individual project might require students to design an object according to their critical interpretation of the current era or their group's era. One on one consulting between teacher and student might be undertaken to keep up with student progress and provide feedback about the object design. These objects might then be presented in a final exhibit by the groups along with collectively determined criteria for assessment, which have been discussed and generated online, that become the rubrics with which they critique each other's work.

Again, this is only one possible interpretation of how the above strategies might be enacted in the classroom. The second example would be significantly different than the first example, yet both were generated using the same tool. The two examples offered are meant to illustrate the potential of this folk pedagogical tool to generate new approaches to teaching. These actions must be documented, however, if they are to become the object of reflection, and therefore part of a designerly pedagogic praxis.

Some potential guidelines for the documentation of this practice come from Osterman and Kottkamp (1993) who describe a tool called the case record described in section 2.7.1.5. The case record would provide a record of the development of the course or individual class and has been reframed in the context of the folk pedagogy tool to generate the guidelines provided below. Figure 60 illustrates guidelines for use of the folk pedagogy tool to facilitate double-loop learning by teachers.

designerly pedagogic praxis: case record

THE PROBLEM: IDENTIFY PROBLEM AND SELECT ONE STRATEGY FROM EACH COLUMN
Who is involved?
What is the pertinent background information?
What is your role in the problem?
Which four folk pedagogy strategies did you select?
Were these randomly chosen? Why or why not?

OUTCOME AND/OR OBJECTIVES DESIRED: PLAY WITH DIFFERENT POSSIBLE CONFIGURATIONS OF THE STRATEGIES
What do you hope to accomplish?
How might the four stratgies chosen help you meet these objectives?

ALTERNATIVES CONSIDERED: DEVELOP MULTIPLE APPROACHES USING VARIOUS FOLK PEDAGOGY COMBINATIONS AND PROPORTIONS
What alternatives did you consider to solve the problem?
What methods did you consider for assessing your success?

STRATEGIES IMPLEMENTED: DESIGN AND IMPLEMENT YOUR SOLUTION
What action did you take in an attempt to achieve your objectives?

RESULTS: REVIEW YOUR ORIGINAL OBJECTIVES AND CONSIDER IF THEY WERE MET
Were your objectives achieved? How do you know?
What happened as a result of your actions?

ASSESSMENT: REFLECT UPON YOUR INTENTIONS, YOUR ACTIONS, AND YOUR RESULTS
Did your plan work as intended?
What critical events, decisions, situations influenced the outcome?
How did your folk pedagogy strategies impact the results?
What would you do differently, if anything?

Figure 61. Case record guidelines to facilitate designerly pedagogic praxis.

Use of the above case record and guidelines is meant to stimulate the practice of documentation of pedagogic intentions and practices. This may be done at both macro scales (for an entire program curriculum) as well as micro levels (for a semester-long course or one module or class within a course). This tool may also be used by an individual or be collectively generated by a group of teachers. The essence of this activity is to generate actions and data for reflection.

5.2.3.3 Reflection and designerly ways of teaching in industrial design education. Previous sections have attempted to describe the pedagogical practices of design teachers as 'designerly.' This section will nestle the concept of pedagogic praxis by design educators into the framework of designerly ways of teaching. The two activities that constitute pedagogic praxis are action and reflection. The folk pedagogy tool invites new possibilities for action and reflection.

Strategies for creating reflection opportunities are recommended by Moon (1999). Many of these strategies align with the elements of designerly ways of knowing described by Cross (2006). For example, Moon recommends that tasks to be reflected upon involve 'messy' or ill-structured problems. The development of a program curriculum, course syllabus, or individual module or class all qualify as 'wicked' challenges for which no right solution is possible though one must be attempted. The tool above is meant to facilitate the process of determining possible solutions as well as assess the outcomes.

Moon also indicates that reflection on such tasks should involve asking the 'right' kinds of questions, which are qualified as questions to which there is no 'right' answer. Setting challenges which can be reflected upon is also essential and would involve (according to Cross) conjectures about potential solution states which become fuel for analysis and problem (re)framing. The case record shapes teacher reflections upon their efforts with a series of questions for which no singular correct response is possible. Instead, the questions generate open-ended responses about the relationship between intentions (theories-of-action) and actions (theories-in-use).

Moon also includes the idea that task should challenge the learner (in this case the teacher) to integrate new learning into existing knowledge. This process is akin to the 'constructive' process of thinking indicated by Cross and also described by Schön (1993) as a repertoire of potential moves that the designer continually refers to and builds through reflection-in-action and reflection-on-action. With each attempt to design a class or course utilizing the folk pedagogy tool, new information is generated by the actions of the teacher, the responses by students, and the consequential consideration of the teacher who gains new understandings about what they consider successful or not.

Moon also suggests that tasks for reflection should demand the ordering of thoughts which aligns with the designerly use of 'codes' to translate abstract to concrete and communicate the results. The use of the folk pedagogy tool is already coded by the folk pedagogy theoretical framework, but other codes are generated in the process. When a teacher translates their perceptions about their teaching practice into responses for the case record, these reflections become another coded language for communicating abstract pedagogical intentions into concrete actions and assessable outcomes. Teacher's narrative responses to the case record questions become a storied language of understanding about their own teaching practice.

Finally, Moon prescribes the use of tasks that require evaluation as the subject of any program to promote reflection. Though not explicitly implicated in Cross's theory of designerly ways of knowing, the use of evaluation is inherent in his discussion of solution-focused strategies that involve trial-and-error experimentation by the designer in an effort to move towards a preferred state. Schön also discusses implicit theories

(theories-in-use) that are generated as patterns of practice through daily work over time via reflection.

While it seems that reflection is a theory-in-use within the discipline of industrial design, acknowledged by many as a hallmark of practice, there is little explicit evidence available about the nature of these reflections and their impact upon practice in the domain of industrial design teaching. The lack of documentation about design teacher's folk pedagogies coupled with the design problems facing industrial design education reveal a need for both reflection-in-action and reflection-upon-action. Utilizing a designerly approach to generating both teaching actions and reflections, the folk pedagogy tool emerges as a vehicle for both capturing and catalyzing design teacher's pedagogic efforts and the body of knowledge that they iteratively create.

5.2.3.4 Questions to frame action research in industrial design education. Although the previous sections offered responses to the initial three research questions that framed this inquiry, they also exposed new questions that have yet to be answered. Preferred folk pedagogies do exist for industrial design education and are characterized by the transformation that the profession is experiencing. Design educators exhibit pedagogical practices that may be considered 'designerly.' It is therefore possible that designerly approaches to teaching can be employed in pursuit of preferred pedagogical experiences.

It is possible that such efforts are already underway, however little tangible evidence is available to support this possibility at a collective level. The following questions remain unanswered and serve as potential points of departure for participatory action research efforts by both individual teachers and the greater community of industrial design educators and stakeholders:

- How might design education prepare students for the evolving needs of the profession?
- How might design educators generate a body of knowledge about their pedagogical efforts?
- How might folk pedagogies in industrial design education be transformed?
- How might case records of industrial design teaching contribute to new understanding?
- How might pedagogic praxis empower design educators in the (re)design of design education?

5.3 Conclusions about Research Problem

The research problem that this study aimed to address is the lack of critical understanding of industrial design pedagogy, both existing and preferred. This knowledge is essential in order to ensure that industrial design education will be able to meet the future needs of the profession. While this study did provide new knowledge about folk pedagogies in industrial design and revealed preferred strategies of designerly pedagogy, it does not provide a solution to the problem. This study, instead, provides a frame for considering future research efforts aimed at generating new propositional and procedural knowledge about industrial design education. It also offers a tool that may be employed as a coded language for designing pedagogy and communicating that process.

The research reported herein offers preliminary steps towards the generation of a historical self-consciousness about industrial design pedagogy. This research report is itself a report of action and an object for reflection. The following list describes the contributions that this research study offers to the growing body of knowledge about industrial design education:

- This study generates new knowledge about pedagogical beliefs and preferences by both industrial design students and teachers.
- This study identifies multiple preferred pedagogical strategies by industrial design teachers and students.
- This research applies the theoretical framework of folk pedagogies to empirical data in order to create a coded language for communicating about industrial design pedagogy.
- This research provides new insight into the relationship between industrial design teacher's folk pedagogical beliefs (theories-of-action) and behaviors (theories-in-use).
- This study described the potential for conceptualizing the practice of design educators as designerly ways of teaching.
- This study introduced a tool for designerly pedagogic praxis that may be utilized in future action research efforts within the context of industrial design education.

5.4 Implications for Theory

There is little knowledge yet accumulated about pedagogical practices and beliefs of industrial design educators. Aside from descriptions of pedagogic intent offered in accounts of the establishment and development of the Bauhaus, little empirical evidence is available upon which to base theoretical propositions about industrial design pedagogy. Much research has been conducted to explore the nature of design activity and numerous theories provide vehicles for explaining design practice and even learning, however comparatively little is known about the nature of design teaching and the pedagogical practices of industrial design educators.

This study has generated new understandings about the nature of industrial design teaching utilizing the lens of Bruner's folk pedagogies to code and story the data. The language of folk pedagogy offers a vehicle for communicating about theories-of-action and theories-in-use as discussed and demonstrated by design educators. The four folk pedagogies, 'Do,' 'Know,' 'Think,' and 'Manage,' that were utilized in this study were most commonly preferred and performed in combinations of two or more. These amalgamations indicate the possibility of hybrid pedagogical orientations which include various strategies and proportional prioritizations of each.

Additionally, reflections collected from design teachers (both in the survey and via the case studies) contribute to new interpretations of their intentions and actions as designerly. This concept offers additional empirical evidence in support of the foundational work of Cross and his conjectures regarding designerly ways of knowing. At the same time, the results of this study implicate design teachers in behaviors that are likely as designerly as that of practicing professionals.

5.5 Limitations

This study is situated within a small social context, limited by the small survey sample and two cases from one university. The survey sample size and the number and types of cases constitute limitations in terms of the ability to generalize results to the greater population of industrial design educators. Generalizability was not necessarily the aim of this research, so this limitation is an expected result of the research design. Furthermore, these limitations are the same ones that will be faced by anyone undertaking an action research study of this nature.

The online survey respondent sample may also be limited to those who felt most strongly (for better or worse) about their design learning and teaching experiences.

Additionally, the results of the survey data may be skewed by the type of program or level of the student respondents, i.e. most students were undergraduates. Most survey respondents reporting affiliation with a NASAD-accredited industrial design program so their responses are likely not representative of all possible industrial design programs in the United States.

The two teacher cases were selected according to the criteria described herein. It is possible that the content of their courses or how these courses are situated within the curriculum of the industrial design programs impacted the results in unforeseeable ways. These teachers are not expected to be generalizable analogues of industrial design educators everywhere, rather they offer two unique illustrative examples of how pedagogical beliefs are storied and embodied in the studio and classroom.

5.6 Implications for Further Research

This research study was undertaken to identify a gap between existing and preferred folk pedagogies in industrial design education and to catalyze future research on the topic. This document has suggested a number of questions that might be utilized to frame future action research efforts by educators and other stakeholders in industrial design education. These questions are triggers for pedagogic praxis, meant to inspire educators to enter into a research relationship with themselves (and each other) in order to advance current knowledge about the 'hows' and 'whys' of design education.

Based upon the previous discussion of the folk pedagogy tool and case record, future research efforts could include action research efforts that utilize the tool and share the results. A number of contributions by educators utilizing the tool and reporting their actions and reflection would begin to generate a new kind of knowledge about design teaching. It would be new 'content' of course, new information about design pedagogy and teaching strategies, but it would also represent a new method, a new approach to collective reflexivity through the building of a body of knowledge about design pedagogy from the inside out, by the teachers who are both acting and reflecting upon that action.

The use of the theory of folk pedagogies as a lens for exploring teaching practices of industrial design educators should be extended to other cases. The same observation and interview technique could be used to study teachers in different universities and across other kinds of institutions including non-NASAD-accredited programs. This method could be used to study design educators from tangential disciplines like interior design, visual communication design, and interaction design. Similarities and differences across any of these sample populations may reveal strategies or practices to be shared or removed or hybridized. For this study, an open coding scheme was initially used with most of the data and then the folk pedagogy codes were applied to these open codes. Future research might generate completely new, study-specific open codes and then apply the folk pedagogy codes. The generation of open codes and assignment of the folk pedagogy codes must be negotiated and explicated in future research efforts.

The online survey of folk pedagogy beliefs and preferences could also be administered to a larger sample or a more diverse sample of student levels. A larger sample size would allow for more generalizable results as well as potentially generate new strategies within each column of the folk pedagogy tool. The survey could also be modified in order to generate typologies, i.e. folk pedagogy profiles, for design teachers as an additional tool to aid in pedagogic praxis. This type of instrument would require considerable research and testing for validity and reliability of results.

The results of this study indicate that design teachers exhibit behaviors that may be considered ‘designerly’ according to Cross (2006). These findings are likely no surprise considering the fact that most design teachers were once (or continue to be) design practitioners. These results, however, do not distinguish design teachers from teachers in other disciplines or professions. It is quite possible that teaching itself is 'designerly' and that studies with other teachers (i.e. from art or math or law or science) would reveal similar ways of pedagogic knowing that is unique not only to design teachers but to teachers in general.

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APPENDIX A

ONLINE SURVEY INSTRUMENT

Pedagogy in Design Education

Welcome!

Hello.

My name is Tamara Christensen. I am PhD candidate under the direction of Professor Jacques Giard, PhD in the College of Design at Arizona State University.

I am conducting a research study to explore the pedagogical beliefs and preferences of industrial/product design teachers and students. I am inviting your participation, which will involve completion of this survey and will last between 10 and 20 minutes.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. There are no foreseeable risks or discomforts to your participation.

Your responses will be anonymous. The results of this study may be used in reports,presentations, or publications but your name will not be known. Results will only be shared in the aggregate form.

If you have any questions concerning the research study, please contact the research team at: Jacques.Giard@asu.edu or Tamara.Christensen@asu.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Completion of the survey will be considered your consent to participate.

Sincerely,

Tamara Christensen

To proceed, please select which best describes you.

- ○ student of design (present or past)
- ○ teacher of design (minimum one year as primary instructor of course)

Pedagogy in Design Education

(T) Teacher of Design

Please indicate which of the following best describes your current position.

- ◯ Administrator
- ◯ Professor
- ◯ Associate Professor
- ◯ Assistant Professor
- ◯ Faculty Associate
- ◯ Adjunct Faculty
- ◯ Lecturer
- ◯ Visiting/Guest Lecturer
- ◯ Professional Practitioner
- ◯ Teaching Assistant/Associate
- ◯ Other (please specify)

Please indicate which of the following best describes you.

- ◯ Male
- ◯ Female

Please provide your current age, in years.

Please indicate (in years or months) how long you have been teaching design. Be sure to indicate if the number represents years or months.

Pedagogy in Design Education

From the list below, please indicate which course content or topics that you teach (presently or in the past). Please select all that apply.

- ☐ History of Design
- ☐ General/Fundamental Design Principles
- ☐ Industrial Design Principles
- ☐ Drawing and Rendering
- ☐ Visual Methods of Communication, Visualization, Imaging
- ☐ Computer Rendering & Modelling
- ☐ Human Factors
- ☐ Materials and Manufacture
- ☐ Sustainability
- ☐ Brand and Identity
- ☐ Design Management
- ☐ Professional Practice
- ☐ Internship
- ☐ Shop/Workshop training
- ☐ Applied Design Project (i.e. studio)
- ☐ Methodologies
- ☐ Theory
- ☐ Research
- ☐ Teaching
- ☐ Other (please specify, max 50 chararcters)

From the list below, please indicate the types of courses (i.e. the format of the course) that you teach and have taught. Please select all that apply.

- ☐ Lecture (i.e. emphasis on content delivered by instructor)
- ☐ Seminar (i.e. emphasis on discussion among students)
- ☐ Studio (i.e. emphasis on applied learning, project-centered)
- ☐ Practicum (i.e. emphasis on practical work experience)
- ☐ Online (i.e. predominantly learning via virtual media)

Other (please specify, max 50 characters)

Pedagogy in Design Education

What are the different class sizes you have taught? The choices below represent the number of students enrolled in a particular class. Please select all that apply to the classes you teach and have taught.

- [ ] 1-15
- [ ] 16-30
- [ ] 31-45
- [ ] 46-100
- [ ] 101-200
- [ ] 201-300
- [ ] 300+

Have you ever (please check all that apply):

- [ ] taught an interdisciplinary course?
- [ ] taught a graduate level course?
- [ ] cotaught a course with another instructor?
- [ ] taught a course designed by another educator?
- [ ] modified or revised a course designed by another educator?
- [ ] designed a course 'from scratch'?
- [ ] taken any teacher training courses, workshops, events, etc?

Pedagogy in Design Education

(T) Design Teacher Training & Preparation

Please describe the teacher training or preparation course or workshop that you have taken. You may provide information for up to three courses.

Course #1: Where was it offered and by whom?

Course #1: How long did it last? (i.e. hours/credit hours, days, weeks, semesters?)

Course #1: Was it required? If so, by whom? If not, why did you attend?

Course #1: What did you learn?

Course #1: Would you recommend it to a colleague or new teacher? Why (not)?

Course #2: Where was it offered and by whom?

Course #2: How long did it last? (i.e. hours/credit hours, days, weeks, semesters?)

Course #2: Was it required? If so, by whom? If not, why did you attend?

Course #2: What did you learn?

Course #2: Would you recommend it to a colleague or new teacher? Why (not)?

Course #3: Where was it offered and by whom?

Course #3: How long did it last? (i.e. hours/credit hours, days, weeks, semesters?)

Course #3: Was it required? If so, by whom? If not, why did you attend?

Course #3: What did you learn?

Course #3: Would you recommend it to a colleague or new teacher? Why (not)?

Pedagogy in Design Education

(S) Student of Design

Please indicate which of the following best describes your current position.

- Graduate Student- PhD program
- Graduate Student- Master's program
- Undergraduate Student
- Recent Graduate (past year)
- Professional Practitioner (graduated over one year ago)
- Other (please specify)

Please indicate which of the following best describes you.

- Male
- Female

Please provide your current age, in years.

From the list below, please indicate which course content or topics that you have studied. Please select all that apply.

- History of Design
- General/Fundamental Design Principles
- Industrial Design Principles
- Drawing and Rendering
- Visual Methods of Communication, Visualization, Imaging
- Computer Rendering & Modelling
- Human Factors
- Materials and Manufacture
- Sustainability
- Brand and Identity
- Design Management
- Professional Practice
- Internship
- Shop/Workshop training
- Applied Design Project (i.e. studio)
- Methodologies
- Theory

Pedagogy in Design Education

- [ ] Research
- [ ] Teaching
- [ ] Other (please specify)

From the list below, please indicate the types of courses that you have taken (i.e. the format of the course). Please select all that apply.

- [ ] Lecture (i.e. emphasis on content delivered by instructor)
- [ ] Seminar (i.e. emphasis on discussion among students)
- [ ] Studio (i.e. emphasis on applied learning, project-centered)
- [ ] Practicum (i.e. emphasis on practical work experience)
- [ ] Online (i.e. predominantly learning via virtual media)

Other (please specify)

What are the different class sizes in which you have learned? The choices below represent the number of students enrolled in a particular class. Please select all that apply to the classes you taken.

- [ ] 1-15
- [ ] 16-30
- [ ] 31-45
- [ ] 46-100
- [ ] 101-200
- [ ] 201-300
- [ ] 300+

Pedagogy in Design Education

(T) Design Learning & Practice

Where did/do you receive professional education and training? For each entry, please list school name, country/location, and degree earned (if applicable). Please indicate at least one school.

1.
2.
3.
4.
5.

How many years of professional design experience did/do you have? (This may include work you are presently doing)

In your own words, please describe your area(s) of expertise.

Pedagogy in Design Education

(T) Design Program and Teaching

Which of the following Basic Carnegie Classifications best describes the institution at which you currently teach?

- ◯ Associate's College
- ◯ Doctorate-granting University
- ◯ Master's College or University
- ◯ Baccalaureate College
- ◯ Special Focus Institution
- ◯ Tribal College

Is the design program in which you teach accredited by NASAD (National Association of Schools of Art and Design)?

- ◯ yes
- ◯ no
- ◯ don't know

Of the following programs, which are found in the same college or school as the product or industrial design program/department at your institution? (Please select all that apply)

- ☐ Engineering
- ☐ Architecture
- ☐ Interior Design
- ☐ Graphic Design
- ☐ Fine Arts
- ☐ Applied Arts
- ☐ Other (please specify)

Pedagogy in Design Education

Please indicate your level of agreement with the following statements about your own teaching practice and the department/program in which you teach.

	Strongly Agree	Agree	Neutral/Not sure	Disagree	Strongly Disagree
My department encourages me to develop my teaching practice.	○	○	○	○	○
The program pedagogy was a persuasive factor in my decision to teach here.	○	○	○	○	○
I regularly reflect on my teaching practice.	○	○	○	○	○
I rarely discuss teaching approaches with my colleagues.	○	○	○	○	○
I am free to utilize whichever teaching strategies I prefer.	○	○	○	○	○
The pedagogic goals of the department are unclear.	○	○	○	○	○
I often experiment with different teaching methods.	○	○	○	○	○
The program curriculum contrasts with my own beliefs about teaching.	○	○	○	○	○
I modify the classes I teach from one semester to the next.	○	○	○	○	○
I am not sure where to look for teaching support/resources.	○	○	○	○	○
The pedagogy of the program is similar to my own.	○	○	○	○	○

Pedagogy in Design Education

(S) Design Learning & Practice

Where did/do you receive professional education and training? For each entry, please list school name, country/location, and degree earned (if applicable).

1.
2.
3.
4.
5.

How many years of professional design experience do you have? (if none, please put '0')

In your own words, please describe the area(s) of expertise you (hope to) specialize in.

Pedagogy in Design Education

(T) Ranking

The following is a ranking exercise. For each statement, please RANK the four possible conclusions from 1 (highest) to 4 (lowest). Though you may agree or disagree with the statements, you are asked to consider the options in relation to each other only and rank them accordingly.

Design learning is essentially about...

knowledge acquisition

acquiring personal beliefs

critical management of information

skill acquisition

The primary role of the design teacher is...

information manager

demonstrator

presenter

collaborator

The main task of the design student is to....

construct knowledge

imitate

comprehend

interpret

In order to be successful, a design student must possess the ability to...

contribute to culture

learn

do

think

A design student is most like a(n)...

knower

maker

expert

thinker

A design educator is most like a(n)...

consultant

colleague

authority

craftsperson

Pedagogy in Design Education

(S) Ranking

The following is a ranking exercise. For each statement, please RANK the four possible conclusions from 1 (highest) to 4 (lowest). Though you may agree or disagree with the statements, you are asked to consider the options in relation to each other only and rank them accordingly.

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Pedagogy in Design Education

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contribute to culture

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learn

A design student is most like a(n)...

maker

thinker

expert

knower

A design educator is most like a(n)...

colleague

craftsperson

consultant

authority

Pedagogy in Design Education

(T) Design Education Beliefs

With regards to education in the area of product and industrial design, please indicate your level of agreement with the following statements. There are no right or wrong answers, only your opinions and beliefs.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Design students should be presented with facts and rules of action to remember and apply.	○	○	○	○
Students cannot master skills unless they have seen them demonstrated.	○	○	○	○
Historical knowledge should not be questioned by students.	○	○	○	○
The learners mind is like a blank slate (or vessel) to be filled.	○	○	○	○
Design competence consists primarily of talents, skills, and abilities.	○	○	○	○
Design students should consider evidence and reasons behind beliefs in the design field.	○	○	○	○
Students should be encouraged to question what they are learning.	○	○	○	○
When a student knows facts and theories, knowing how to apply them will necessarily follow.	○	○	○	○
Students should understand both what they think and how they arrive at those beliefs.	○	○	○	○
Problem solving is applied theory.	○	○	○	○
Learners should understand the difference between knowledge held personally and knowledge held collectively by the design community.	○	○	○	○
It is important for design students to be capable of thinking about their thinking.	○	○	○	○
Discussion is an essential element of design education.	○	○	○	○
Design students learn best by imitating teachers who are experts.	○	○	○	○
Reflection is not important in learning to/about design.	○	○	○	○
Collaboration is an essential element of design education.	○	○	○	○
Students must learn to scrutinize commonly held assumptions about design.	○	○	○	○
Knowledge is delivered by the teacher to the student.	○	○	○	○
Apprenticeship is the best way to learn design skills.	○	○	○	○
Teaching is like a performance of how to do things correctly.	○	○	○	○

Pedagogy in Design Education

(S) Design Education Beliefs

With regards to education in the area of product and industrial design, please indicate your level of agreement with the following statements. There are no right or wrong answers, only your opinions and beliefs.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Collaboration is an essential element of design education.	○	○	○	○
When a student knows facts and theories, knowing how to apply them will necessarily follow.	○	○	○	○
Design students learn best by imitating teachers who are experts.	○	○	○	○
Students should understand both what they think and how they arrive at those beliefs.	○	○	○	○
Design students should be presented with facts and rules of action to remember and apply.	○	○	○	○
Learners should understand the difference between knowledge held personally and knowledge held collectively by the design community.	○	○	○	○
The learners mind is like a blank slate (or vessel) to be filled.	○	○	○	○
Teaching is like a performance of how to do things correctly.	○	○	○	○
Historical knowledge should not be questioned by students.	○	○	○	○
Knowledge is delivered by the teacher to the student.	○	○	○	○
It is important for design students to be capable of thinking about their thinking.	○	○	○	○
Design students should consider evidence and reasons behind beliefs in the design field.	○	○	○	○
Students cannot master skills unless they have seen them demonstrated.	○	○	○	○
Problem solving is applied theory.	○	○	○	○
Apprenticeship is the best way to learn design skills.	○	○	○	○
Discussion is an essential element of design education.	○	○	○	○
Design competence consists primarily of talents, skills, and abilities.	○	○	○	○
Students should be encouraged to question what they are learning.	○	○	○	○
Reflection is not important in learning to/about design.	○	○	○	○
Students must learn to scrutinize commonly held assumptions about design.	○	○	○	○

Pedagogy in Design Education

(T) Tips for Teachers

For any of those times when you found yourself thinking "I wish someone would have told me this when I first started teaching...", here is your chance to share insights you have gained from your teaching experiences.
Imagine you have been given the chance to offer new design teachers advice for creating exceptional learning experiences.
In the spaces below, please list your top 10 essential "dos" and "don'ts" of effective design teaching. (maximum of 100 characters per tip)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Pedagogy in Design Education

(S) Tips for Teachers

For all of those times when you found yourself thinking "If I were the teacher, I would...", here is your chance to share some of those ideas.
Imagine you have been given the chance to offer design teachers your advice for creating exceptional learning experiences. (maximum of 100 characters per tip)
In the spaces below, please list your top 10 essential "dos" and "don'ts" of effective design teaching.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Pedagogy in Design Education

Conclusion

Thank you for taking the time to complete this survey. Your responses have been recorded and will contribute to new understandings about teaching and learning in product/industrial design education.

Based upon results of this survey, the researcher will conduct week-long studies with teachers in different programs and institutions across the United States. If you would like to learn more about being a teacher participant, please include your email below and you will be contacted with additional information. Entering your email address does not commit you to any part of the study, it only indicates that you wish to learn more about participation in the second phase of research.

Again, thank you for sharing your time and experiences!

APPENDIX B

SURVEY RECRUITMENT LIST OF SCHOOLS

Academy of Art University
Arizona State University
Art Center College of Design
Art Institute Of Fort Lauderdale
Art Institute of Pittsburgh
Auburn University
Brigham Young University
California College of the Arts
California State Univ - Long Beach
Carnegie-Mellon University
Cleveland Institute of Art
College for Creative Studies
Columbia College Chicago
Columbus College of Art & Design
Cranbrook Academy of Art
Georgia Inst of Technology
Kean University
Kendall College of Art & Design (Ferris State U)
Massachusetts College of Art
Metropolitan State College of Denver
Milwaukee Institute of Art & Design
Montclair State University
North Carolina State Univ
Notre Dame
Ohio State University
Parsons School of Design
Philadelphia University
Pratt University
Purdue University
Rhode Island School of Design
Rochester Institute of Technology
San Francisco State University
San Jose State University
Savannah College of Art & Design
Southern Illinois University
Stanford University, Institute of Design
Syracuse University Art Center
The School of the Art Institute of Chicago
University of Illinois - Urbana-Champaign
University of Bridgeport
University of Cincinnati
University of Illinois-Chicago
University of Kansas
University of Louisiana-Lafayette
University of Michigan
University of the Arts
University of Wisconsin-Stout
Virginia Polytechnic Institute
Wentworth Institute of Technology
Western Michigan University
Western Washington University

APPENDIX C

RECRUITMENT EMAIL FOR ONLINE SURVEY

EMAIL RECRUITMENT SCRIPT

Dear :

My name is Tamara Christensen. I am a PhD candidate under the direction of Dr. Jacques Giard in the College of Design at Arizona State University. I am conducting a research study to explore the pedagogical beliefs of product/industrial design teachers and students.

I am recruiting participants to complete an online survey which will take approximately 10-20 minutes. I am writing to ask you to forward this request to the teachers and students in your product/industrial design department. The survey is available online by following this link:

http://www.surveymonkey.com/s.aspx?sm=Iidj1BO8iRujqmC3YtdnIQ_3d_3d

Participation in this study is voluntary. If you have any questions concerning the research study, please call me at (480) 262.6665.

I thank you for your time and consideration.

Tamara Christensen

APPENDIX D

CODING PROTOCOL FOR 'TEACHER TIPS' DATA FROM ONLINE SURVEY

FP CODES	OPEN CODES	SUBCODES	DESCRIPTIONS
THINK	ASS	PROC	assess the process
DO	ASS	PROD	assess the product
MANAGE	AVASS		avoid assumptions
MANAGE	CF		creative freedom/voice exploration, not imitation, decision making, student as expert
MANAGE	CLOBJ		clear objectives, have them, communicate them
THINK	COLLAB		collaborate
THINK	COLLAB	S	with students, among students
THINK	COLLAB	T	with other teachers
THINK	COMM		communicate
THINK	COMM	S	communicate with students
THINK	COMM	T	communicate with teachers
DO	CRAFT		emphasis on making, artifact
THINK	CRITASS		constructive criticism, temper judgement, fair transp assessment, formative and summative
THINK	EMPATH		have empathy for student condition, try to understand their pov
THINK	ENGAGE		engage the students
KNOW	EXAMP		provide examples to illustrate expectations
MANAGE	EXP	T and S	experiment with teaching, monitor, adjust, adapt to changing needs, explore
THINK	FAIL		allow failure, encourage it, failing=learning, take risks to learn
KNOW	FIRM		firm, management,
THINK	FLEX		be fliexible
	FUN		have fun, make it fun
KNOW	HISTAN		hi standards, accountability, responsibility
	HUM		humour
THINK	INT		intuition, validate it, teach it, trust it
THINK	LFS		learn from students
MANAGE	MANAGE		manage information internal/eternal, critically and contextually
MANAGE	MULTP		mutiple perspectives, guests, multiple types of projects, diverse ways of looking at projects
MANAGE	OL		outside learning, encourage it, facilitiate it
	ORG		be organized, be prepared, forethought
THINK	PASS		passion, excitement
THINK	PB		personal belief, mantra, philosophy
	POS		be positive, champion the student, enjoy the teaching, pos feedback over negative or punitive
DO	PRAC		practice, do industry work, stay fresh
THINK	QUEST		ask questions, ecourage questions
MANAGE	READ		read yourself, encourage them to read, writing too
KNOW	REP		repetition
THINK	RESP		respect for each other, honesty
KNOW	ROLE	AUTH	authoritative,deliverer of content knowledge or theories/principles of procedural knowledge
THINK	ROLE	COLLAB	collaborator, colleague
MANAGE	ROLE	GUIDE	guide, mentor, consultant, facilitator, encourager
KNOW	ROLE	TENFR	teacher not friend
DO	ROLE	DEMO	to demonstrate, model, show them how
KNOW	ROLE	TRAIN	train for world of work, act as boss
MANAGE	RW		real world experience (for the students, for teacher), contextualizing knowledge
THINK	SELF		knowledge of self, reflection, introspection, know thyself
THINK	SFEED		student feedback,
THINK	SLEARNS		students learn from each other
MANAGE	SS		soft skills
THINK	STORY		use story
MANAGE	STUCENT		student-centered, know the students and teach to each student, manage student diversity
DO	TECH		keep up with technology, use technology
THINK	THEORY		theory, theory plus practice
MANAGE	THINK		get them thinking, critically, creatively, analyzing, understanding (managing information), reflection
	TIME		time management
THINK	TLEARN		teacher as learner, don't know everything, co-learning
THINK	TRUST		importance of trust between student and teacher (also resp??)

Added for student coding (not used in teacher tips coding)

	ENV		physical learning space attention and/or accomodation
THINK	COMP		competition, encourage in class and outside competitions
THINK	ONE2ONE		one to one or small group interaction with teacher
THINK	NOFAV		no favorites, no bias (for better or worse)
THINK	AVAIL		be available to students so they can access your thoughts, feedback, etc
	SKILLS		reference to specific hard skills that students should be taught
	NOPERS		keep the personal life out of the classroom/studio
THINK	INSPIRE		inspire and motivate the students (encourage and nurture)

APPENDIX E

OBSERVATION FORMS FROM TEACHER CASE STUDIES

OBSERVATION FORM

participant
date & time

code	what I see and hear	what I think

APPENDIX F

CODING PROTOCOL 1.0 FROM TEACHER CASE STUDY OBSERVATIONS

FP CODES	OPEN CODES	DESCRIPTIONS	SUBCODES	DESCRIPTIONS	SUBCODES	DESCRIPTIONS
MANAGE	CONS	Consulting with students 1:1				
DO	DEMO	Physical demo of task				
THINK	GUIDE	Guiding students through activity				
KNOW	PRES	Presentation of mat'l	I	Image		
KNOW			A	Artifact		
KNOW			SW	Student Work		
KNOW			PW	Personal Work		
KNOW			T	Textbook		
KNOW			VX	Verbal examples		
KNOW	PRINC	Principles, concepts, guidelines	D	Definition/Description/Concept		
KNOW			V	Vocab/Lexicon		
THINK			IT	If/Then		
THINK			PB	Personal Belief		
MANAGE			C	Choice		
MANAGE			R	Reasoning, Justification		
THINK	QUEST	Question	A	Answer taken		
KNOW			T	Teacher answers self		
KNOW			N	No answer taken/given		
			S	from Student		
THINK	CFQ	Calls for Questions				
THINK	STORY	Story, anecdote, narrative	1	1st person		
THINK			2	2nd person		
THINK			3	3rd person		
THINK			P	Poem/Quote		
KNOW	LINK	Circular reference, link	C	Current Class	CE	Class experience
KNOW			P	Past Class	CM	Class Materials
KNOW			F	Future Class		
THINK			LO	Learning Objectives		
MANAGE			IL	Independent Learning ref		
KNOW			RW	Real World exp		
DO	DIR	Direction	D	Do		
THINK			T	Think		
KNOW	REP	Repetition				
THINK	META	Metaphor or simile				
KNOW	TEST	Test given				
MANAGE	GRAT	Gratitude, expressing thanks to students				
MANAGE	CF	Creative freedom				
	ASS	Assignment				
	EVAL	Evaluation or assessment expectations				
	MEDIA	Media	P	Ppt		
			TB	Textbook		
			V	Video		
			B	Board		
	TRANS	Transition				

APPENDIX G

CODING PROTOCOL 2.0 FROM TEACHER CASE STUDY OBSERVATIONS

FP CODES	OPEN CODES (1)	DESCRIPTIONS	SUB CODES (2)	DESCRIPTIONS	SUB CODES (3)	DESCRIPTIONS
	AFFS	Affirmation, encouragement, agreement with student				
	ASS	Assignment				
MANAGE	CF	Creative freedom				
THINK	CFQ	Call for Questions				
MANAGE	CONS	Consulting with students 1:1				
DO	DEMO	Physical demonstration of a task	2O3	2D demonstration of a 3D task/concept		
DO			3O3	3D demonstration of a 3D task/concept		
DO			3O2	3D demonstration of a 2D task/concept		
DO	DIR	Direction, order, instruction	D	Do		
THINK			T	Think		
	EVAL	Evaluation or assessment expectations				
MANAGE	GRAT	Gratitude, expressing thanks to students				
MANAGE	GUIDE	Guiding students through an activity, talking them through it				
KNOW	IDER	Identification of error, correction of mistake				
MANAGE	IDK	Admitting one (teacher) doesn't know the answer				
THINK	LINK	Circular reference, link	C	Current Class	CE	Class experience
THINK			P	Past Class	CM	Class Materials
THINK			F	Future Class		
MANAGE			RW	Real World exp		
	MEDIA	Media	P	Ppt		
			TB	Textbook		
			V	Video		
			B	Board		
			HO	Handout		
THINK	META	Metaphor or simile				
MANAGE	NRA	No Right Answer				
	PRES	Presentation of material	I	Image	SW	Student Work
			A	Artifact	PW	Personal Work
			T	Textbook		
			VX	Verbal examples		
KNOW	PRINC	Principles, concepts, guidelines	D	Definition/Description/Concept		
KNOW			V	Vocab/Lexicon		
THINK			IT	If/Then		
THINK			PB	Personal Belief		
MANAGE			C	Choice, experimentation, trial and error, exploration		
MANAGE			R	Reasoning, Justification		
THINK	QUEST	Question	A	Answer solicited from students		
KNOW			T	Teacher answers self		
KNOW			N	No answer taken/given		
			S	from Student, answered by teacher		
KNOW	REP	Repetition	T	Of something Teacher said		
KNOW			S	Of something Student said		
	RFS	Read From Screen of powerpoint				
THINK	STORY	Story, anecdote, narrative	1	1st person		
THINK			2	2nd person and role playing/hypothetical		
THINK			3	3rd person		
THINK			P	Poem/Quote		
KNOW	SUGG	Suggestion, framed in 2nd person	P	A positive suggestion of something to do/try		
KNOW			N	A negative suggestion of something to avoid		
KNOW	TEST	Test given				
	TRANS	Transition				

APPENDIX H

RESULTS FROM FIRST ROUND OF CODING TEACHER OBSERVATIONS

Observation Coding 1

JA Obs 1			lecture
TEST			KNOW
DIR	D		DO
DIR	D		DO
LINK	CP		
QUEST	A		THINK
QUEST	T		KNOW
PRINC	D		KNOW
TRANS			
MEDIA	P		
ASS			
PRES	SW		KNOW
CF			MANAGE
PRINC	R		MANAGE
QUEST	A		THINK
QUEST	T		KNOW
PRES	SW		KNOW
PRES	T		KNOW
PRES	PW		KNOW
MEDIA	T		
QUEST	N		KNOW
PRINC	D		KNOW
PRES	I		KNOW
PRES	SW		KNOW
PRES	T		KNOW
LINK	C	CM	
QUEST	T		KNOW
QUEST	S		
PRINC	D		KNOW
PRES	I		KNOW
PRINC	R		MANAGE
LINK	RW		KNOW
PRES	I		KNOW
PRES	I		KNOW
QUEST	T		KNOW
PRINC	D		KNOW
LINK	RW		KNOW
QUEST	S		
PRES	T		KNOW
QUEST	T		KNOW
PRINC	D		KNOW
PRES	I		KNOW
PRINC	D		KNOW
LINK	RW		KNOW
PRINC	PB		THINK
DEMO	M		DO
PRINC	IT		THINK
META			THINK
QUEST	S		
STORY	3		THINK
LINK	RW		KNOW
HUM			
QUEST	A		THINK
META			THINK
PRINC	IT		THINK
PRES	I		KNOW
INST	$		
PRINC	PB		THINK
PRINC	R		MANAGE
LINK	RW		KNOW
PRES	T		KNOW
PRINC	PB		THINK
PRES	T		KNOW
LINK	C	CM	
LINK	C	CM	
QUEST	N		KNOW
REP			KNOW
LINK	C	CM	
PRES	SW		KNOW
ASS			
DIR	D		DO

Observation Coding 1
JA Obs 2

			studio
DEMO			DO
DIR	D		DO
ASS			
DIR	D		DO
DIR	D		DO
DIR	D		DO
TRANS			
PRIN	R		MANAGE
DIR	D		DO
GUIDE			THINK
QUEST	A		THINK
DIR	D		DO
REP			KNOW
QUEST	N		KNOW
GUIDE			THINK
QUEST	A		THINK
LINK	RW		KNOW
LINK	RW		KNOW
PRIN	R		MANAGE
DIR	D		DO
PRINC	V		KNOW
QUEST	A		THINK
PRINC	PB		THINK
HUM			
PRINC	PB		THINK
PRINC	IT		THINK
DIR	D		DO
QUEST	A		THINK
GUIDE			THINK
PRINC	PB		THINK
QUEST	A		THINK
STORY	3		THINK
LINK	RW		KNOW
DIR	D		DO
PRINC	V		KNOW
GUIDE			THINK
DIR	D		DO
PRINC	PB		THINK
GUIDE			THINK
DIR	D		DO
GUIDE			THINK
PRINC	V		KNOW
DIR	D		DO
PRINC	IT		THINK
DIR	D		DO
GUIDE			THINK
PRINC	D		DO
PRINC	PB		THINK
META			THINK
DIR	D		DO
GUIDE			THINK
PRINC	PB		THINK
DIR	D		DO
LINK	RW		KNOW
LINK	P	CM	KNOW
PRINC	R		MANAGE
PRIN	C		MANAGE
DIR	D		DO
LINK	RW		KNOW
PRINC	IT		THINK
QUEST	A		THINK
PRINC	PB		THINK
DIR	D		DO
GUIDE			THINK
PRINC	PB		THINK
LINK	RW		KNOW
PRINC	IT		THINK
DIR	D		DO
PRINC	PB		THINK
PRINC	IT		THINK
LINK	RW		KNOW
STORY	1		THINK
PRINC	PB		THINK

DIR	D	DO
GUIDE		THINK
PRINC	PB	THINK
LINK	RW	KNOW
DIR	D	DO
GUIDE		THINK
PRINC	PB	THINK
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
PRINC	PB	THINK
GUIDE		THINK
DIR	D	DO
DIR	D	DO
EVAL		
STORY	3	THINK
MEDIA	B	
ASS		
DIR	D	DO
PRES	SW	KNOW
PRINC	R	MANAGE
PRES	SW	KNOW
PRINC	R	MANAGE
EVAL		
DIR	D	DO
REP		KNOW
PRES	I	KNOW
MEDIA	T	
C4Q		
QUEST	A	THINK
DIR	D	DO
PRINC	C	MANAGE
PRINC	PB	THINK
LINK	RW	KNOW
CONS		MANAGE
PRINC	PB	THINK
DIR	D	DO
PRES	SW	KNOW
PRINC	R	MANAGE
PRES	SW	KNOW
MEDIA	T	
EVAL		
PRINC	PB	THINK
PRINC	C	MANAGE
META		THINK
MEDIA	T	
PRES	SW	KNOW
CONS		MANAGE
PRINC	PB	THINK
PRINC	R	MANAGE
CONS		MANAGE

Observation Coding 1
JA Obs 3 lecture

TEST		KNOW
MEIDA	P	
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
QUEST	A	THINK
PRINC	D	KNOW
REP		KNOW
PRINC	D	KNOW
PRINC	V	KNOW
ASS		
PRINC	PB	THINK
PRES	SW	KNOW
EVAL		
REP		KNOW
LINK	RW	KNOW
PRES	I	KNOW
QUEST	N	KNOW
STORY	3	THINK
DIR	T	KNOW
PRINC	V	KNOW
LINK	OL	
PRES	I	KNOW
PRINC	D	KNOW
PRES	I	KNOW
STORY	1	THINK
PRINC	IT	THINK
PRINC	PB	THINK
PRES	I	KNOW
LINK	RW	KNOW
QUEST	N	KNOW
PRES	I	KNOW
LINK	RW	KNOW
ASS		
PRES	I	KNOW
REP		KNOW
LINK	PCM	KNOW
EVAL		
LINK	LO	THINK
CF		MANAGE
ASS		
PRES	I	KNOW
PRES	I	KNOW
CF		MANAGE
PRES	I	KNOW
CF		MANAGE
PRES	I	KNOW
PRES	I	KNOW
DIR	T	KNOW
ASS		
STORY	2	THINK
QUEST	A	THINK
QUEST	A	THINK
QUEST	N	KNOW
PRINC	PB	THINK
PRES	SW	KNOW
LINK	RW	KNOW
QUEST	N	KNOW
PRINC	D	KNOW
PRINC	V	KNOW

REP		KNOW
MEDIA	T	KNOW
PRES	I	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRES	I	KNOW
PRINC	D	KNOW
STORY	1	THINK
PRES	I	KNOW
PRINC	R	MANAGE
PRES	I	KNOW
LINK	RW	KNOW
STORY	1	THINK
PRES	I	KNOW
STORY	1	THINK
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
QUEST	T	KNOW
MEDIA	T	
PRINC	D	KNOW
PRINC	V	KNOW
PRES	I	KNOW
LINK	RW	KNOW
STORY	3	THINK
PRES	I	KNOW
LINK	RW	KNOW
PRINC	R	MANAGE
QUEST	T	KNOW
PRINC	D	KNOW
PRINC	V	KNOW
PRES	I	KNOW
MEDIA	T	
PRINC	D	KNOW
PRES	I	KNOW
PRES	I	KNOW
MEDIA	T	
QUEST	T	KNOW
PRINC	D	KNOW
PRINC	V	KNOW
STORY	1	THINK
PRES	I	KNOW
LINK	IL	MANAGE
PRES	I	KNOW
LINK	RW	KNOW
QUEST	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	IT	THINK
PRINC	V	KNOW
QUEST	T	KNOW
PRINC	D	KNOW
PRES	I	KNOW
QUEST	T	KNOW
DEMO		DO
QUEST	T	KNOW
MEDIA	T	
DEMO		DO
QUEST	T	KNOW
PRINC	D	KNOW
PRINC	V	KNOW
DEMO		DO
PRES	I	KNOW
LINK	RW	KNOW
REP		KNOW
QUEST	N	KNOW
REP		KNOW
PRES	I	KNOW
PRES	V	KNOW
LINK	RW	KNOW
PRES	I	KNOW
QUEST	S	KNOW
LINK	IL	MANAGE

STORY	2	THINK
STORY	1	THINK
STORY	3	THINK
QUEST	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
REP		KNOW
STORY	1	THINK
PRES	I	KNOW
MGMT		
LINK	RW	KNOW
STORY	1	THINK
QUEST	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
STORY	1	THINK
LINK	RW	KNOW
PRES	V	KNOW
REP		KNOW
LINK	RW	KNOW
STORY	3	THINK
PRES	I	KNOW
REP		KNOW
LINK	RW	KNOW
STORY	3	THINK

Observation Coding 1
JA Obs 4 **studio**

DIR	D	DO
QUEST	A	THINK
LINK	LO	THINK
PRINC	PB	THINK
LINK	PCM	KNOW
DIR	D	DO
QUEST	A	THINK
PRINC	V	KNOW
MEDIA	B	
PRES	I	KNOW
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
PRINC	V	KNOW
QUEST	A	THINK
QUEST	N	KNOW
MEDIA	B	
PRINC	V	KNOW
LINK	IL	MANAGE
LINK	RW	KNOW
REP		KNOW
DIR	D	DO
PRES	A	KNOW
DIR	D	DO
PRINC	IT	THINK
GUIDE		THINK
PRINC	C	MANAGE
MGMT		
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
PRES	A	KNOW
PRINC	V	KNOW
PRINC	V	KNOW
DIR	D	DO
PRINC	V	KNOW
LINK	CCE	KNOW
EVAL		
DIR	D	DO
DEMO		DO
QUEST	A	THINK
PRES	A	KNOW
MEDIA	B	
DEMO		DO
DIR	D	DO
EVAL		
PRINC	C	MANAGE
PRES	A	KNOW
PRINC	V	KNOW
EVAL		
PRINC	D	KNOW
LINK	CCE	KNOW
QUEST	A	THINK
QUEST	A	THINK
PRINC	C	MANAGE
EVAL		
PRES	A	KNOW
EVAL		
LINK	CCE	KNOW
PRINC	C	MANAGE
PRES	A	KNOW
DIR	D	DO
DEMO		DO
MEDIA	B	
PRINC	IT	THINK
PRINC	C	MANAGE
PRES	A	KNOW
QUEST	A	THINK
PRES	A	KNOW
QUEST	A	THINK
PRES	A	KNOW
EVAL		
PRINC	C	MANAGE

PRINC	PB	THINK
LINK	PCM	KNOW
DIR	D	DO
PRINC	C	MANAGE
PRES	A	KNOW
DIR	D	DO
PRINC	C	MANAGE
PRES	A	KNOW
DIR	D	DO
PRINC	C	MANAGE
PRES	A	KNOW
DIR	D	DO
PRINC	V	KNOW
QUEST	A	THINK
PRINC	C	KNOW
DEMO		DO
MEDIA	B	
PRES	A	KNOW
QUEST	A	THINK
QUEST	A	THINK
PRES	A	KNOW
DIR	D	DO
PRINC	D	KNOW
PRINC	IT	THINK
QUEST	A	THINK
MEDIA	B	
DEMO		DO
QUEST	A	THINK
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
PRINC	V	KNOW
EVAL		
DIR	D	DO
QUEST	A	THINK
GUIDE		THINK
QUEST	A	THINK
PRINC	V	KNOW
EVAL		
QUEST	A	THINK
GUIDE		THINK
PRINC	V	KNOW
PRINC	V	KNOW
PRINC	IT	THINK
EVAL		
GUIDE		THINK
QUEST	A	THINK
PRINC	V	KNOW
QUEST	A	THINK
EVAL		
LINK	FCM	KNOW
GUIDE		THINK
QUEST	A	THINK
PRINC	V	KNOW
EVAL		
GUIDE		THINK
QUEST	A	THINK
DIR	D	DO
EVAL		
EVAL		
QUEST	A	THINK
EVAL		
PRINC	C	MANAGE
QUEST	A	THINK
EVAL		
DIR	D	DO
PRINC	C	MANAGE
EVAL		
EVAL		
PRINC	C	MANAGE
EVAL		
PRINC	C	MANAGE
EVAL		
PRES	SW	KNOW
PRINC	C	MANAGE
DIR	D	DO

LINK	RW		KNOW
LINK	IL		MANAGE
DIR	D		DO
DIR	D		DO
EVAL			
DIR	D		DO
REP			KNOW
ASS			
DIR	D		DO
QUEST	S		
DIR	D		DO
PRES	A		KNOW
PRINC	PB		THINK
PRINC	C		MANAGE
QUEST	S		
DIR	D		DO
QUEST	A		THINK
PRES	A		KNOW
EVAL			
META			THINK
DIR	D		DO
PRES	A		KNOW
PRINC	PB		THINK
EVAL			
MEDIA	B		
PRINC	C		MANAGE
PRINC	IT		THINK
PRINC	IT		THINK
PRINC	C		MANAGE
MEDIA	TB		
PRINC	C		MANAGE
LINK	FCM		KNOW
LINK			KNOW
PRINC	IT		THINK
QUEST	T		KNOW
LINK	IL		MANAGE
DIR	D		DO
STORY		3	THINK
LINK	FCM		KNOW
LINK	FCM		KNOW
MEDIA	B		
PRINC	PB		THINK
PRINC	IT		THINK
DIR	D		DO
DIR	D		DO
LINK	PCM		KNOW
LINK	PCM		KNOW
PRINC	V		KNOW
ASS			
MEDIA	B		
PRES	SW		KNOW
STORY		3	THINK
LINK	RW		KNOW
LINK	RW		KNOW
PRINC	IT		THINK
DIR	D		DO
EVAL			
STORY		1	THINK
PRINC	C		MANAGE
ASS			
CFQ			THINK
QUEST	S		
MEDIA	B		
STORY		3	THINK
PRINC	C		MANAGE
CF			
LINK	LO		THINK
STORY		3	THINK
EVAL			
LINK	LO		THINK
DIR	D		DO
CFQ			THINK
DIR	D		DO
QUEST	S		
1TO1			MANAGE

Observation Coding 1
JA Obs 5

		lecture
DIR	D	DO
TEST		KNOW
MEDIA	P	
DIR	D	DO
MGMT		
EVAL		
QUEST	S	
QUEST	S	
QUEST	S	
DIR	D	DO
EVAL		
LINK	FCE	KNOW
DIR	D	DO
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
REP		KNOW
MEDIA	P	
QUEST	A	THINK
QUEST	A	THINK
QUEST	A	THINK
PRINC	R	MANAGE
LINK	RW	KNOW
MEDIA	P	
PRES	I	KNOW
META		THINK
PRES	I	KNOW
META		THINK
PRINC	R	MANAGE
PRINC	V	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINKE	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
META		THINK
TRANS		
PRINC	D	KNOW
PRES	I	KNOW
PRINC	D	KNOW
EVAL		
QUEST	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	R	MANAGE
QUEST	A	THINK
QUEST	T	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRES	I	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	IT	THINK
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
PRES	I	KNOW
PRES	SW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
PRES	I	KNOW
LINK	RW	KNOW
DIR	D	DO
DIR	D	DO

Observation Coding 1

RP Obs 1 **lecture**

STORY	P		THINK
QUEST	A		THINK
DIR	T		THINK
PRINC	PB		THINK
STORY	3		THINK
DIR	T		THINK
LINK	LO		THINK
LINK	CM		KNOW
TRANS			
MEDIA	P		
STORY	P		THINK
LINK	LO		THINK
QUEST	A		THINK
DEMO			DO
STORY	1		THINK
LINK	IL		MANAGE
ASS			
DIR	D		DO
PRES	VX		KNOW
QUEST	A		THINK
STORY	1		THINK
LINK	IL		MANAGE
LINK	P	CE	KNOW
HUM			
PRINC	IT		THINK
QUEST	A		THINK
META			THINK
STORY	3		THINK
QUEST	A		THINK
PRINC	D		KNOW
META			THINK
QUES	S		
REP			KNOW
PRINC	PB		THINK
PRINC	PB		THINK
HUM			
QUEST	A		THINK
STORY	3		THINK
PRINC	IT		THINK
QUEST	A		THINK
STORY	1		THINK
PRINC	PB		THINK
PRINC	IT		THINK
DIR	T		THINK
ASS			
DIR	D		DO
C4Q			
QUEST	S		

Observation Coding 1
RP Obs 2

			lecture
GUIDE			THINK
MEDIA	P		
PRINC	IT		THINK
ASS			
STORY	P		THINK
REP			KNOW
QUEST	A		THINK
PRINC	PB		THINK
HUM			
PRINC	C		MANAGE
STORY	2		THINK
QUEST	S		
STORY	3		THINK
QUEST	N		KNOW
STORY	P		THINK
PRINC	R		MANAGE
QUEST	N		KNOW
DIR	T		THINK
QUEST	N		KNOW
QUEST	S		
PRINC	PB		THINK
STORY	3		THINK
PRINC	R		MANAGE
PRINC	PB		THINK
QUEST	N		KNOW
PRES	D		KNOW
STORY	3		THINK
STORY	1		THINK
QUEST	N		KNOW
HUM			
LINK	C	CE	KNOW
QUEST	N		KNOW
DIR	T		THINK
PRINC	IT		THINK
PRINC	D		KNOW
PRINC	D		KNOW
STORY	3		THINK
PRINC	IT		THINK
DIR	T		THINK
REP			KNOW
MEDIA	B		
PRINC	D		KNOW
QUEST	A		THINK
PRINC	R		MANAGE
PRINC	PB		THINK
QUEST	S		
REP			KNOW
QUEST	N		KNOW
TRANS			
QUEST	S		
GRAT			MANAGE
QUEST	A		THINK
PRINC	R		MANAGE
PRINC	PB		THINK
STORY	2		THINK
PRINC	D		KNOW
STORY	2		THINK
PRINC	R		MANAGE
PRINC	IT		THINK
LINK	C	CM	KNOW
LINK	F	CM	KNOW
PRINC	R		MANAGE
LINK	C	CM	KNOW
PRINC	IT		THINK
STORY	1		THINK
QUEST	N		KNOW
LINK	C	CE	KNOW
PRINC	D		KNOW
DIR	T		THINK
DIR	D		DO
QUEST	S		
QUEST	T		KNOW
LINK	RW		KNOW

STORY	2		THINK
QUEST	N		KNOW
QUEST	N		KNOW
QUEST	N		KNOW
QUEST	N		KNOW
STORY	3		THINK
HUM			
STORY	1		THINK
QUEST	A		THINK
QUEST	A		THINK
PRINC	R		MANAGE
PRINC	PB		THINK
QUEST	S		
DIR	D		DO
QUEST	A		THINK
STORY	1		THINK
DIR	T		THINK
ASS			
DIR	D		DO
DIR	T		THINK
HUM			
MEDIA	P		
STORY	P		THINK
PRINC	PB		THINK
MGMT			
STORY	3		THINK
STORY	2		THINK
QUEST	S		
PRINC	R		MANAGE
STORY	2		THINK
PRINC	D		KNOW
HUM			
PRINC	D		KNOW
LINK	C	CM	KNOW
QUEST	A		THINK
HUM			
LINK	C	CE	KNOW
PRINC	D		KNOW
REP			KNOW
ASS			
DIR	D		DO
LINK	C	CM	KNOW
STORY	1		THINK
DIR	T		THINK
LINK	F		KNOW
DIR	D		DO

Observation Coding 1

RP Obs 3 **lecture**

GUIDE		THINK
MEDIA	P	
LINK	PCE	KNOW
LINK	PCM	KNOW
HUM		
LINK	PCE	KNOW
QUEST	S	
DIR	D	DO
PRINC	R	MANAGE
PRINC	D	KNOW
PRINC	IT	THINK
QUEST	S	
LINK	PCM	KNOW
PRINC	PB	THINK
DIR	T	THINK
STORY	2	THINK
PRINC	IT	THINK
PRINC	PB	THINK
STORY	3	THINK
PRINC	D	KNOW
PRINC	PB	THINK
PRINC	PB	THINK
QUEST	S	
LINK	PCM	KNOW
QUEST	S	
PRINC	PB	THINK
PRNC	IT	
STORY	1	THINK
QUEST	S	
QUEST	S	
REP		KNOW
LINK	PCM	KNOW
QUEST	S	
QUEST	T	KNOW
QUEST	S	
QUEST	T	KNOW
PRINC	PB	THINK
STORY	2	THINK
TRANS		
DIR	D	DO
STORY	P	THINK
REP		KNOW
STORY	3	THINK
QUEST	N	KNOW
MEDIA	P	
PRINC	R	MANAGE
LINK	LO	THINK
META		
PRINC	R	MANAGE
PRINC	IT	THINK
STORY	3	
HUM		THINK
STORY	2	THINK
STORY	1	THINK
QUEST	N	KNOW
STORY	1	THINK
META		
HUM		
PRINC	D	KNOW
PRINC	V	KNOW
DIR	T	THINK
PRINC	V	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
DIR	T	THINK
HUM		
PRINC	V	KNOW
PRINC	D	KNOW
HUM		
STORY	3	THINK
PRES	VX	KNOW
DIR	D	DO
QUEST	S	

QUEST	T		KNOW
PRINC	PB		THINK
STORY	3		THINK
STORY	1		THINK
PRINC	D		KNOW
PRINC	V		KNOW
PRES	VX		KNOW
STORY	1		THINK
QUEST	A		THINK
LINK	IL		MANAGE
PRINC	V		KNOW
PRINC	D		KNOW
STORY	1		THINK
PRINC	V		KNOW
PRINC	D		KNOW
STORY	3		THINK
PRINC	V		KNOW
PRINC	D		KNOW
HUM			
QUEST	N		KNOW
DIR	D		DO
PRINC	V		KNOW
PRINC	D		KNOW
STORY	3		THINK
PRINC	V		KNOW
STORY	1		THINK
STORY	2		THINK
PRINC	D		KNOW
STORY	2	RP	THINK
STORY	2	RP	THINK
PRINC	IT		THINK
PRINC	V		KNOW
PRINC	D		KNOW
PRES	VX		KNOW
PRINC	V		KNOW
PRINC	D		KNOW
MGMT			
HUM			
PRINC	IT		THINK
PRES	VX		KNOW
PRINC	IT		THINK
HUM			
LINK	LO		THINK
PRINC	R		MANAGE
PRES	VX		KNOW
C4Q			THINK
QUEST	S		
QUEST	T		KNOW
MGMT			
HUM			
QUEST	S		
QUEST	T		KNOW
MGMT			
HUM			
QUEST	S		
QUEST	T		KNOW
PRINC	IT		THINK
C4Q			THINK
QUEST	S		
QUEST	T		KNOW

Observation Coding 1
RP Obs 4

		lecture
GUIDE		THINK
CFQ		THINK
QUEST	S	
STORY	P	THINK
QUEST	A	THINK
REP		KNOW
QUEST	A	THINK
QUEST	T	KNOW
META		THINK
PRINC	IT	THINK
PRINC	PB	THINK
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
HUM		
STORY	1	THINK
RFS		
PRINC	D	KNOW
LINK	RW	KNOW
PRINC	IT	THINK
PRES	VX	KNOW
STORY	2	THINK
PRINC	IT	THINK
LINK	RW	KNOW
META		THINK
STORY	2	THINK
PRINC	D	KNOW
LINK	RW	KNOW
PRINC	D	KNOW
STORY	1	THINK
LINK	RW	KNOW
PRINC	D	KNOW
LINK	RW	KNOW
RFS		
PRINC	D	KNOW
LINK	RW	KNOW
QUEST	A	THINK
QUEST	A	THINK
TRANS		
MGMT		
LINK	CCE	KNOW
LINK	CCM	KNOW
LINK	RW	KNOW
PRINC	D	KNOW
QUEST	A	THINK
QUEST	S	
PRINC	D	KNOW
RFS		
STORY	2	THINK
PRES	VX	KNOW
PRINC	IT	THINK
STORY	1	THINK
PRINC	D	KNOW
STORY	2	THINK
PRINC	IT	THINK
PRES	VX	KNOW
LINK	PCE	KNOW
PRINC	D	KNOW
RFS		
PRINC	PB	THINK
PRINC	D	KNOW
QUEST	S	
RFS		
STORY	1	THINK
PRINC	D	KNOW
PRES	VX	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
CFQ		THINK
MEDIA	HO	
STORY	1	THINK
QUEST	S	

TRANS		
PRINC	D	KNOW
QUEST	A	THINK
PRINC	D	KNOW
PRINC	IT	THINK
PRES	VX	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
STORY	1	THINK
PRINC	IT	THINK
PRINC	D	KNOW
PRES	VX	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
PRINC	D	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
DIR	D	DO
QUEST	T	KNOW
PRINC	V	KNOW
DIR	D	DO
DIR	T	THINK
RFS		
QUEST	N	KNOW
STORY	1	THINK
QUEST	N	KNOW
QUEST	T	KNOW
QUEST	A	THINK
PRINC	D	KNOW
PRINC	D	KNOW
PRINC	D	KNOW
LINK	RW	KNOW
PRINC	D	KNOW
QUEST	N	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
QUEST	A	THINK
STORY	2	THINK
QUEST	N	KNOW
QUEST	S	
QUEST	S	
IDK		
HUM		
PRINC	D	KNOW
STORY	2	THINK
PRINC	IT	THINK
RFS		
PRINC	D	KNOW
REP		KNOW
PRINC	D	KNOW
PRINC	D	KNOW
PRINC	IT	THINK
LINK	PCM	KNOW
HUM		
PRINC	IT	THINK
PRINC	D	KNOW
PRINC	D	KNOW
PRES	VX	KNOW
PRINC	D	KNOW
STORY	2	THINK
PRINC	D	KNOW
STORY	2	THINK
LINK	RW	KNOW
PRES	VX	KNOW
CFQ		THINK
QUEST	S	
PRINC	C	MANAGE
STORY	1	THINK
CFQ		THINK
QUEST	S	
PRINC	D	KNOW
DIR	D	DO
GUIDE		THINK
PRINC	R	MANAGE
QUEST	S	
PRINC	IT	THINK

PRES	VX	KNOW
PRINC	IT	THINK
PRINC	R	MANAGE
LINK	RW	KNOW
HUM		
QUEST	S	
DIR	D	DO
PRINC	IT	THINK
PRIC	IT	THINK
PRINC	IT	THINK
PRINC	IT	THINK
STORY	1	THINK
LINK	RW	KNOW
PRES	VX	KNOW
QUEST	S	
STORY	1	THINK
QUEST	S	
CFQ		THINK

Observation Coding 1

RP Obs 5 **lecture**

QUEST	A	THINK
GUIDE		THINK
MGMT		
LINK	FCM	KNOW
MEDIA	P	
QUEST	A	THINK
PRINC	PB	THINK
LINK	FCM	KNOW
LINK	FCM	KNOW
PRINC	C	MANAGE
META		THINK
PRINC	IT	THINK
LINK	RW	KNOW
MGMT		
LINK	FCM	KNOW
ASS		
STORY	3	THINK
STORY	P	THINK
QUEST	A	THINK
STORY	1	THINK
STORY	3	THINK
STORY	P	THINK
REP		KNOW
REP		KNOW
PRINC	D	KNOW
LINK	RW	KNOW
STORY	3	THINK
PRINC	R	MANAGE
PRINC	PB	THINK
PRINC	IT	THINK
LINK	LO	THINK
PRINC	D	KNOW
DIR	D	KNOW
QUEST	A	THINK
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
DIR	D	DO
QUEST	N	KNOW
QUEST	A	THINK
DIR	D	DO
DEMO		DO
LINK	CCE	KNOW
GUIDE		THINK
DIR	D	DO
PRINC	V	KNOW
PRINC	D	KNOW
PRINC	R	MANAGE
STORY	1	THINK
PRINC	D	KNOW
DIR	D	DO
QUEST	N	KNOW
QUEST	N	KNOW
DIR	D	DO
QUEST	N	KNOW
PRINC	R	MANAGE
LINK	LO	THINK
PRINC	D	KNOW
QUEST	N	KNOW
DIR	D	DO
LINK	LO	THINK
PRINC	IT	THINK
QUEST	N	KNOW
DIR	D	DO
DIR	T	THINK
LINK	CCE	KNOW
QUEST	N	KNOW
QUEST	S	
STORY	1	THINK
DIR	D	DO
QUEST	S	
STORY	1	THINK

QUEST	S	
QUEST	S	
PRINC	C	MANAGE
DIR	D	DO
DIR	T	THINK
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	N	KNOW
DIR	T	THINK
QUEST	N	KNOW
STORY	1	THINK
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	S	
QUEST	S	
QUEST	S	
LINK	LO	THINK
MGMT		
PRINC	PB	THINK
PRINC	IT	THINK
PRINC	C	MANAGE
PRINC	PB	THINK
DIR	D	DO
QUEST	N	KNOW
ASS		

APPENDIX I

RESULTS FROM SECOND ROUND OF CODING TEACHER OBSERVATIONS

Observation Coding 2
JA Obs 1

lecture

DIR	D		DO
DIR	D		DO
TEST			KNOW
MEDIA	P		
DIR	D		DO
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
QUEST	A		THINK
PRINC	V		KNOW
PRINC	D		KNOW
QUEST	A		THINK
REP	S		KNOW
TRANS			
MEDIA	P		
RFS			
QUEST	A		THINK

PRINC	R		MANAGE
MEDIA	P		
PRES	I	SW	
PRES	I	PW	
MEDIA	P		
RFS			
QUEST	T		KNOW
MEDIA	P		
PRINC	D		KNOW
MEDIA	TB		
MEDIA	P		
PRES	I		
MEDIA	P		
PRES	I		
MEDIA	P		
PRES	I		
MEDIA	P		
QUEST	T		KNOW
MEDIA	TB		
QUEST	S		
RFS			
MEDIA	P		
RFS			
PRINC	D		KNOW
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
MEDIA	P		
MEDIA	TB		
QUEST	T		KNOW
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
PRINC	D		KNOW
MEDIA	P		
PRES	I		
QUEST	S		
MEDIA	P		
MEDIA	TB		
QUEST	T		KNOW
MEDIA	P		
PRINC	D		KNOW
MEDIA	P		
PRES	I		
DEMO	2O2		DO
MEDIA	P		
LINK	RW		MANAGE
PRES	I		
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
DEMO	3O2		DO
PRES	A		
PRINC	IT		THINK
META			THINK
QUEST	S		

MEDIA	P		
STORY	3		THINK
META			THINK
LINK	RW		MANAGE
MEDIA	P		
HUM			
PRINC	C		MANAGE
PRES	I		
QUEST	A		THINK
MEDIA	P		
STORY	3		
PRINC	C		MANAGE
MEDIA	P		
PRINC	D		KNOW
PRINC	C		MANAGE
MEDIA	P		
PRES	I		
LINK	CCM		THINK
PRINC	PB		THINK
LINK	RW		MANAGE
PRINC	R		MANAGE
PRINC	PB		THINK
PRINC	R		MANAGE
SUGG	N		KNOW
MEDIA	P		
PRES	I		
MEDIA	P		
PRES	I		
MEDIA	P		
PRES	I		
DEMO	2O2		DO
LINK	CCM		THINK
MEDIA	P		
PRES	I		
LINK	CCM		THINK
DEMO	2O2		DO
QUEST	N		KNOW
REP	T		KNOW
LINK	CCM		THINK
MEDIA	P		
PRES	I	SW	
MEDIA	P		
DIR	D		DO

Observation Coding 2
JA Obs 2

		studio
DEMO	2O2	DO
MEDIA	HO	
ASS		
DIR	D	DO
SUGG	P	KNOW
TRANS		
LINK	LO	THINK
LINK	IL	MANAGE
DIR	D	DO
GUIDE		MANAGE
QUEST	A	THINK
REP	S	KNOW
QUEST	A	THINK
AFFS		
QUEST	A	THINK
DIR	D	DO
REP	S	KNOW
AFFS		
SUGG	P	KNOW
QUEST	N	KNOW
DIR	D	DO
REP	S	KNOW
QUEST	A	THINK
GUIDE		MANAGE
GUIDE		MANAGE
AFFS		
LINK	RW	MANAGE
LINK	RW	MANAGE
SUGG	P	KNOW
LINK	PCM	THINK
DIR	D	DO
QUEST	A	THINK
SUGG	P	KNOW
AFFS		
DIR	D	DO
QUEST	A	THINK
GUIDE		MANAGE
QUEST	A	THINK
SUGG	P	KNOW
LINK	RW	MANAGE
DIR	D	DO
QUEST	A	THINK
GUIDE		MANAGE
AFFS		
PRINC	PB	THINK
AFFS		
QUEST	N	KNOW
STORY	3	THINK
LINK	RW	MANAGE
PRINC	IT	THINK
DIR	D	DO
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
GUIDE		MANAGE
REP	S	KNOW
AFFS		
GUIDE		MANAGE
QUEST	A	THINK
PRINC	C	MANAGE
GUIDE		MANAGE

QUEST	A		THINK
PRINC	V		KNOW
GUIDE			MANAGE
QUEST	A		THINK
PRINC	V		KNOW
GUIDE			MANAGE
DIR	D		DO
SUGG	P		KNOW
PRINC	IT		THINK
AFFS			
PRINC	PB		THINK
LINK	RW		MANAGE
PRINC	PB		THINK
IDER			KNOW
PRINC	C		MANAGE
REP	T		KNOW
PRINC	PB		THINK
SUGG	P		KNOW
DIR	D		DO
LINK	RW		MANAGE
IDER			KNOW
PRINC	D		KNOW
SUGG	P		KNOW
LINK	RW		MANAGE
QUEST	A		THINK
AFFS			
SUGG	P		KNOW
AFFS			
PRINC	PB		THINK
LINK	RW		MANAGE
REP	S		KNOW
PRINC	PB		THINK
STORY	1		THINK
LINK	RW		MANAGE
PRINC	PB		THINK
AFFS			
IDER			KNOW
PRINC	PB		THINK
PRINC	PB		THINK
LINK	RW		MANAGE
AFFS			
PRINC	PB		THINK
QUEST	A		THINK
AFFS			
AFFS			
QUEST	A		THINK
DIR	D		DO
ASS			
DIR	D		DO
DIR	D		DO
EVAL			
STORY	3		THINK
HUM			
SUGG	P		KNOW
MEDIA	HO		
PRES	I	SW	
LINK	LO		THINK
PRINC	R		MANAGE
QUEST	S		
DIR	D		DO

REP	T	KNOW
DEMO		DO
MEDIA	TB	
LINK	PCM	THINK
CFQ		THINK
QUEST	A	THINK
DIR	D	DO
CONS		MANAGE
PRINC	C	MANAGE
QUEST	S	
LINK	RW	MANAGE
PRINC	PB	THINK
CONS		MANAGE
DEMO	2O2	DO
CONS		MANAGE
QUEST	S	
AFFS		
SUGG	P	KNOW
PRES	I	
SUGG		
MEDIA	TB	
PRES	I	
EVAL		
CONS		MANAGE
CONS		MANAGE
SUGG	P	KNOW
PRINC	IT	THINK
PRINC	PB	THINK
META		THINK
IDER		KNOW
MEDIA	TB	
PRINC	IT	THINK
CONS		MANAGE
QUEST	S	
LINK	RW	MANAGE
STORY	1	THINK
CONS		MANAGE
CONS		MANAGE

Observation Coding 2
JA Obs 3 **lecture**

MEDIA	P		
DIR	D		DO
TEST			KNOW
QUEST	A		THINK
DIR	D		DO
DIR	D		DO
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
PRINC	V		KNOW
QUEST	A		THINK
REP	S		KNOW
PRINC	D		KNOW
MEDIA	P		
PRINC	D		KNOW
ASS			
MEDIA	P		
STORY	3		THINK
MEDIA	P		
EVAL			
REP	T		KNOW
PRINC	D		KNOW
MEDIA	P		
LINK	RW		MANAGE
PRES	I		
STORY	3		THINK
QUEST	N		KNOW
QUEST	N		KNOW
SUGG	P		KNOW
PRINC	V		KNOW
DIR	T		THINK
MEDIA	P		
QUEST	A		THINK
LINK	IL		MANAGE
PRINC	PB		THINK
PRINC	V		KNOW
MEDIA	P		
PRINC	V		KNOW

STORY	1		THINK
LINK	RW		MANAGE
QUEST	N		KNOW
PRINC	IT		THINK
PRES	IT		THINK
LINK	RW		MANAGE
PRINC	V		KNOW
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
PRINC	V		KNOW
MEDIA	P		
MEDIA	TB		
LINK	CCM		THINK
SUGG	N		KNOW
SUGG	P		KNOW
REP	T		KNOW
LINK	PCM		THINK
SUGG	P		KNOW
PRINC	IT		THINK
SUGG	P		KNOW
SUGG	P		KNOW
LINK	LO		THINK
PRINC	V		KNOW
MEDIA	P		
PRES	I		
META			THINK
MEDIA	P		
PRES	I		
LINK	LO		THINK
PRINC	C		MANAGE
MEDIA	P		
PRES	I		
PRINC	V		KNOW
MEDIA	P		
PRES	I		
PRINC	C		MANAGE
SUGG	N		KNOW
DIR	T		THINK
MEDIA	P		
QUEST	A		THINK
RFS			
AFFS			
QUEST	A		THINK
AFFS			
QUEST	T		KNOW
PRINC	C		MANAGE
MEDIA	P		
PRES	I	SW	
LINK	RW		MANAGE
MEDIA	P		
MEDIA	TB		
RFS			
QUEST	T		KNOW
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	D		KNOW
PRES	I		
REP	T		KNOW
MEDIA	P		
PRES	I		

PRINC	D		KNOW
MEDIA	P		
PRES	I		
MEDIA	P		
PRES	I	PW	
LINK	RW		MANAGE
STORY	1		THINK
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
STORY	1		THINK
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
STORY	1		THINK
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
PRINC	R		MANAGE
MEDIA	P		
PRES	I		
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
QUEST	T		KNOW
MEDIA	P		
MEDIA	T		
PRINC	D		KNOW
PRES	I		
MEDIA	P		
PRES	I		
LINK	RW		MANAGE
PRINC	R		MANAGE
PRINC	V		KNOW
MEDIA	P		
PRES	I		
PRINC	V		KNOW
LINK	RW		MANAGE
PRINC	R		MANAGE
MEDIA	P		
RFS			
PRINC	V		KNOW
RFS			
MEDIA	P		
MEDIA	TB		
PRES	I		

PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRINC	D	KNOW
PRES	I	
MEDIA	P	
MEDIA	TB	
RFS		
QUEST	T	KNOW
PRINC	V	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRINC	D	KNOW
MEDIA	P	
PRES	I	
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
MEDIA	P	
MEDIA	TB	
RFS		
REP	T	KNOW
PRINC	V	KNOW
MEDIA	P	
MEDIA	TB	
PRES	I	
LINK	RW	MANAGE
STORY	1	THINK
MEDIA	P	
PRES	I	
LINK	IL	MANAGE
PRINC	D	KNOW
MEDIA	P	
PRES	I	
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
QUEST	T	KNOW
MEDIA	P	
RFS		
PRES	I	
PRINC	D	KNOW
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
PRINC	IT	THINK
MEDIA	P	
RFS		
PRINC	V	KNOW
QUEST	T	KNOW
MEDIA	P	
PRES	I	
RFS		
PRINC	D	KNOW
PRINC	V	KNOW
MEDIA	P	
PRES	I	
QUEST	T	KNOW

FS		
EMO	303	DO
EDIA	P	
EDIA	TB	
UEST	T	KNOW
RINC	V	KNOW
FS		
EDIA	P	
FS		
RINC	D	KNOW
RINC	V	KNOW
RES	I	
EMO	303	DO
EDIA	P	
FS		
UEST	T	KNOW
RINC	V	KNOW
EDIA	P	
FS		
RINC	D	KNOW
RINC	V	KNOW
RES	I	
EMO	303	DO
EDIA	P	
RINC	D	KNOW
RINC	V	KNOW
EP	T	KNOW
EDIA	P	
RINC	D	KNOW
RINC	V	KNOW
INK	RW	MANAGE
EDIA	P	
RES	I	
RINC	V	KNOW
UEST	N	KNOW
INK	RW	MANAGE
EP	T	KNOW
EDIA	P	
RES	I	
RINC	V	KNOW
EP	T	KNOW
EDIA	P	
RES	I	
INK	RW	MANAGE
RINC	V	KNOW
RINC	D	KNOW
EDIA	P	
INK	RW	MANAGE
RES	I	
EDIA	P	
RES	I	
FS		
INK	RW	MANAGE
UEST	S	
INK	IL	MANAGE
TORY	3	THINK
TORY	1	THINK
INK	RW	MANAGE
EDIA	P	
EDIA	TB	
FS		
UEST	N	KNOW

MEDIA	P	
RFS		
PRES	I	
PRINC	D	KNOW
REP	T	KNOW
MEDIA	P	
PRES	I	
PRINC	D	KNOW
STORY	1	THINK
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
LINK	RW	MANAGE
STORY	1	THINK
STORY	3	THINK
MEDIA	P	
MEDIA	TB	
QUEST	T	KNOW
PRINC	V	KNOW
MEDIA	P	
PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
REP	T	KNOW
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
STORY	1	THINK
MEDIA	P	
PRES	I	
REP	T	KNOW
PRINC	D	KNOW
PRINC	V	KNOW
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
STORY	3	THINK
MEDIA	P	
PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
DIR	D	DO

Observation Coding 2
JA Obs 4 **studio**

DIR	D	DO
DIR	D	DO
QUEST	A	THINK
HUM		
LINK	LO	THINK
LINK	PCM	THINK
EVAL		
DIR	D	DO
QUEST	A	THINK
PRINC	V	KNOW
DEMO	203	DO
DIR	D	DO
QUEST	A	THINK
DIR	D	DO
QUEST	A	THINK
QUEST	T	KNOW
PRINC	V	KNOW
DEMO	203	DO
QUEST	A	THINK
LINK	PCE	THINK
META		THINK
AFFS		
QUEST	A	THINK
REP	T	KNOW
EVAL		
DIR	D	DO
PRES	A	
SUGG	P	KNOW
PRINC	PB	THINK
QUEST	A	THINK
AFFS		THINK
PRINC	D	KNOW
DIR	D	DO
QUEST	A	THINK
PRES	A	
AFFS		
DIR	D	DO
PRES	A	
GUIDE		MANAGE
PRINC	D	KNOW
PRINC	V	KNOW
DIR	D	DO
PRINC	C	MANAGE
AFFS		
DIR	D	DO
QUEST	N	KNOW
DEMO	203	DO
PRES	A	
PRINC	C	MANAGE
DIR	D	DO
PRES	A	
DIR	D	DO
PRINC	V	KNOW
IDER		KNOW
PRINC	C	MANAGE
QUEST	N	KNOW
PRES	A	
LINK	CCE	THINK
QUEST	A	THINK
QUEST	A	THINK

AFFS		
CF		MANAGE
PRINC	D	KNOW
LINK	CCE	THINK
IDER		KNOW
PRES	A	
SUGG	P	KNOW
PRES	A	
DIR	D	DO
DEMO	203	DO
PRINC	C	MANAGE
SUGG	N	KNOW
QUEST	A	THINK
PRES	A	
PRINC	C	MANAGE
SUGG	P	KNOW
PRINC	PB	THINK
PRINC	IT	THINK
DIR	D	DO
PRES	A	
DIR	D	DO
QUEST	A	THINK
AFFS		
SUGG	P	KNOW
DEMO	203	DO
PRINC	D	KNOW
QUEST	A	THINK
QUEST	A	THINK
DIR	D	DO
PRES	A	
PRINC	C	MANAGE
QUEST	A	THINK
DEMO	203	DO
QUEST	A	THINK
DIR	D	DO
DIR	D	DO
QUEST	N	KNOW
QUEST	A	THINK
DIR	D	DO
DIR	D	DO
EVAL		
QUEST	A	THINK
QUEST	A	THINK
AFFS		
PRINC	D	KNOW
QUEST	A	THINK
AFFS		
AFFS		
LINK	RW	MANAGE
SUGG	N	KNOW
SUGG	P	KNOW
QUEST	A	THINK
QUEST	A	THINK
AFFS		
LINK	FCM	THINK
AFFS		
AFFS		
PRINC	D	KNOW
QUEST	A	THINK
DIR	D	DO
AFFS		

PRINC	PB	THINK
SUGG	P	KNOW
QUEST	N	KNOW
AFFS		
DIR	D	DO
AFFS		
PRINC	V	KNOW
IDER		KNOW
AFFS		
PRINC	PB	THINK
IDER		KNOW
PRES	I	
PRINC	PB	THINK
DIR	D	DO
LINK	RW	MANAGE
SUGG	P	KNOW
DIR	D	DO
EVAL		
QUEST	S	
DIR	D	DO
DIR	D	DO
DIR	D	DO
DIR	D	DO
DIR	D	DO
DIR	D	DO
ASS		
DIR	D	DO
PRES	A	
DIR	D	DO
DIR	D	DO
QUEST	S	
DIR	D	DO
PRES	A	
PRINC	PB	THINK
QUEST	S	
DIR	D	DO
PRES	A	
PRINC	C	MANAGE
META		THINK
PRES	A	
DIR	D	DO
PRINC	PB	THINK
SUGG	P	KNOW
EVAL		
DEMO	2O3	DO
PRINC	C	MANAGE
PRINC	IT	THINK
SUGG	P	KNOW
MEDIA	TB	
SUGG	P	KNOW
LINK	FCM	THINK
PRINC	IT	THINK
QUEST	N	KNOW
LINK	IL	MANAGE
SUGG	P	KNOW
LINK	FCM	THINK
DEMO	2O3	DO
PRINC	PB	THINK
SUGG	P	KNOW
DIR	D	DO
DIR	D	DO
PRINC	C	MANAGE
LINK	PC	THINK

PRINC	V	KNOW
MEDIA	B	
DEMO	2O3	DO
SUGG	P	KNOW
SUGG	P	KNOW
PRES	I	
LINK	RW	MANAGE
DIR	D	DO
PRINC	IT	THINK
SUGG	P	KNOW
LINK	LO	THINK
EVAL		
STORY	1	THINK
CFQ		THINK
QUEST	S	
DEMO	2O3	DO
QUEST	S	
DEMO	2O3	DO
SUGG	P	KNOW
SUGG	N	KNOW
PRINC	C	MANAGE
CFQ		THINK
LINK	LO	THINK
EVAL		
LINK	LO	THINK
DIR	D	DO
CFQ		THINK
DIR	D	DO
DIR	D	DO
QUEST	S	
DIR	D	DO

Observation Coding 2
JA Obs 5

		lecture
DIR	D	DO
TEST		KNOW
DIR	D	DO
EVAL		
QUEST	S	
QUEST	S	
QUEST	S	
DIR	D	DO
EVAL		
DIR	D	DO
DIR	D	DO
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
AFFS		
PRINC	D	KNOW
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
PRINC	D	KNOW
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
PRINC	D	KNOW
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
PRINC	D	KNOW
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
PRINC	D	KNOW
QUEST	A	THINK
PRINC	V	KNOW
REP	S	KNOW
PRINC	D	KNOW
AFFS		
TRANS		
MEDIA	P	
RFS		
QUEST	A	THINK
PRINC	C	MANAGE
NRA		MANAGE
QUEST	A	THINK
REP	S	KNOW
QUEST	A	THINK
PRINC	R	MANAGE
LINK	RW	MANAGE
LINK	CCM	THINK
QUEST	N	KNOW
MEDIA	P	
META		THINK
PRES	I	
PRINC	R	MANAGE
MEDIA	P	
META		THINK
PRES	I	
PRINC	R	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
PRINC	V	KNOW
PRINC	D	KNOW
STORY	P	THINK
GRAT		MANAGE
MEDIA	P	
PRES	I	
LINK	RW	MANAGE
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
LINK	RW	MANAGE
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
LINK	RW	MANAGE

PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
META		THINK
PRINC	PB	THINK
MEDIA	P	
MEDIA	TB	
PRINC	D	KNOW
MEDIA	P	
PRES	I	
LINK	FCE	THINK
EVAL		
LINK	LO	THINK
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
PRINC	D	KNOW
PRINC	V	KNOW
REP	T	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
REP	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
REP	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
REP	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
MEDIA	TB	
RFS		
PRES	I	
PRINC	V	KNOW
PRINC	D	KNOW
PRINC	R	MANAGE

MEDIA	P		
QUEST	A		THINK
QUEST	N		KNOW
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I		
QUEST	A		THINK
MEDIA	P		
MEDIA	TB		
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I		
QUEST	N		KNOW
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I		
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I	T	
REP	T		KNOW
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I		
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I	T	
MEDIA	P		
MEDIA	TB		
RFS			
PRINC	V		KNOW
PRINC	D		KNOW
PRES	I	SW	
STORY	3		THINK
PRES	I		
LINK	RW		MANAGE
PRES	I		
PRINC	V		KNOW
LINK	RW		MANAGE
PRES	I		
LINK	RW		MANAGE
MEDIA	P		
MEDIA	TB		
DIR	D		DO

Observation Coding 2

RP Obs 1

		lecture
STORY	P	THINK
QUEST	A	THINK
DIR	T	THINK
PRINC	C	MANAGE
STORY	3	THINK
SUGG	P	KNOW
LINK	CCE	THINK
ASS		
PRINC	PB	THINK
QUEST	S	
QUEST	A	THINK
HUM		
STORY	1	THINK
LINK	LO	THINK
TRANS		
MEDIA	P	
STORY	P	THINK
LINK	LO	THINK
QUEST	A	THINK
PRES	A	
STORY	1	THINK
ASS		
PRES	VX	
QUEST	A	THINK
STORY	1	THINK
LINK	IL	MANAGE
LINK	CCE	THINK
STORY	1	THINK
PRINC	IT	THINK
QUEST	A	THINK
PRINC	D	KNOW
META		THINK
QUEST	A	THINK
QUEST	A	THINK
META		THINK
PRINC	D	KNOW
QUEST	S	
PRINC	PB	THINK
PRINC	PB	THINK
HUM		
QUEST	A	THINK
STORY	3	THINK
PRINC	IT	THINK
QUEST	A	THINK
STORY	1	THINK
PRINC	PB	THINK
PRINC	IT	THINK
DIR	T	THINK
ASS		
CFQ		THINK
QUEST	S	
QUEST	S	
QUEST	S	

Observation Coding 2
RP Obs 2

		lecture
GUIDE		MANAGE
PRINC	IT	THINK
GRAT		MANAGE
LINK	LO	THINK
LINK	CCM	THINK
ASS		
PRINC	IT	THINK
STORY	3	THINK
STORY	P	THINK
REP	T	KNOW
QUEST	A	THINK
AFFS		
MEDIA	P	
PRES	I	
HUM		
PRINC	D	KNOW
NRA		
STORY	2	THINK
SUGG	P	KNOW
QUEST	A	THINK
QUEST	N	KNOW
STORY	3	THINK
DIR	T	THINK
QUEST	N	KNOW
MEDIA	P	
STORY	P	THINK
MEDIA	P	
STORY	3	THINK
PRINC	V	KNOW
PRINC	D	KNOW
QUEST	N	KNOW
DIR	T	THINK
QUEST	N	KNOW
PRINC	V	KNOW
HUM		
QUEST	S	
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
PRINC	C	MANAGE
MEDIA	P	
PRINC	D	KNOW
PRINC	PB	THINK
DIR	T	THINK
QUEST	N	KNOW
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
LINK	CCE	THINK
QUEST	N	KNOW
STORY	3	THINK
LINK	PCE	THINK
DIR	T	THINK
QUEST	N	KNOW
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
PRINC	IT	THINK

MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
MEDIA	P	
STORY	3	THINK
PRINC	V	KNOW
PRINC	D	KNOW
PRINC	IT	THINK
DIR	T	THINK
DIR	D	DO
REP	T	KNOW
QUEST	N	KNOW
MEDIA	B	
PRINC	V	KNOW
QUEST	A	THINK
PRINC	D	KNOW
SUGG	P	KNOW
QUEST	N	KNOW
QUEST	N	KNOW
DIR	D	DO
QUEST	S	
GRAT		MANAGE
QUEST	A	THINK
AFFS		
STORY	2	THINK
PRINC	IT	THINK
PRINC	PB	THINK
LINK	RW	MANAGE
STORY	2	THINK
PRINC	R	MANAGE
SUGG	P	KNOW
PRINC	IT	THINK
LINK	FCE	THINK
LINK	LO	THINK
LINK	CCM	THINK
PRINC	IT	THINK
STORY	3	THINK
DIR	T	THINK
QUEST	N	KNOW
LINK	CCE	THINK
PRINC	D	KNOW
STORY	3	THINK
DIR	T	THINK
DIR	D	DO
QUEST	N	KNOW
QUEST	S	
LINK	RW	MANAGE
QUEST	S	
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	N	KNOW
PRINC	D	KNOW
STORY	1	THINK
QUEST	A	THINK
QUEST	A	THINK
PRINC	PB	THINK
QUEST	S	
QUEST	S	
SUGG	P	KNOW
STORY	1	THINK
CFQ		THINK
STORY	1	THINK
SUGG	P	KNOW
CFQ		THINK
ASS		
DIR	D	DO
DIR	T	THINK

PRINC	R	MANAGE
LINK	CCM	THINK
MEDIA	P	
RFS		
STORY	P	THINK
MEDIA	P	
RFS		
PRINC	PB	THINK
STORY		THINK
MGMT		
STORY	3	THINK
STORY	2	THINK
QUEST	S	
AFFS		
IDER		KNOW
SUGG	P	KNOW
MEDIA	P	
RFS		
QUEST	N	KNOW
MEDIA	P	
RFS		
QUEST	N	KNOW
MEDIA	P	
RFS		
QUEST	N	KNOW
REP	T	KNOW
MEDIA	RFS	
SUGG	P	KNOW
PRINC	D	KNOW
MEDIA	P	
LINK	CCM	THINK
PRINC	D	KNOW
MEDIA	P	
PRINC	D	KNOW
QUEST	A	THINK
AFFS		
QUEST	A	THINK
MEDIA	P	
PRINC	V	KNOW
PRINC	C	MANAGE
REP	T	KNOW
ASS		
DIR	D	DO
LINK	CCM	THINK
PRES	VX	
STORY	1	THINK
DIR	T	THINK
QUEST	S	
DIR	D	DO
DIR	D	DO

Observation Coding 2
RP Obs 3 **lecture**

GUIDE		MANAGE
MEDIA	P	
LINK	PCM	THINK
HUM		
LINK	PCE	THINK
QUEST	S	
DIR	D	DO
PRINC	R	MANAGE
PRINC	PB	THINK
PRINC	D	KNOW
SUGG		KNOW
LINK	LO	THINK
LINK	CCE	THINK
ASS		
QUEST	S	
SUGG		KNOW
PRINC	PB	THINK
DIR	T	THINK
QUEST	N	KNOW
PRINC	IT	THINK
PRINC	D	KNOW
STORY	3	THINK
SUGG	P	KNOW
PRINC	PB	THINK
PRINC	PB	THINK
QUEST	S	
QUEST	S	
ASS		
EVAL		
STORY	1	THINK
NRA		MANAGE
QUEST	S	
QUEST	S	
REP	T	KNOW
QUEST	S	
QUEST	S	
SUGG	P	KNOW
STORY	2	THINK
PRINC	IT	THINK
TRANS		
MEDIA	HO	
DIR	D	DO
STORY	3	THINK
STORY	3	THINK
REP	T	KNOW
QUEST	N	KNOW
MEDIA	P	
RFS		
PRINC	R	MANAGE
MEDIA	P	
PRINC	D	
PRES	VX	
PRINC	IT	THINK
MEDIA	P	
QUEST	N	KNOW
STORY	1	THINK

MEDIA	P	
PRES	I	
STORY	1	THINK
META		THINK
MEDIA	P	
PRINC	V	KNOW
DIR	D	DO
PRINC	V	KNOW
PRINC	D	KNOW
RFS		
DIR	T	THINK
LINK	RW	MANAGE
MEDIA	P	
RFS		
PRINC	D	KNOW
PRINC	V	KNOW
PRES	VX	
DIR	T	THINK
HUM		
LINK	RW	MANAGE
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
STORY	3	THINK
PRES	VX	
LINK	CCE	THINK
LINK	IL	MANAGE
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
RFS		
PRES	VX	
STORY	3	THINK
PRINC	IT	THINK
STORY	2	THINK
MEDIA	P	
RFS		
PRES	VX	
PRINC	D	KNOW
PRINC	V	KNOW
STORY	2	THINK
PRINC	IT	THINK
MEDIA	P	
PRINC	D	KNOW
PRINC	V	KNOW
QUEST	N	KNOW
PRINC	IT	THINK
RFS		
LINK	RW	MANAGE
DIR	D	DO
STORY	2	THINK
MEDIA	P	
PRINC	C	MANAGE
PRINC	D	KNOW
RFS		
LINK	RW	MANAGE
PRINC	IT	THINK
PRES	VX	
STORY	2	THINK
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	C	MANAGE
STORY	2	THINK
PRINC	IT	THINK
PRES	VX	

PRINC	IT	THINK
MEDIA	P	
STORY	2	THINK
PRINC	IT	THINK
LINK	RW	MANAGE
PRES	VX	
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
PRES	VX	
PRINC	IT	THINK
LINK	RW	MANAGE
MEDIA	P	
RFS		
PRINC	V	KNOW
LINK	RW	MANAGE
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
MGMT		
HUM		
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
LINK	RW	MANAGE
PRES	VX	
PRINC	IT	THINK
STORY	2	THINK
MEDIA	P	
RFS		
PRINC	D	KNOW
PRINC	V	KNOW
PRINC	IT	THINK
STORY	2	THINK
LINK	RW	MANAGE
HUM		
PRINC	R	MANAGE
PRINC	C	MANAGE
QUEST	A	THINK
QUEST	S	
MGMT		
PRINC	D	KNOW
HUM		
QUEST	S	
PRINC	D	KNOW
MGMT		
HUM		
QUEST	S	
PRINC	IT	THINK
STORY	1	THINK
CFQ		THINK
QUEST	S	
PRINC	D	KNOW

Observation Coding 2
RP Obs 4 **lecture**

GUIDE		MANAGE
CFQ		THINK
QUEST	S	
PRINC	C	MANAGE
STORY	P	THINK
STORY	3	THINK
REP	T	KNOW
QUEST	A	THINK
QUEST	A	THINK
AFFS		
PRINC	D	KNOW
PRINC	C	MANAGE
PRINC	PB	THINK
LINK	RW	MANAGE
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
PRES	VX	
LINK	RW	MANAGE
STORY	1	THINK
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
PRES	VX	
PRINC	IT	THINK
LINK	RW	MANAGE
PRES	VX	
STORY	3	THINK
PRINC	IT	THINK
HUM		
MEDIA	P	
RFS		
PRINC	V	KNOW
PRINC	D	KNOW
META		THINK
PRES	VX	
LINK	RW	MANAGE
MEDIA	P	
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
STORY	1	THINK
STORY	2	THINK
PRES	VX	
MEDIA	P	
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
PRES	VX	
QUEST	A	THINK
QUEST	A	THINK
MGMT		
HUM		
LINK	CCM	THINK
MEDIA	P	
RFS		
PRINC	D	KNOW
QUEST	A	THINK
QUEST	S	

PRINC	D	KNOW
MEDIA	P	
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
LINK	CCE	THINK
STORY	1	THINK
PRINC	IT	THINK
MEDIA	P	
RFS		
LINK	RW	MANAGE
PRINC	IT	THINK
PRINC	IT	THINK
LINK	RW	MANAGE
STORY	3	THINK
MEDIA	P	
RFS		
PRINC	D	KNOW
PRINC	PB	THINK
MEDIA	P	
RFS		
QUEST	S	
PRINC	D	KNOW
PRES	VX	
LINK	RW	MANAGE
STORY	3	THINK
HUM		
PRES	VX	
MEDIA	P	
RFS		
PRES	VX	
PRINC	D	KNOW
CFQ		THINK
MEDIA	HO	
QUEST	S	
PRINC	D	KNOW
QUEST	S	
STORY	1	THINK
QUEST	S	
MEDIA	P	
PRINC	D	KNOW
PRINC	V	KNOW
PRES	VX	
QUEST	A	THINK
MEDIA	P	
PRINC	IT	THINK
PRES	VX	
PRINC	IT	THINK
MEDIA	P	
PRINC	IT	THINK
STORY	1	THINK
LINK	RW	MANAGE
MEDIA	P	
PRINC	D	KNOW
PRES	VX	
MEDIA	P	
PRINC	D	KNOW
PRES	VX	
MEDIA	P	
PRINC	D	KNOW
PRES	VX	
MEDIA	P	

PRINC	D	KNOW
PRES	VX	
MEDIA	HO	
DIR	D	DO
MEDIA	P	
QUEST	T	KNOW
PRINC	V	KNOW
PRINC	D	KNOW
DIR	D	DO
MEDIA	P	
RFS		
QUEST	N	KNOW
PRES	VX	
STORY	1	THINK
MEDIA	P	
RFS		
QUEST	N	KNOW
MEDIA	P	
RFS		
QUEST	N	KNOW
MEDIA	P	
RFS		
PRINC	D	
QUEST	A	THINK
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
RFS		
PRINC	D	KNOW
LINK	RW	MANAGE
PRINC	R	MANAGE
RFS		
PRINC	D	KNOW
QUEST	N	KNOW
PRES	VX	
MEDIA	P	
RFS		
PRINC	D	KNOW
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	S	
PRINC	IT	THINK
QUEST	S	
PRINC	IT	THINK
IDK		MANAGE
AFFS		
QUEST	S	
HUM		
MEDIA	P	
PRINC	D	KNOW
LINK	RW	MANAGE
STORY	2	THINK
SUGG	P	KNOW
RFS		
PRINC	D	KNOW
REP	T	KNOW
RFS		
PRINC	D	KNOW
RFS		
PRINC	D	KNOW
PRINC	IT	THINK
LINK	PCE	THINK
MEDIA	P	
PRINC	D	KNOW
HUM		
STORY	2	THINK
LINK	RW	MANAGE

RFS		
STORY	2	THINK
RFS		
STORY	2	THINK
RFS		
STORY	2	THINK
HUM		
CFQ		THINK
QUEST	S	
PRINC	IT	THINK
STORY	1	THINK
CFQ		THINK
QUEST	S	
PRINC	D	KNOW
PRINC	IT	THINK
MEDIA	HO	
GUIDE		MANAGE
QUEST	S	
PRINC	IT	THINK
LINK	RW	MANAGE
PRINC	IT	THINK
PRINC	R	MANAGE
SUGG		KNOW
HUM		
QUEST	S	
DIR	D	DO
PRINC	IT	THINK
PRINC	IT	THINK
PRINC	IT	THINK
PRINC	IT	THINK
PRES	VX	
STORY	1	THINK
PRES	VX	
STORY	2	THINK
QUEST	S	
STORY	1	THINK
QUEST	S	
QUEST	A	THINK

Observation Coding 2

RP Obs 5

		lecture
QUEST	A	THINK
GUIDE		MANAGE
MGMT		
PRINC	IT	THINK
TEST		KNOW
MEDIA	P	
QUEST	A	THINK
PRINC	PB	THINK
LINK	FCM	THINK
LINK	FCE	THINK
META		THINK
MGMT		
HUM		
LINK	LO	THINK
ASS		
PRES	VX	
PRES	VX	
QUEST	A	THINK
STORY	1	THINK
STORY	3	THINK
REP	T	KNOW
MEDIA	P	
PRINC	D	KNOW
MEDIA	P	
RFS		
PRINC	D	KNOW
PRINC	PB	THINK
MEDIA	P	
PRINC	R	MANAGE
MEDIA	P	
PRINC	V	KNOW
PRINC	D	KNOW
DIR	D	DO
MEDIA	HO	
QUEST	A	THINK
AFFS		
DIR	D	DO
QUEST	A	THINK
AFFS		
DIR	D	DO
AFFS		
DIR	D	DO
AFFS		
QUEST	N	KNOW
DIR	D	DO
DIR	D	DO
AFFS		
PRES	VX	
DIR	D	DO
AFFS		
AFFS		
PRINC	V	KNOW
PRINC	D	KNOW
PRES	VX	
STORY	1	THINK
PRINC	D	KNOW

DIR	T	THINK
MEDIA	P	
MEDIA	HO	
DIR	D	DO
DIR	T	THINK
QUEST	N	KNOW
LINK	RW	MANAGE
QUEST	N	KNOW
LINK	RW	MANAGE
PRINC	R	MANAGE
PRINC	R	MANAGE
PRINC	C	MANAGE
MEDIA	P	
MEDIA	HO	
QUEST	N	KNOW
DIR	T	THINK
LINK	LO	THINK
PRINC	IT	THINK
MEDIA	HO	
QUEST	N	KNOW
DIR	T	THINK
LINK	CCE	THINK
QUEST	N	KNOW
QUEST	S	
STORY	2	THINK
HUM		
PRINC	PB	THINK
DIR	T	THINK
QUEST	N	KNOW
QUEST	S	
STORY	1	THINK
LINK	CCE	THINK
PRES	VX	
QUEST	N	KNOW
QUEST	S	
QUEST	S	
PRINC	C	MANAGE
DIR	T	THINK
STORY	2	THINK
QUEST	N	KNOW
QUEST	N	KNOW
DIR	T	THINK
QUEST	N	KNOW
PRINC	PB	THINK
STORY	1	THINK
QUEST	N	KNOW
QUEST	N	KNOW
QUEST	S	
PRINC	IT	THINK
QUEST	S	
AFFS		
ASS		
MGMT		
QUEST	N	KNOW
PRINC	PB	THINK
PRINC	IT	THINK
LINK	RW	MANAGE
PRINC	PB	THINK
DIR	D	DO
QUEST	N	KNOW
ASS		
DIR	D	DO

FP CODES	OPEN CODES (1)	DESCRIPTIONS	SUB CODES (2)	DESCRIPTIONS	SUB CODES (3)	DESCRIPTIONS
	AFFS	Affirmation, encouragement, agreement with student				
	ASS	Assignment				
MANAGE	CF	Creative freedom				
THINK	CFQ	Call for Questions				
MANAGE	CONS	Consulting with students 1:1				
DO	DEMO	Physical demonstration of a task	2O3	2D demonstration of a 3D task/concept		
DO			3O3	3D demonstration of a 3D task/concept		
DO			3O2	3D demonstration of a 2D task/concept		
DO	DIR	Direction, order, instruction	D	Do		
THINK			T	Think		
	EVAL	Evaluation or assessment expectations				
MANAGE	GRAT	Gratitude, expressing thanks to students				
MANAGE	GUIDE	Guiding students through an activity, talking them through it				
KNOW	IDER	Identification of error, correction of mistake				
MANAGE	IDK	Admitting one (teacher) doesn't know the answer				
THINK	LINK	Circular reference, link	C	Current Class	CE	Class experience
THINK			P	Past Class	CM	Class Materials
THINK			F	Future Class		
MANAGE			RW	Real World exp		
	MEDIA	Media	P	Ppt		
			TB	Textbook		
			V	Video		
			B	Board		
			HO	Handout		
THINK	META	Metaphor or simile				
MANAGE	NRA	No Right Answer				
	PRES	Presentation of material	I	Image	SW	Student Work
			A	Artifact	PW	Personal Work
			T	Textbook		
			VX	Verbal examples		
KNOW	PRINC	Principles, concepts, guidelines	D	Definition/Description/Concept		
KNOW			V	Vocab/Lexicon		
THINK			IT	If/Then		
THINK			PB	Personal Belief		
MANAGE			C	Choice, experimentation, trial and error, exploration		
MANAGE			R	Reasoning, Justification		
THINK	QUEST	Question	A	Answer solicited from students		
KNOW			T	Teacher answers self		
KNOW			N	No answer taken/given		
			S	from Student, answered by teacher		
KNOW	REP	Repetition	T	Of something Teacher said		
KNOW			S	Of something Student said		
	RFS	Read From Screen of powerpoint				
THINK	STORY	Story, anecdote, narrative	1	1st person		
THINK			2	2nd person and role playing/hypothetical		
THINK			3	3rd person		
THINK			P	Poem/Quote		
KNOW	SUGG	Suggestion, framed in 2nd person	P	A positive suggestion of something to do/try		
KNOW			N	A negative suggestion of something to avoid		
KNOW	TEST	Test given				
	TRANS	Transition				