A theoretical framework of design critiquing in architecture studios

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While critiquing is generally recognized as an essential pedagogical tool in architecture design studios, no systematic attempt has been made to develop a descriptive theory that can account for the complexity of critiquing. Various studies exist that describe the design studio, but many of these provide fragmentary descriptions of critiquing. In this paper, through a review of publications that are concerned with the architecture design studio as well as other areas of design, we identify a basic set of factors that enable us to articulate the variables that affect the practice of critiquing in design studios. Based on these factors, we then propose a conceptual framework that allows studio instructors to systematically plan and examine their critiquing practice.
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The design studio lies at the heart of architectural education. Students devote a tremendous amount of time and academic energy into their studio learning. Many students actually spend most of their time in the design studio, where they work, study, eat, and even sleep (Anthony, 1991; Cuff, 1991). A casual review of any university architecture curriculum will reveal that the studio is the central activity in every architecture student's life.

In most other disciplines throughout the university, lecture classes are the most common mode of teaching and learning. Instructors teach by lecturing, assigning homework, and assessing student performance through tests. The studio is different. Unlike a lecture course, in a design studio, students learn through working on projects, where the students are asked to provide an effective solution to the hypothetical design problem defined by the instructor. Rather than being assessed by tests and homework, students in

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an architecture studio are evaluated through a series of presentations and discussions. Through the processes of working on and presenting their work (often publicly) and receiving feedback from the instructor and classmates, the students reflect on and revise their designs. The instructor—often an experienced architect—provides feedback on student work for the duration of the studio course.

This feedback is called *critiquing*, and it is the predominant way through which architecture students acquire design expertise from their instructors. In light of this, it is remarkable that we lack an in-depth understanding of critiquing in design education. Ochsner (2000) points out:

> There has been surprisingly little examination in depth of design studio as an educational environment. In particular, there seems to be almost complete silence on two questions: (1) the precise nature of the creative process in which students are asked to engage in design studio; and (2) the character of the interaction between students and faculty that would best enhance the students' learning of design. Little is written on how faculty might enhance this interaction or how they might improve the quality of their design studio instruction.

We certainly can find studies about the architecture design studio, and many of these include fragmentary information related to critiquing. We know, for instance, that critiques are an essential pedagogical tool in the design studio, and that critiques are based on the instructor's expertise and professional experiences. However, we also find that theoretically or empirically informed discussions on design pedagogy are uncommon among the instructors of architecture studios.

1 Background

The instructional methods used in the architecture design studio have inherited the historical tradition of the Ecole des Beaux-Arts and its atelier model. Moore argues that instructors in architectural studios have followed ingrained conventions through generations without seriously examining the underlying pedagogy (Moore, 2001). While practicing architects no doubt bring a great deal of experience to the studio, their teaching methods are often based only on their own learning experiences or on intuition (Grasha, 1996). They often cannot articulate what instructional method they are using, or is appropriate, for a specific condition.

While we can continue to rely on the instructor's intuition or implicit understanding of critiquing, we suggest that by providing instructors with a systematic means of examining their own critiquing habits and strategies, we can improve the learning experience in the design studio. Our goal, then, is to develop a framework for describing and understanding critiques that take place in design studio. What do instructors do to convey their design expertise and

knowledge to students? What forms of critiquing are available? When is each form appropriate to use, and what are their advantages and disadvantages? Through this analysis, we can build a foundation for how the instructor might manage critiquing sessions to stimulate student learning. This in turn could strengthen the dialog between the instructor and the students.

We first reviewed the literature related to critiquing in architecture education. We looked through major design journals (*Design Studies*, *Journal of Architectural Education*, and *Journal of Architectural and Planning Research*), several key conferences (the *Architectural Education Exchange*, *Design Thinking Research Symposium*, and *Common Ground Design Research Society International Conference*), a PhD dissertation, *The Digital Design Coach* (Bailey, 2004), and recently published books, such as Dana Cuff's *Architecture: The Story of Practice* (1991), Don Schön's seminal work, *The Design Studio: An exploration of its traditions and potentials* (1985), and Kathryn Anthony's *Design Juries on Trial: The Renaissance of the Design Studio* (1991). We found the literature by searching for the keywords: critiques, critiquing, studio learning, and architecture education and pedagogy.

These published works include experimental data, protocol analyses, analyses and syntheses, criticism, and suggestions or proposals about design studio and critiquing. We believe that this literature review offers a representative, though not necessarily complete, picture of critiquing in current architectural education. Our literature review primarily focuses on the architecture design studio with a few exceptions, which will be indicated in later sections. These articles discuss various topics about design critiquing and studio education: studio teaching and curriculum (Salama, 1995; Wilkin, 2000), design knowledge transferred through critiquing (Uluoglu, 2000), teaching styles and roles (Attoe & Mugerauer, 1991; Dutton, 1987), formal reviews (Anthony, 1991; Dinham, 1986), and other general topics and issues (Argyris, 1981, pp. 551−660; Boyer & Mitgang, 1996; Cuff, 1991; Dannels, Gaffney, & Martin, 2008; Koch et al., 2002). However, each focuses on a specific topic or topics but does not attempt a systematic framework for design critiquing. Two interesting exceptions are Goldschmidt, Hochman, and Dafni (2010) and Schön (1985).

Schön (1985) provides the best portrayal of design critiquing to date. In *The Design Studio*, he attempts to describe what design knowledge is conveyed and what a studio teacher does in a desk-crit using the concept of 'repertoire,' that is, a collection of images, ideas, examples, and actions. As professionals, designers build up repertoires from their experience. When a studio teacher reviews student designs, the teacher scans their repertoire for similar situations, for example, a known building, or previously encountered problems. The teacher then shares knowledge drawn from his or her repertoire. The teacher seldom merely points out errors; he or she also describes examples or references

to similar situations from personal design experiences and demonstrates how to solve the design problems. Feedback helps students understand their problems, eliminate errors from their proposed solutions, and eventually construct their own repertoire. Although Schön's description seems reasonable and plausible, it does not provide a sufficiently detailed account of critiquing in design.

Through empirical experiments, Goldschmidt et al. (2010) attempt to explain one-on-one critiquing activities, specifically, teacher critiquing activities such as how they manage critiquing sessions, and how they respond to students based on their teaching profiles (we discuss these profiles in Section 2.2).[1]

We analyzed and synthesized a range of observations and findings about critiquing with the aim of developing a descriptive framework of the pedagogy of critiquing. The next section presents ten key factors, which we have identified. Based on these factors, in Section 3 we develop a framework of critiquing which the instructor can use for planning as well as self-reflection. We discuss how to plan studio courses by suggesting critiquing strategies. We introduce the concept of 'rhetorical situation' to look at critiquing factors from the studio teacher's view. Finally, we identify a process model for individual critiquing activity.

2 Fundamental factors of design critiquing

We identify eleven fundamental factors of design critiquing that are identified through the literature review. We then divide these factors into two groups: 'methods' and 'conditions' (Table 1). We define methods as the various ways that studio teachers use to convey their design knowledge and skills to their students. The five factors of methods are critiquing settings, teacher—student relationships, communication modalities, delivery types, and delivery. We also define conditions as the contexts in which critiquing occurs. Studio teachers consider these conditions when selecting a particular critiquing method or composing a set of critiquing methods. The six factors of conditions: are design phases, individual differences, knowledge/experiences, student response types, design artifacts, and learning goals. This section describes each of these factors.

2.1 Critiquing settings

Design education researchers refer to several types or settings of critiques that an instructor uses to interact with students. (We shall call them 'settings' to

Table 1 Fundamental factors of design critiquing: methods and conditions.

	Factors
Methods	Critiquing settings, teacher—student relationship, communication modalities, delivery types, delivery
Conditions	Design phases, individual differences, knowledge/experiences, student response types, design artifacts, learning goals

distinguish them from the term 'delivery type'.) Bailey (2004) provides the most comprehensive list: desk crit, group crit, interim review, final review, and informal interaction. These derive from his analysis of the history of architecture education as well as his interpretation of Schön's observations (Schön, 1985). The rest of this section explains these five critique settings and discusses three perspectives from which to examine them.

2.1.1 Desk crit(iques)

A desk crit is an individual critiquing session involving an instructor and a single student that is often held at the student's desk. Desk crits take place throughout the entire period (typically 12−16 weeks) of a studio course. Several researchers emphasize the value of desk crits in design studios. Goldschmidt (2002, pp. 430−437), Koch et al. (2002), and Schön (1985) all consider desk-crits to be an essential component of studio teaching. Koch et al. (2002) argue that desk crits are the most effective way for an instructor to monitor each student's progress over time. Uluoglu (2000) notes that the desk crit enables an instructor to lead individual students to see their design problems from the instructor's viewpoint. Goldschmidt (2002, pp. 430−437) found that desk crits transfer a wide range of critical design knowledge.

2.1.2 Group crit

Group crits engage a small group of four to six students. The instructor may schedule group crits frequently, as often as once a week. Students put work on the wall or gather around each student's desk with the instructor, where the instructor and students discuss each student's presented work. Group crits provide students the opportunity to see each student's approach to solving the same design problem.

Several studies point out the merits of group crits. For instance, Farivarsadri (2001) argues that group crits are especially appropriate for introductory design studios. They are valuable for students with little design experience because they expose students to multiple solutions to the same problem. Compared to larger reviews groups, crits tend to engage new students who may lack confidence to speak in a larger and more public session. Students can participate more actively in the discussion because of the smaller group size and informal setting.

2.1.3 Interim review

Interim reviews involve the entire class at key milestones during a studio project. Instructors hold interim reviews when they think all students can benefit from sharing their progress and knowledge with others in the class, or when the instructor sees many students encountering similar problems or opportunities in their designs. The first interim review often occurs after students have performed an analysis of the building site. Students share their analyses of site and data such as historical background, urban conditions, neighborhood character, or environmental issues. Another common time for an interim

review is as students prepare for their final review at the end of the studio course. Each student presents his solution to a small jury group composed of other studio instructors, professional architects, and sometimes even clients. This serves as a rehearsal for the final review. During interim reviews, while one student's work is critiqued, other students listen to the comments made by the instructor and external reviewers and often provide their own comments.

2.1.4 Formal (final) review

The final review has the character of ceremony or ritual in the design studio, and some students dress up in formal or special attire. It is held at the end of the course and external critics are often invited. The 'jury' of critics typically consists of three to five local architects, the instructors from other studios at the same school, other non-studio faculty members (i.e., a structural engineer or an architecture historian), or representatives of the client if there is one.

At the formal final review, students usually prepare a large panel where they arrange the key drawings that describe their designs. Students present their drawings and physical models as the jury moves from one student to the next, commenting on each work publicly. Jurors are sometimes asked to fill out an evaluation form for each student, which is later given to the student along with the studio instructor's assessment of his or her performance over the entire studio course.

Researchers note several goals for a final review. For example, Dinham (1986) suggests three purposes:

(1) The jury can directly teach individual students by discussing and evaluating their designs.
(2) The final review is a tool for teaching all students in the studio together. As the jury comments on an individual student's work, they often broaden the scope of discussion from an issue found in one student's work to a common issue—leading other students to learn from their classmates' work.
(3) A jury composed of professional architects who continually engage in professional dialog provides students the opportunity to hear challenging and inspiring conversation, observe professional skills, and perhaps acquire some of their expertise. Students can learn the prevailing culture of architectural practice and professional experience. They can practice analyzing and evaluating the presented projects while referencing their expertise or experiences and observe how to conduct a professional presentation.

Despite its value, the formal review is often surrounded by what Argyris (1981, pp. 551−660) calls the 'mystery/mastery syndrome.' The term mystery/mastery refers to the tendency of critics to use sophisticated words that convey

an aura of mystery in order to display their mastery of architectural expertise. This tendency can confuse students and make it more difficult for them to understand professional discussions and comments. Another criticism of formal reviews is that the conversation can intimidate students. Formal reviews with juries are characterized by their open and public nature (Anthony, 1991). Juries may give serious and harsh criticism to students in front of the class. Interaction between jury and students may become hostile or adversarial (Groat & Ahrentzen, 1996).

2.1.5 Informal interaction

Design studios are organized to foster informal discussion among students. In an open studio space, students naturally monitor each other's progress, comment informally on each other's work, compare design approaches, or learn certain skills such as drawing and modeling (Cuff, 1991). It is not unusual for students to benefit from overhearing other students' desk crits.

Cuff (1991) also reports that students are likely to form close learning groups after working together for long hours in a common studio space. Students benefit significantly from interacting with their peers as they share interests and problems (Schön, 1985).

We have listed five critique settings. As shown in Figure 1, we can discuss these settings from three perspectives: (1) number of students, (2) public/private, and (3) informal/formal. First, we can characterize a critiquing setting by the number of participants. In general, the instructor can expect more active participation from smaller groups of students. Second, a critiquing setting can be identified on a continuum between private and public. Desk crits are private, although in an open studio environment, students can easily hear another student's critique. The larger the group, the more public the critiquing session becomes. External judges and reviewers make this critiquing session highly public. Finally, a critiquing setting can be characterized by its formality. Informal critiquing sessions tend to be more constructive, and formal critiquing sessions more evaluative. Some students may be reluctant to voice their opinions in more public or formal sessions. Compared to group crits, interim reviews are deliberately more formal, and less peer participation is expected.
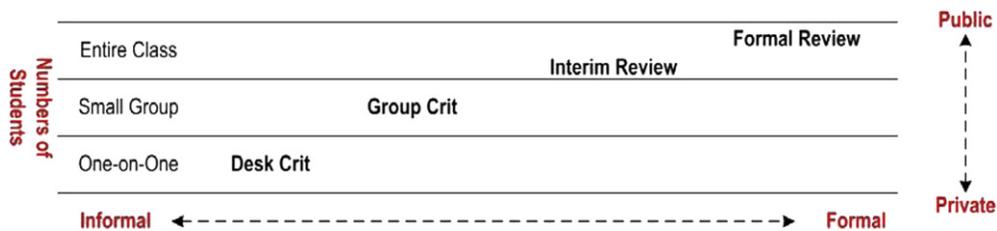

Figure 1 Three perspectives of critiquing settings: (1) numbers of students; (2) public–private; and (3) informal–formal.

Interim reviews are, in turn, less formal than a final review. The same jury members who attend an interim review may also attend the final review, but during an interim review their critiquing tends to be more constructive than evaluative (Anthony, 1991; Bailey, 2004). Highly regarded architects are often invited to the final review—adding to the formality. In addition, the final review often attracts a large audience of interested students and local architects who were not involved in the design project being presented.

2.2 Teacher–student relationships

In design studios, students learn from instructor and peer comments. Several researchers note that the relationship between the studio instructor and students may influence student learning. They identify three types of relationships and report on the merits and disadvantages of each. These relationships are: master and apprentice, user and designer, and peer critiquing.

2.2.1 Master and apprentice

The most common model for the relationship between an instructor and a student in a design studio is the master and apprentice. The instructor plays the role of the master and the student plays the role of apprentice.[2] The premise of this model is that the instructor (the master)—often a professional architect—holds the knowledge and experience to solve all the design problems on which the student will work. Thus, the instructor can provide helpful feedback as the student develops solutions for design problems.

Some researchers raise concerns about students feeling disoriented in their learning when their teachers act as a master. In the master model, the instructor has power to control the student's work, so that it is easy for students to follow the instructor's direction without considering how they want to develop, or without fully understanding what the instructor's feedback means. A student might follow the master's critiques blindly without integrating the master's feedback into his or her own thinking. For example, a student might just follow the approach demonstrated by the master without reflecting on or understanding the suggestions. Dutton (1991), Koch, Schwennsen et al. (2002) and Odgers (2001) note that an overpowering master's feedback might impede the apprentice's learning and critical thinking. Likewise, Grasha (1996) argues that the instructor who is frequently overbearing while displaying his expertise can intimidate students.

Several researchers propose alternative strategies to studio teaching. For example, Dutton (1991) recommends avoiding desk crits and conducting peer review sessions instead because the overpowering authority of the instructor discourages students in a desk crit from participating freely in debate, asking questions, and reflecting on their own designs (Odgers, 2001). To empower students, Odgers (2001) proposes replacing individual critiquing sessions with asynchronous communication between students and the instructor using

a design journal. Students would be asked to record their design rationales and sketches and to describe their difficulties. Odgers argues that the journal would encourage students to participate in later public review sessions, such as interim and final reviews.

2.2.2 User and designer

Some instructors employ a user—designer relationship (Dutton, 1991). In this relationship, the instructor refrains from judging student work—offering neither positive nor negative evaluations. Instead, the instructor acts to represent a user or a group of users and comments on the design from the perspective of a user. Although it is impossible to eliminate the instructor's role as an expert, the user—designer approach provides a less intimidating, more constructive learning environment.

2.2.3 Peer critiquing

Peer critiquing may occur either in informal discussions or in group crits. Students discuss personal experiences and viewpoints with their peers who are engaged in solving the same design problem. Although peer-critiquing sessions do not involve the instructor, he can play a role by providing students with the opportunity to critique each other's work and by demonstrating how to critique appropriately. Several researchers detail the merits of the peer-to-peer critique (Bailey, 2004). Looking at their peer's work exposes students to alternative approaches to the same design project. Peer critiquing also enables students to participate more actively in debates or discussions. Students learn to formulate a critique and to take responsibility for what they learn. In addition, peer critiquing supports collaborative learning and encourages students to value peers opinions.

Actual interpersonal relationships between an instructor and her students are often more complex than the three forms described here. In Sections 2.4 and 2.5, we will discuss how subtle linguistic choices and the manner of a critique delivery can influence the instructor—student relationship.

2.3 Communication modalities

Critiquing in design studios involves a wide range of communication modalities including speech, written comment, drawing, and gesture.

2.3.1 Speech

Speech is the primary communication modality used in all critiquing settings. For example, in the desk crit that Schön described in his book (Schön, 1985), the instructor (Quist) shows how to resolve the difficulties the student (Petra) faces, or indicate what is promising or problematic in her design. Anthony (1991) notes that speech is often accompanied by other modalities, such as drawing, because the instructor can deliver implicit meaning by drawing quick sketches (Ulusoy, 1999). For example, architectural drawings can deliver

various design ideas such as forms of spaces, location relationships among spaces, physical connections, and adjacencies.

2.3.2 Written comments

Except for brief notes and labels that accompany drawings, written comments are rarely used in the design studio (Bailey, 2004). Still, some instructors make quick notes to accompany their desk-crit sketches and jury members are often asked to provide students with written feedback after a review. A written critique has various advantages. As students read written comments they construct stories in their minds and interpret the text; these stories can then inspire design (Iser, 1978). Alon-Mozes (2006) reports on the use of stories in landscape architecture studios as a guide for student concept generation. Finally, the written form serves as a permanent reminder of the critique so that a student need not remember everything the instructor says.

2.3.3 Drawing: graphic annotation and image

Instructors often draw during a design studio critique as they talk to demonstrate ideas (Schön, 1985). Drawing ranges from abstract diagrams to representational forms. As the instructor discovers the relationship between architectural elements presented in the student's drawings (Ulusoy, 1999), he or she may make a simple diagram to illustrate the relationship. To suggest other building forms, the instructor may place tracing paper over the student's drawing and occasionally draw directly on the student's drawing. The instructor may also make quick sketches on a pad of paper to show how the design might proceed or might have been done differently.

2.3.4 Gesture

Instructors gesture while they offer feedback on student work. These gestures are commonly regarded as a means to facilitate communication and play an important role in design thinking and collaboration (McNeill, 1992; Visser & Maher, 2011). The instructor may point to a part of a drawing or a model while referencing it in the discussion. Jared Donovan, Heinemann, Matthews, and Buur (2011) argue that pointing is not merely used for indexing, locating, or fixing a reference to an object; it can accomplish intersubjectivity and resolve misunderstandings or disagreements that could happen in communication. In addition, gestures can be considered 'invisible' drawings, that is, drawing actions that do not leave a permanent mark. For example, the instructor may indicate the contour of a landscape with hand gestures.

2.3.5 Combining modalities

Critiquing communication seldom occurs in a single mode. Rather, instructors frequently use verbal and visual modes simultaneously to communicate their ideas to students. Multiple critiquing modalities work together and help students to understand the instructor's intentions. Bailey (2004) characterizes a good instructor as a critic who can clarify the relationship between verbal comments and visual representations.

2.3.6 Modalities in digital design studios

Many studio instructors and researchers have explored how to infuse a studio education with digital technology (Andia, 2002; Gross & Do, 1999, pp. 144–148; Kvan, 1997, pp. 163–177). These digital studios, which utilize both traditional techniques (e.g., one-on-one critiquing) and online techniques, are considered to be enhancements to studio education (Bender & Vredevoogd, 2006). This digital technology has radically changed the way studio teachers have conversations with students. Especially, critiquing modalities in digital design studios are quite limited compared to ones in traditional studios. Although students could use the same materials to communicate with teachers by uploading the images of sketches and physical models in digital design studios, the main modality teachers use would be text. These textual feedbacks have a couple of merits (Bender & Vredevoogd, 2006; Sagun, Demirkan, & Göktepe, 2001): (1) students have access to the offered feedback whenever they want; and (2) students have learning opportunities from feedback on their colleagues' work.

2.4 Delivery types

The language used by the instructor is essential to the success of the critiquing session. As a critiquing session takes the form of a conversation between instructor and student, the instructor must select appropriate content, including the choice of examples and the level of abstraction in order to maximize the student's learning.

According to Bailey (2004), Goldschmidt (2003), and Uluoglu (2000), instructors use two response styles while critiquing: facilitative and directive. This distinction follows a study of instructor's responses in English writing education by Straub (1996). The teacher's choice of response style makes a difference to the students' subsequent actions and learning. Therefore, it is important for the teacher to be aware of different ways to communicate the same content. However, the design education literature does not address this distinction.

A facilitative critique encourages a student to elaborate on reasoning and design decisions. While pointing at a specific part of a student's design, a teacher may ask 'Why did you place your gallery here?' or 'Why did you make this opening here?' Here the teacher helps the student reflect on the work, discover design problems, and articulate design rationale. In contrast, a directive critique involves direct comments from the instructor rather than a series of questions. This style reflects the teacher's judgment. For example, Schön observes the teacher saying to his student, 'It's a general pass through that anyone has the liberty to pass through, but it is not a corridor. It marks a level difference from here to here—it needs to have steps or a ramp.' Here, instead of reflecting on current problems, the student would focus on future solutions.

Bailey (2004) and Uluoglu (2000) both identify five delivery types that instructors use in critiquing: evaluation (positive or negative) comments on a student's work, interpretation of a student's work, demonstration of potential solutions or other design solutions, introduction/reminder of issues or strategies, and descriptions of existing design examples or analogies.

2.5 Delivery

Critiquing delivery is different from the delivery types and communication modalities discussed in the previous section. Delivery is the *manner* in which instructors express comments based on their linguistic and modality choices. An instructor's body language—facial expressions and hand gestures—communicate subtle nuances of the instructor's attitudes or decisions. The voice quality[3] of the instructor (e.g., such as intonation and loudness) as well as manner of drawing (e.g., deliberate and slow vs. rough rapid) are also part of delivery (Roach et al., 1998).

Anthony (1991) reports that these nonverbal aspects of communication are as important as the instructor's linguistic choices. She postulates that the effective use of nonverbal expression can deepen communication between an instructor and a student. She presents four distinct messages that nonverbal body language can convey: confirming—repeating, denying—refusing, strengthening—emphasizing, and regulating—controlling. She argues that an instructor must learn what nonverbal expressions convey to the students.

Anthony also suggests that the instructor should try to be consistent in verbal expressions and nonverbal behaviors. When an instructor's verbal expression implies a positive connotation, body language, and facial expression should also communicate positive attitude. Otherwise, the inconsistency can confuse students or cause them to question what their instructor really thinks about their work. If an instructor frowns at a student and says, 'You are doing well in this part of floor plan, it looks interesting,' the student may wonder whether the instructor is actually entertaining a different thought than that which the words communicate.

2.6 Design phases

Critiques that students receive differ depending on the phase of design in which they are engaged. Uluoglu (2000) notes that instructors decide the purpose and content of a critique according to the design phase. She examined the syllabi of second-year studios at several architecture schools in the US (U.C. Berkeley, MIT, CMU, and Harvard) and Turkey (Istanbul Technical University). She identified a common six-phase outline:

(1) Introduction—introducing studio goals and requirements
(2) Place/space—investigating fundamental knowledge (e.g., site analysis)

(3) Settlement/building—early stage designing and sketching design ideas to communicate

(4) Building (life/space)—designing by considering a building program, or concepts

(5) Supporting knowledge—studying existing buildings and design theories

(6) Building (systems)—considering knowledge on building systems and details.

An instructor may help a student locate and form a building in a given site by asking questions and introducing alternative approaches in the third phase. In contrast, during the fifth phase the instructor may offer relevant precedents to lead the student to look at other architects' work with similar concepts or situations.

2.7 Individual differences

Although usually all students in a studio have completed a common set of required courses, individual students bring unique qualities to the learning experience, including spatial ability, gender, and cultural background.[4]

2.7.1 Spatial ability

In architectural design, both instructor and students often use visual representations: sketches, 3D computer graphics, and physical models. Therefore, each student's spatial ability is a factor that influences learning. According to cognitive scientist, Richard Mayer (2001), learning materials that combine text and graphics (as opposed to text only) work better for learners who lack prior knowledge about the subject matter and for learners who have high spatial ability.

2.7.2 Gender, race, and culture

Some researchers argue that design studios should value diversity such as student gender, race, cultural background, and ideologies (Koch et al., 2002; Willenbrock, 1991). Based on personal experiences in an undergraduate architectural program, Willenbrock (1991) suggests that a more equal exchange between instructor, students, and peers is needed in design studio.

Several researchers point out that different student identities (e.g., gender, race, experience, and cultural background) may influence learning and dialog with instructors. Boyer and Mitgang (1996) note that (in the US) according to the statistical data on female and minority students and faculty in accredited architecture programs, architecture remains an undiversified professional domain dominated by white males. Some researchers report that the master-apprentice model reinforces the image of men as masters (Ahrentzen & Anthony, 1993). Most design studios follow the master-apprentice model and most architecture studio instructors are male, which frequently makes design studio teaching patriarchal (Willenbrock, 1991). Consequently, these researchers express concern that critiquing in a patriarchal learning climate

can disempower and discourage some students. Some students experience emotional difficulty and damage to self-esteem when subjected to fierce public criticism (Ahrentzen & Anthony, 1993; Anthony, 1991).

2.8 Student knowledge and experiences

Although we did not find any studies that attempt to establish the relationship between critiquing and a student's level of experience or knowledge, it is reasonable to assume that an instructor would consider what a student does (or does not) already know in critiquing sessions. In particular, it would be useful to understand what design experience and knowledge can be expected from a student based on their stage in the educational program.

Some studies compare the design processes employed by beginning design students and upper-level students. For example, Atman et al. (1999) analyzed verbal protocols of 24 seniors and 26 freshmen, who were given open-ended design problem and compared their design processes. They found that the design processes of seniors and freshmen differ in several dimensions: scoping problems, considering multiple alternatives, transitions between design stages, and paying adequate attention to each design stage. Compared with beginning design students, experienced students considered multiple alternatives and could transition more rapidly between design stages while paying closer attention to each stage. This and other studies suggest that it is important for the instructor to understand a student's level of experience and design ability in order to provide effective feedback.

2.9 Student response types

Critiques require students to reflect on instructor comments. Some students may grasp the feedback they receive; however, others have difficulty relating to the feedback. Rohrbach (2005) suggests that design teachers lack understanding about how to reconstruct their teaching methods, specifically critiquing, based on student responses. Student response is also an important factor in design critiquing because critiquing is an interaction between student and teacher. Teacher critiques would not be same if student responses were different. For example, if student responses are undesirable, then studio teachers would offer the same critique using other critiquing methods to help students understand the critique. Therefore, it is reasonable to assume that teachers consider student responses in order to reconstruct their critiquing methods.

Using interviews conducted after critiquing sessions, Kent (2001) identifies six types of students: thinkers, listeners, skeptics, followers, misinterpreters, and the affirmed. Thinkers reflect on what they hear and they have ideas about how to incorporate the feedback into their designs. Listeners hear and can repeat the teacher's opinions but cannot come up with a clear plan to act. Skeptics are cynical or skeptical about the teacher's comments and tend to discount the feedback they receive. Followers remember and use the teacher's concrete

comments. Misinterpreters misunderstand the teacher's feedback and turn it into what they want to hear. Finally, the affirmed feel that their teacher agrees with their ideas.

2.10 Design artifacts and learning goals

Two additional factors have not yet been discussed. The first is the variety of artifacts that students produce as they develop their designs. Design artifacts include diagrams, rough sketches, drawings, and physical models. Design artifacts are the main results of design studios and the communication tools between teachers and students. Without these artifacts, teachers cannot understand and evaluate student design solutions and offer feedback based on these artifacts. Therefore, it is important for the instructor to understand the student's ability to produce them.

The second factor is the learning goals that the instructor must address. Regardless whether they are articulated explicitly, each studio course has a set of learning goals, and in order to provide students with appropriate feedback, the instructor must clearly understand these learning goals.

3 A theoretical framework of design critiquing

We have presented eleven factors that influence design critiquing, and we have analyzed a range of observations and findings about each factor. Based on these factors, we now develop a framework of critiquing for understanding the dependencies and relationships between the key factors of critiquing. Section 3.1 presents a process model of design critiquing for individual critiquing activity. Section 3.2 discusses a framework of design critiquing.

3.1 A process model of critiquing

We can describe what happens during critiquing as a sequence of steps or a process model (Figure 2). When a student explains his or her design work by showing the studio instructor drawings and physical models, the instructor listens and observes what the student has presented (observation). Upon noticing problematic and promising aspects of the student's work (noticing), the instructor must clearly identify the issues and why they are problematic or promising based on understanding the immediate learning goals (identification). We separated the identification step from the noticing step because identifying problematic or promising aspects of the student's work requires some

Figure 2 Critiquing steps: (1) observation; (2) noticing; (3) identification; (4) sequence; (5) delivery types and communication modalities; and (6) delivery.

deliberation, whereas noticing may be done intuitively. The instructor then considers the order with which to deliver feedback to the student (sequence). For example, the instructor may decide to begin critiquing by pointing out positive aspects, or the instructor may address critical issues first and leave other less important issues for later.

After the sequence of delivery is determined, the instructor must decide on delivery types and communication modalities. The instructor can use many communication modalities to deliver comments to the student. The instructor may use hand gestures while talking or may sketch over the student's drawing. The instructor must also formulate the critique in an appropriate manner, or what we shall call 'delivery type,' (e.g., directive or facilitative). Finally, the instructor delivers the critique (delivery). Here, linguistic choices and strategies are important (Torrey, 2009). Subtle differences such as language choices, facial expressions, and voice qualities, influence the relationship between instructor and the student and, hence, the effectiveness of the critique.

This analytical model describes a process for developing critiques and selecting delivery types and communication modalities through an analysis of the situation. It identifies the detailed steps of individual critiquing, but it is not a cognitive model of critiquing, nor is it a prescriptive model. We do not mean to suggest that an instructor does, or must, follow these steps deliberately every time he or she critiques a student's design. However, this model seems to account in a general way for what human critics do, and it helps human critics develop effective critiquing through the careful analysis of the situation in the design studio.

3.2 A framework of design critiquing

We have developed a framework of critiquing practice. This framework presents relationships between the eleven factors of critiquing. Figure 3 illustrates how a critic can use these factors in deciding on a strategy to critique a student. The six factors on the left are usually the part of the pedagogical context in which studio instructors do not control or manipulate directly. Those variables constitute the situation on which critiquing decisions are based. The factors on the right constitute the variables that are determined by the instructor for a particular course. Among these factors, critiquing types and instructor—student relationship can be decided as part of the course planning before the class starts. It is easy to think that instructor—student relationships might be determined by teacher profiles such as master, coach or parent and their own individual differences and characteristics. Although it is true in critiquing practice in some sense, we put the factor of instructor—student relationship into the group of critiquing methods. It is because we think that teachers better think about what other relationships could have with their students and (dis)advantages of individual relationships before the critiquing sessions. Studio teachers then consider having other relationships, not just insisting their own individual
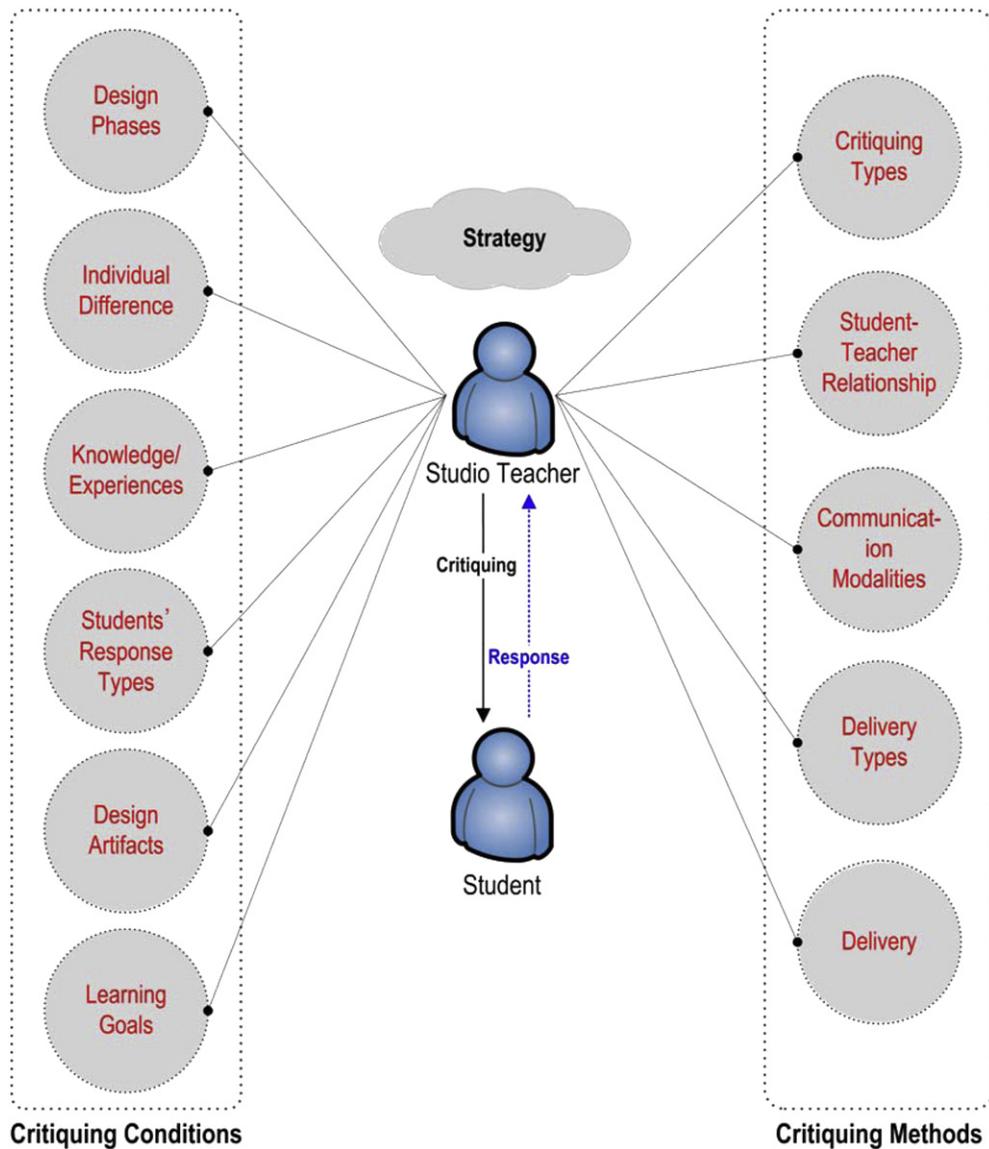
Figure 3 A framework for critiquing practice: conditions and methods. A studio teacher considers critiquing conditions and then selects a set of critiquing methods to offer feedback.

profiles. The other factors, modalities, response styles, and delivery styles are decided on the spot when instructors provide their student(s) with feedback.

This framework might be useful in developing a more formal and rigorous pedagogy for design education. As mentioned above, although critiquing is the backbone of studio-based education, design educators do not learn critiquing formally, nor has critiquing been the subject of learning sciences research that could result in more effective teaching practice.

The goal of critiquing is to provide students with effective feedback that optimally contributes to their learning. We consider this a rhetorical problem.[5] Charles (Bazerman, 1988) defines a rhetorical problem as 'the set of constraints and goals recognized by a person framing a symbolic response within a rhetorical situation.' A 'rhetorical situation' is a context that demands communication. While the theoretical concept of rhetorical situation was originally conceived to address social and political discourse, it has since been used widely in the pedagogy of speech and composition. Purdue's Online Writing Lab (OWL), for instance, defines a rhetorical situation as 'any set of circumstances that involves at least one person using some sort of communication to modify the perspective of at least one other person.' Rhetorical situations are usually described in terms of rhetor (speaker), subject, audience, context, and purpose. Table 2 shows how these rhetorical situation dimensions map to the key factors of critiquing.

The instructor's task is to analyze his rhetorical situation of critiquing from the perspective of these dimensions and their relations, and then find the optimal way to communicate his feedback in order to provide students with the knowledge they need to learn. We believe the rhetorical analysis of critiquing provides instructors with a way to systematically understand their critiquing performance, hence, providing them with an opportunity for critical reflection and planning.

3.3 Critiquing in course planning

In the previous sections, we mapped the identified critiquing factors into our framework of a rhetorical situation and proposed a detailed model of

Table 2 How factors of critiquing map to the dimensions of rhetorical situation.

Dimensions of rhetorical situation	Dimensions of rhetorical situation in critiquing	Relevant factors
Rhetor (speaker)	Instructor	Relationships between instructors and students, modalities, response styles, delivery
Subject (content)	What the instructor want the student(s) to understand	Learning goals
Audience[a]	Students	Student level of experience/knowledge, individual differences, student response types, design artifacts
Context	Circumstances that call for critiquing	Design phase, critiquing type, design artifacts
Purpose	To provide students with effective feedback that will lead to optimal learning	Learning goals

[a] We should clarify how to define the term 'audience.' Audience is a student in a critiquing session. Audience is not only being influenced by a symbolic action but is also influencing the design/plan of a symbolic action (Benson 1978). In other words, students are not just recipients and but are implicit in critiquing conversations in which they act as a constraint upon making a plan for design critiquing. Studio instructors consider student design artifacts and student response (and further their response types) as important and then decide how to deliver their feedback to their students.

individual critiquing. Based on that section, this section provides a framework for developing an overall critiquing strategy for an entire studio course.

Careful course planning is important in education, and architecture studios are not an exception. Since critiquing is the primary means of interaction between the instructor and students, explicit planning with regard to critiquing would improve learning in design studios. However, as we stated earlier, the current literature does not provide a clear framework to help instructors develop critiquing plans. The literature suggests that most instructors do not make explicit plans or develop strategies for critiquing—even though they may carefully plan their instructions in terms of other variables like the complexity of the project, phases, project description, and requirements.

Explicit plans for critiquing will also allow instructors to describe their teaching method clearly to students. While we did not find any evidence in architectural education, Goldschmidt (2002, pp. 430–437) found that providing students with the rational behind the instructor's teaching methods leads to better learning. Through several protocol analyses, she finds that 'the apparent lack of structure of crits' can be one point of failure of critiquing. Often, students do not understand why instructors are teaching in certain ways. However, when students become aware of instructional methods (i.e., metacognitively), they can be more receptive to the methods and can develop a better relationship with the instructor.

We propose the following two steps to provide students with effective feedback that will lead to optimal learning, which is the purpose of critiquing. First, we consider two rhetorical dimensions in which to plan studio critiquing: audience and context (see Table 2). The instructor needs to consider the use of critiquing types according to the design phases as well as student levels of experience and knowledge. For example, in the analysis stage where everybody is looking at the same data, it may make sense to require peer group discussions so that each student can verify his or her research against others. As each student begins to develop an approach, it may make sense to conduct desk-crits. At this stage, it is also appropriate to consider the level of feedback that should be communicated to the students. For example, if you are planning to do a round of desk-crits during a week when students are producing initial sketches for the assignment, you may decide not to point out detailed design flaws that may become irrelevant as their design develops further.

Second, the instructor needs to consider the rhetor (speaker) and the audience according to his analysis of the previous step. Here, the instructor thinks about what kind of relationships the he or she wishes to have with the students. As we discussed in Section 2, the relationship between the instructor and students is often subtle, and it is primarily established through the choice of linguistic styles and delivery styles. One instructor may use multiple relationships in

a single studio course. For example, if the audience is a group of freshmen architecture students, the instructor may decide to be more directive in the early phases in order to help students focus on issues at hand, but the instructor may use more facilitative language later in the semester to encourage individual creativity. On the other hand, in a senior studio, the instructor may start a course with a facilitative approach, but use more directive critiquing at the final review to provide students with professional experience.

4 Conclusion

Critiquing is the critical and fundamental means with which to teach design in a architecture studio. We have demonstrated that the instructor in an architecture studio has a wide range of factors to consider and reflect upon to examine their critiquing practice. We also proposed that critiquing sessions should take place not only between instructors and students but also among classmates. Thus, it is the instructor's job to create opportunities for peer-to-peer critiquing.

We believe that just as in teaching writing or mathematics, there are better and worse ways of teaching design. Developing more systematic ways of critiquing may be integral for developing better teaching methods. However, the current practice of architectural design studio has an inherent problem arising from the fact that instructors teach students in ways that are derived primarily from their own academic experience and intuition. While instructors, who are often professional architects, can share their professional insights and practical knowledge, they tend to comment on student work without a clear understanding of critiquing or the pedagogy of critiquing.

In response to this problem, we presented a descriptive framework of critiquing. Based on a literature survey, we identified eleven key factors that allow us to examine critiquing practices in an architectural design studio. We then developed a model of critiquing from the perspective of the instructor. The model is intended to be a conceptual framework with which the instructor can think about his/her critiquing, both during the course planning as well as during the interactive critiquing sessions in the studio.

We do not think that our framework improves critiquing practice or could be a direct solution to problems in the current critiquing practice. Rather, we argue that the first step to improving critiquing practice and developing a critiquing strategy is to suggest a systematic way to articulate design critiquing. Therefore, we have developed a framework of design critiquing, which helps us articulate and analyze individual critiquing sessions and propose further research into improving critiquing practice.

We hope that the framework presented in this article will facilitate the development of a systematic method for understanding, and comparing critiquing practices in design studios. We hope it will provide a means for

evaluating the effectiveness of computational design tools such as intelligent critiquing systems. We also hope that that it will provide a means by which studio teachers can plan and improve their critiquing strategies.

Notes

1. We use the term, 'teacher−student relationships,' which could be selected based on the specific critiquing situation. However, we found a different position taken by Goldschmidt et al. (2010). They use the term 'teachers' profiles.' They imply these profiles cannot be selected because these profiles are teacher characteristics. For example, a teacher with authority cannot be a teacher as a peer.

2. Besides the three instructor−student relationships, there are other definitions of teacher roles. For example, Attoe and Mugerauer (1991) describe three roles: (1) coach, (2) counselor, and (3) parent. A coach is similar to a master in that he or she may be an authoritative figure who knows what excellence is, what the goal is, how to achieve it, and who may be a heavy critic. However, a coach is different from a master model in that he or she lets students choose their directions. A teacher as counselor plays a gentler role and aims to help students discover themselves. A counselor's goal is to lead students to think critically on their own. In the parent model, a teacher is more comprehensive: nurturing and open to the student's academic growth. Attoe and Mugerauer argue that coaching and counseling should be replaced by the parenting role. Compared to the first two roles, the main character of parenting is caring. They describe caring as showing an interest in the student's individual life as well as work.

   In addition, Quayle (1985) identifies six different roles for teachers: (1) the expert who transmits factual information, concepts and perspectives; (2) the formal authority who sets learning goals and procedures by defining structure and evaluating performance; (3) the socializing agent who clarifies goals and career paths to prepare students for the future demands of their professional and personal lives; (4) the facilitator who promotes creativity and growth to help overcome learning obstacles; (5) the ego ideal who demonstrates the ultimate worth of personal commitment to material or educational goals; (6) the person who conveys the full range of human needs and skills by being self-revealing, trustworthy, warm and open.

3. Voice qualities are often described in terms of prosodic and/or paralinguistic features. As these linguistic terms are not well defined, I use the term 'voice quality' in this work (Roach 1998).

4. We recognize that there are various individual differences between instructors, but our model does not explicitly include them for the following reason—our model is intended to cover all the factors of critiquing that would complete the 'space' of critiquing available to instructors. While it would be interesting to consider how individual instructors with different personal characteristics could strategically choose specific critiquing approaches, it is outside of the scope of this paper. In addition, there is no known research on individual difference among instructors.

5. While the term rhetoric today often has a negative connotation, we adopt the broader and traditional definition of rhetoric, that is, as an art of persuasion through a means of symbolic system.

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