MADE:

Design Education & the Art of Making

26th National Conference on the Beginning Design Student

College of Arts + Architecture
The University of North Carolina at Charlotte

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PROCEEDINGS
2010

26

MADE:
Design Education & the Art of Making

MADE: Design Education & the Art of Making examined the role of making past, present & future, both in teaching design and in the design of teaching. The conference addressed theories & practices addressing fabrication & craft in all studio disciplines, and to take measure of their value in pedagogies of beginning design.

Paper presentations delivered a set of eight themes derived from the overall focus on Making. The team of moderators drove the agenda for these themes, and arranged paper presentations into specific sessions indicated by the schedule. Abstracts were reviewed in a blind peer-review process.

Conference co-chairs:

Jeffrey Balmer & Chris Beorkrem

Keynote speakers:

Simon Unwin
David Leatherbarrow

Offered through the Research Office for Novice Design Education, LSU, College of Art and Design, School of Architecture

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Session Topics

Making Real
Moderator: Greg Snyder
Making Virtual
Moderators: Nick Ault, David Hill
Making Writing
Moderators: Nora Wendl, Anne Sobiech-Munson
Making Drawings
Moderators: Thomas Forget, Kristi Dykema
Making Pedagogy
Moderator: Michael Swisher
Making Connections
Moderator: Janet Williams, Patrick Lucas
Making Masters
Moderators: José Gamez, Peter Wong
Making the Survey
Moderators: Emily Makas, Rachel Rossner
Open Session
Moderators: Jennifer Shields, Bryan Shields

Paper abstract reviewers

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WRITING ARCHITECTURE: THE ROLE OF PROCESS JOURNALS IN ARCHITECTURAL EDUCATION

Making Writing

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This paper explores research and theories related to journaling. It relates findings to architectural education and proposes methods that may be useful in evaluating cognitive development of architecture students. The intention of presenting this paper at the National Conference on the Beginning Design Student is to foster dialogue about the role of writing in architecture and to explore avenues for future research.

Manolopoulou (2005) says that note-making in architecture "shifts between writing and drawing, and takes advantage of both" (p. 517). Many architecture professors encourage students to explore ideas and record their thought processes in design process journals (see Figure 1: Excerpt from an architectural design scroll). These process journals can take the form of

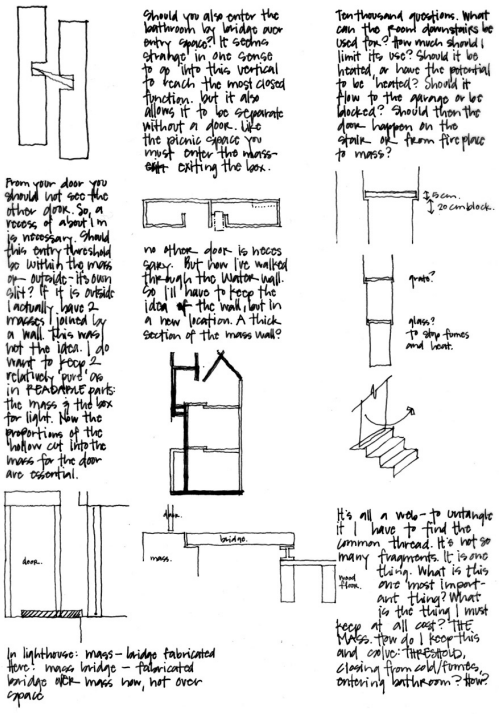


FIGURE 1:

bound sketchbooks or continuous scrolls of paper. Such journals incorporate text, annotated diagrams, sketches, overlays and collages, tracings, maps, formal measured drawings, and the like.

Arrendondo and Rucinski's (1994) two-year qualitative study found that college courses that incorporated a workshop approach along with reflexive journaling promoted meta-cognition and fostered self-regulated learning. Journaling facilitates critical thinking, deep learning, and purposeful design; it fosters reflective judgment and conscientious decision-making (Hiemstra, 2001; Rawes, 2007; Tanner & Le Riche, 2000; Vojnovich, 1997; Winter, Buck, & Sobiechwska, 1999).

Architectural education seeks to develop students' ability to think critically and autonomously in the manner described by Mezirow (1997) as "transformative learning." It causes a transformation in the way students see the world and understand their role in it. Architectural education uses problem-based learning to promote critical reflection and transformative learning. Clark (1997) asserts that educators can initiate transformation by prompting students to write, to imagine, and to exchange ideas through open dialogue.

Individuals can use journaling to "re-story their lives," construct new interpretations, and transform the way they exist in the world, explains Rossiter (1999, p. 84). Journaling incorporates contextual, retrospective, interpretive, and temporal dimensions of narrative and story telling. Rossiter insists these dimensions are critical to developing meaning and giving it order. Since architects design places that are embedded with meaning and environments that structure our lives, it is important for students to master interpretation, analysis, and thoughtful decision-making.

Journaling is employed in education for all sorts of professions because it fosters a "trans-

fer of learning" from classroom to practice (Davies & Kinloch, 2000). Writing helps professional students interpret situations they encounter in the field and uncover meaning (Winter, Buck, & Sobiechwska, 1999). Like other practitioners, architects use journaling to enhance their efficacy. The firm *Resolution: 4 Architecture* (1997) describes using a "continuous process of layering, copying and tracing information" (p. 8) to produce architecture.

Journaling holds particular relevance in architectural education. Designers employ representational devices to imagine, construct, and manipulate experience (Craig, 2002). These devices include sketches and models, as well as narratives and metaphors that help designers structure and solve problems.

Dogan (2003) says architects use conceptual diagrams to mediate between problem structuring and problem solving. A design problem emerges and gains definition in the process of seeking solutions. The full extent of the design problem is not known from the outset of the design process; it emerges through a process of critical inquiry and active engagement.

Design students learn to use representational tools to explore, compare, and communicate design ideas. Record keeping facilitates the development of well-synthesized designs. It allows students to review previous conclusions in light of new information – to evaluate their own thought processes and tweak them over time.

Journaling also seems to increase student engagement, by helping students connect course content to their own memories and perceptions. Astin (1999) asserts that students who are actively engaged in curricular and co-curricular activities learn far more than students who aren't. Although not all architecture students embrace journaling and record keeping, thoughtful writing and diagram making clearly promote higher levels of student learning. The National Architectural Accrediting Board's policies support this claim. NAAB (2004) includes written and graphic communication at the top of the list of required abilities for graduates of professional architecture programs. Architecture programs must demonstrate that their students' writing meets professionally acceptable standards.

Written records such as the design process journals that students create provide ideal resources for study. Researchers can analyze such documents to evaluate how students make decisions and how students' cognitive processes change over time. El-Sabbagh (1997) conducted such an analysis of architectural process documents. He analyzed journals and design sketches that architect Le Corbusier created in the process of design (as both a student and a seasoned practitioner). El-Sabbagh identified patterns in Corbusier's work and compared these with documents created by students today. He found that as students learn to organize and construct knowledge, they move from representations that are empirically based to those that are more conceptual. He identified three specific stages that typically occur in this transition:

1 initiation into the domain
2 building expertise and mastery
3 critical creative actions

Fostering Synthesis and Engagement

Journaling fosters reflective thinking and conscientious decision-making. Record keeping aids in the process of synthesis because it allows students to review previous conclusions in light of new information and to evaluate their own thought processes. The level of engagement with the journal seems to correspond with the degree of student learning.

Astin (1999) insists that with any educational program, student learning and development occur in direct proportion to the quality and quantity of the student's involvement. The educational effectiveness of any program, policy, or activity is related to its capacity to increase student involvement. He argues that students learn more when they connect new ideas to the things that concern them most deeply. Simply put, students learn more when they invest energy – be it physical or psychological – in objects or activities. Sustained engagement appears central to achieving high levels of cognitive development.

Educational experts laud the architecture curriculum for its remarkably high levels of student engagement (Boyer & Mitgang, 1996; Koch, Schwennsen, Dutton, & Smith, 2002). The process journals that architecture students

create provide an ideal resource for gauging student involvement, growth, and intellectual development. These journals can help scholars understand how architecture students formulate decisions and how an individual's cognitive processes change over time.

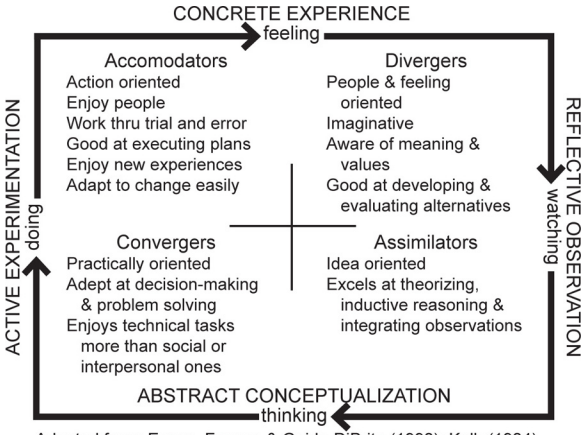
Astin (1999) has recommended using diaries to "assess the time and energy the student devotes" to various activities (p. 527). Although he suggested using time diaries, architectural process journals provide a source of data that is more authentic (and thus more credible) than data recorded for its own sake.

Fostering Metacognition

Architecture professors encourage meta-cognition (or thinking about thought). Educators encourage students to consciously consider the processes they use to make decisions and the way they think. Students utilize a wide range of approaches to problem solving and learn to flexibly modify decisions in light of emerging information. Journaling and record keeping are important parts of learning to balance disparate (and often shifting) concerns. "Reflective actions and thinking," Rawes (2007) indicates, "are inherent in the education of the architectural designer and in the individual student's experience of inhabiting the built environment " (p. 74).

Architectural education seeks to promote humanist and renaissance ideals that include understanding vastly different but interrelated realms of knowledge (Boyer & Mitgang, 1996). Students must think iteratively in order to design complex objects and interconnected systems. Architecture professors require students to explain the rationale for, and processes of arriving at, each design decision. This is particularly true for controversial decisions or positions with which the faculty member disagrees. Architecture studio courses involve very high levels of interaction with professors and peers. In this interaction, faculty and upper-level students model behaviors of analysis and self-critique for incoming students.

The studio format involves the sort of action learning and inquiry that Cree and Davidson (2000) recommend. Kvan (2001) has identified four steps fundamental to the learning process in studio-based courses. As cited in Ellmers (2006) these fundamental steps are: (1) formulating the design problem, (2) exploring solutions using hands-on activities, (3) re-examining the problem and repeating this cycle before (4) presenting the work to a jury for examination. These steps are similar to Kolb's decision-making cycle (see Figure 2: Kolb's Decision Making Model overlaid with preferred Kolb's Learning Styles chart). Kolb's work will be described in more detail later in this paper.



Adapted from: Evans, Forney, & Guido-DiBrito (1998); Kolb (1984)

FIGURE 2:

Vojnovich (1997) found that reflective journaling, critical thinking, and collaborative learning improved motivation among high school students. Students' levels of participation increased when these techniques were implemented, and behavioral problems decreased. Problem-solving exercises resulted in measurably higher levels of critical thinking. Journaling activities enhanced reflection as well as metacognition. Burbach, Matkin, and Fritz (2004) support Vojnovich's (1997) claims. They identified three key instructional strategies linked to development of critical thinking skills:

a small groups, scenarios, case studies, and questioning
b service learning
c journal writing.

These strategies are popular among architectural educators.

Students begin to question the process and meaning of learning – and thus develop metacognitive abilities – through the act of reflection (Cole, 1993; Pilling-Cormack, 1997). Providing prompts can enhance learning and reflection, indicate Berthold, Nuckles, and Renkl (2007). Hearn (2006) evaluated writing submitted by 16 twelfth-grade students

and found that most instances of metacognition occurred in situations where prompts were given. Hearn's qualitative study found, however, that some students use prompts to simply produce what they think the instructor wants.

Cole recommends using questions that are generated by the learner. Getting students to generate their own questions is important for architectural design. Pilling-Cormack indicates that the ability to self-direct is essential for transformative learning in any discipline.

Coates (1974) encourages educators at all levels to create non-conventional learning environments. The educational goals he recommends include helping students to:

- learn *from* and *about* life
- view the world holistically, and see interrelated parts rather than fragmented disciplines
- become aware of how the natural and built environment is influenced by human values, actions, and decisions
- develop an action orientation. Journaling, he says, can support these goals.

Graphic Note-Making

Journal writing encourages personal reflection and conscientious problem solving (Hiemstra, 2001), and in many situations, journaling includes images in addition to text. Reflective journaling and graphic note-making promote intentional observation, enhance the development of skills, and facilitate the transfer of learning in professional education (Tanner & Le Riche, 2000).

Architectural process journals include texts and illustrations of many types. Designers intermittently employ writing and drawing and this helps them connect critical thinking and imagination. "Sketches work as intuitive devices," Manolopoulou (2005) asserts, "stimulating the imagination, entailing spontaneous action, but also posing questions and tempting one's curiosity to explore things through longer processes" (p. 517).

The firm *Resolution: 4 Architecture* (1997) juxtaposes and transfers layers to create "a text that becomes a (destabilized) foundation for the projects' conceptual landscape." These architects uncover "a new network, or matrix, of information… through the 'art of making copies' from other forms of information" (pp. 8-9). Successful diagramming requires intellectual skill, argues Manolopoulou. It facilitates abstraction of space and time.

Like architects, social workers are also encouraged to make diagrammatic notes. Gould (2000) describes the use of matrices or *repertory grids* in social work professions, to promote reflection and to spur learning. Making these grids involves organizing and diagramming important constructs. The grids are similar to the grids, matrices, and annotated diagrams that appear in architectural process journals.

An increasing number of social work educators are using reflective journals as pedagogical tools. Davies and Kinloch (2000) believe that critical, reflective analysis of incidents can help students transfer theories into practice. They encourage social workers to record:

- unusual incidences in the field
- their emotions during these incidences
- the thought processes used to address such situations (Clapton, 2000).

Winter, Buck, and Sobiechwska (1999) stress that art is an important aspect of reflective writing. They see writing as a way to spark investigative imagination. Writing helps students in all sorts of professional fields interpret situations and uncover meaning. Winter et al. believe that professional education today reflects a "strange absence of creative imagination" (p. 180). They suggest that using a range of techniques (many typical in architectural education) that include journal writing.

Defining and Solving Design Problems

Although ideas about time and space are difficult to explore or explain in word-only or image-only formats, hybrid formats facilitate quick investigation and communication of concepts. Informal notes, sketches, and diagrams help the designer develop and communicate spatial and architectural ideas. Manolopoulou (2005) explains that architects use such tools to imagine, to understand relationships, and to "construct and communicate what is important." She adds that diagrams are used to "extract the fundamental issues of a scheme and visually articulate them in the form of signs" (p. 517).

Designers' representational devices include narrative and metaphor in addition to physical models, sketches, drawings, and diagrams. Craig (2002) researched the use of analogy in

designers' study models. He found that designers construct and manipulate experiences that help them structure and solve design problems.

Similarly, El-Sabbagh (1997) suggests that over time an architect constructs a unique and coherent point-of-view through (a) a process of negotiating various historical and critical conceptions related to architecture and (b) by differentiating and integrating various personal experiences. In evaluating architectural design methodology, El-Sabbagh draws from Piaget's constructivist theories of knowledge development.

Craig (2002), Dogan (2003), and Bay (2001) all incorporate social sciences approaches and frameworks in their discussions of design process journals. Dogan (2003) has evaluated how conceptual diagrams were used to develop three very well known buildings. Process documents for these buildings reflect iteration: the designers continually formulated, evaluated, changed, and refined their design ideas. Dogan has developed what he calls a cognitive-historical method of analysis. In studying specific cases of design, he has found that architects use conceptual diagrams to mediate between (a) problem structuring and (b) problem solving. *Problem structuring* involves conceptualizing situations. *Problem solving* involves searching for meaningful spatial configurations that enhance that conceptualization. Successful design requires continually shifting between the two realms.

Bay (2001) also used a cognitive science approach. He incorporates methods from architectural theory and environmental engineering. Bay analyzed design errors resulting from cognitive biases. Based on Tversky and Kahneman's (1974, 1981, 1982) studies of heuristics and biases, Bay identified that cognitive biases of assumed similarity (or assumed representativeness) often result in biases of allusion. Ease of recall can promote another sort of assumption, which Bay calls *biases of imaginability*.

Bay (2001) proposes future development of a *rebuttal mechanism* to enhance the accuracy of design thinking. This would control for biases that lead to dysfunction in a designer's built work. Although Bay's work remains inconclusive, it might enhance the study of students' design journals. Bay's work could help identify, define, and/or operationalize various dysfunctional design strategies evident in students' design journals.

Student Development in Architecture

Architectural education builds skill in all areas of Kolb's (1984) decision-making cycle (as shown in Figure 2). The cycle involves active experimentation, concrete experience, reflective observation, and abstract conceptualization. Architectural education requires students to use all of these modes of thinking. Students make objects, test or experience results physically, critique what they see and experience, create abstract representations, and use these to create new and/or revised objects… thus continuing the cycle. Students in some majors can work in just one or two of the quadrants (usually the ones where they feel most comfortable), but architecture requires agility in all four areas. Most studio assignments require at least one full cycle, and each smaller decision benefits from holistic analysis as well. Linear thinking just doesn't work for architects.

Students learn to analyze, synthesize, and evaluate in order to complete assignments beginning at first year. These are all listed as high-level abilities in Bloom's well-known taxonomy, developed in 1956. Bloom described

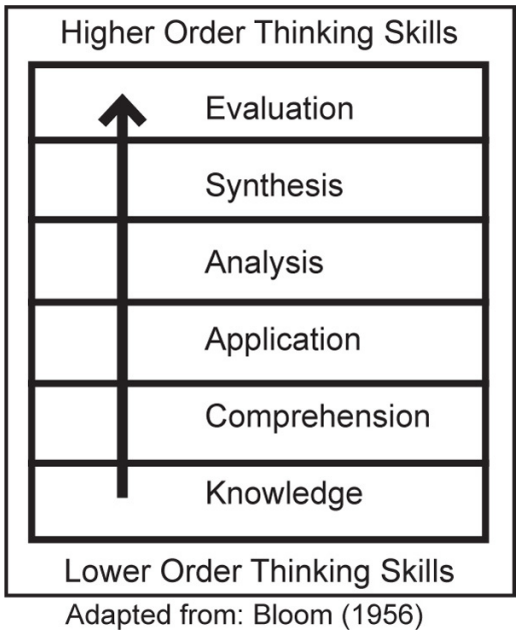


FIGURE 3:

a progression from lower-order to complex thinking (see Figure 3: Bloom's Taxonomy).

To produce comprehensive design responses, students must be able to see how various parts and perspectives relate to the whole object. They must also be able to evaluate various options in context. This context changes as various alternatives are tested and then adopted, discarded, or stored for future consideration.

Most architectural design projects require students to use all levels of Bloom's (1956) taxonomy. As students progress through the years, the complexity of design assignments increases. Students learn to reconcile conflicts, integrate numerous sources of information, consider multiple points of view, and synthesize a wide array of concerns.

Perry (1970, 1999) was the first to identify how college students develop these cognitive abilities. Perry defined the transition that college students make as they shift away from dualistic thinking (where they assume there are fixed "right" and "wrong" answers). Students begin to understand that there are many possible answers to a given question, and the best response varies depending upon the specific situation and its context. Perry's schema of intellectual development is shown in the top row of Figure 4.

Perry (1970) calls the highest stage of cognitive development *relativism* and commitment to a relativistic way of thinking. Relativism represents the ability to make decisions in context. Perry sees this ability as essential to being able to formulate an independent identity. To reach the level of relativism, an individual must experience a *revolutionary restructuring* in the way he or she conceptualizes authority, knowledge, and truth, as well as his or her role in defining them.

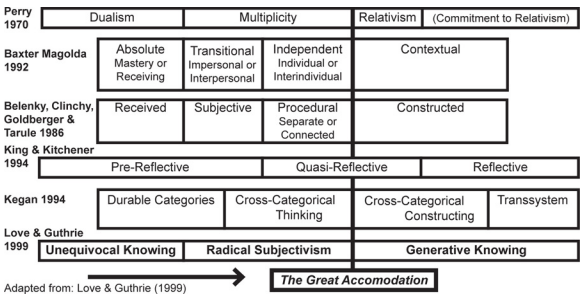


FIGURE 4:

Jan Henriksson describes the development of architecture students in a way that is similar to Perry (1970). Henriksson, a member of the project called *Psychoanalysis Meets Art and Architecture*, is also a professor of architecture. In an interview with Ulla-Britt Parment (2009), Professor Henriksson explained that the working process in architecture includes research, penetration and interpretation…. The training of the students includes… critical thinking, to enable them to gain the insight that that which is the truth, [or what] looks like the truth *no longer is the truth*. To be given a lot of freedom during the training helps the students to find an inner compass, an inner bearing which will be decisive in their work. *Conflicts are seen as vitalizing* and the alternation between order and chaos as fertilizing for creative thinking and acting to take place. (p. 19, emphasis added)

The feeling of disorientation Henriksson describes – the disintegration of external authority, the fledgling emergence of one's own internal compass, the resolution of conflicting truths – are critical components of most theories on student development (see Figure 4: Love and Guthrie's comparison of developmental theories).

Love and Guthrie (1999) note that almost all student development theories share a common break-through point where the learner accepts the role of defining truths and generating knowledge. They call this break-through "The Great Accommodation." It reflects a new realization that uncertainty is everywhere. They say that as the place of knowledge, truth, and authority disintegrates for an individual, the person's own role as authority and knower emerges.

Architectural terms pepper the descriptors used by theorists to describe high-level cognitive abilities. Belenky, Clinchy, Goldberger, and Tarule (1986) define the highest level thinking as "constructed," Baxter Magolda (1992) calls it "contextual," and Kegan (1994) uses the terms "cross-categorical constructing" and "transsystem" thinking. The vertical line in Love and Guthrie's (1999) chart suggests a break between novice thinking (to the left) and refined thinking (to the right).

Love and Guthrie (1999) indicate that college professors spend a great deal of time trying to coax students to make The Great Accommoda-

tion. Theorists agree that it is rare for students to cross this line in their undergraduate years, although Love and Guthrie indicate that the percentage of undergraduate students crossing the threshold has probably risen over the four decades since Perry develop the base theory. In any case, it is clear that architectural educators focus on getting students to think contextually and helping them construct new approaches.

Students develop the ability to think contextually in some domains more readily than others. Kuhn, Cheney, and Weinstock (2001) describe four distinct domains of knowledge: personal taste, aesthetics, value, and truth. Architecture students must navigate these domains and accept the contextual nature of knowledge (in at least some of these domains) early on. Students find they must provide rational analysis and explanation of decisions – architecture professors consistently reject subjective reasoning. Likewise, architecture students cannot necessarily adopt the characteristics of Perry's (1970) relativism in all aspects of their lives at once, but they are soon forced to recognize multiple points-of-view, incorporate holistic analyses, and seek synthesis, congruence, and holism. Those who cannot do this are encouraged (or forced) to leave the major.

It is not unusual for those who teach college freshmen to encounter individuals in the earlier stages (i.e., to the far left of The Great Accommodation). Educators spend a great deal of time questioning beginning design students' assumptions. They actively model contextual thinking. Journaling is one way to promote this type of growth and foster high-order cognitive abilities. It helps move students forward along the developmental continuum.

In higher order thinking, the student realizes his or her own power to generate, produce, originate, author, or construct knowledge and truth. At the constructivist stage as defined by Belenky, Clinchy, Goldberger, and Tarule (1986), individuals view themselves as capable of generating and creating knowledge. They understand most knowledge to be relative and contextual. In other words, they see knowledge as being relative to the frame through which it is viewed. Individuals at this stage see theory as an approximation that attempts to define various phenomena. Most view dialogue as key in developing knowledge. In the process of constructing knowledge, students develop deeper understanding of themselves.

Chickering and Reisser (1993) focus on the development of identity rather than cognitive ability. In their theory, students begin by (1) developing competence and (2) managing emotions. Students eventually (3) move from a sense of dependence to an emerging sense of autonomy and eventually develop a sense of interdependence. In (4) developing mature interdependent relationships, students begin to (5) establish identity. Over time, individuals (6) develop purpose and (7) develop integrity. Purpose and integrity allow individuals to align their behaviors with their personal values. Journaling helps students critically evaluate their own values and motives. It can help them develop along each of the seven vectors identified by Chickering and Reisser (1993).

Most theorists recommend that educators allow students to progress through developmental stages at their own natural pace (Love & Guthrie, 1999). This is not something architecture professors typically do. Although the accelerated pace of architectural education seems at odds with theorists' recommendations, it may fit the needs of specific types of students quite well. "Students seeking an artistic avenue with a practical bent soon become fiercely devoted to the design studio culture," explain Boyer and Mitgang (1996, p. 5). "For many, architecture school is an opportunity to be part of a tight-knit community on campus that is defiantly proud of its distinctive methods and its reputation for long hours and hard work" (p. 8).

King and Kitchener (1994) also lend support for accelerated development. They recommend that educators press students to engage the next higher position (on various stage theories). This is known as a "plus one" approach. Evans, Forney, and Guido-DiBrito (1998) explain King and Kitchener's recommendation to gear assignments and activities "to the leading edge of development rather than to [students'] central tendency" (p. 166).

Several distinctive aspects used in architectural education seem to accelerate learning. These include the technique of compiling process journals, the collaborative design studio format, and the integration of hands-

on activities (including modeling and drawing, service learning projects, and international travel). Such activities provoke reflection and help reveal new challenges. A proper balance of challenge and support is necessary, Sanford (1962) insists, to promote growth.

Overall, architectural educators appear committed to enhancing various abilities that Sanford (1962) describes as positive development:

- freeing of one's impulse by developing imagination and ease in handling cultural symbols
- enlightenment of one's conscious as reflected in the ways one determines beliefs and how one aligns personality with values
- ability to visualize increasingly differentiated points of view, refine one's individual responses, and contemplate one's own process

Unfortunately, architectural educators do not always ensure readiness before requiring a student to meet a new challenge. Nor do they always provide adequate support for individual learners (Boyer & Mitgang, 1996; Koch, Schwennsen, Dutton, & Smith, 2002). Sanford sees these as ethical imperatives.

Conclusions

Boyer and Mitgang (1996) indicate that studio-based education offers a unique way of teaching students that can, and should, serve as a model for educators in other disciplines. The Boyer Commission (1998) also recognizes studio pedagogy as a unique contribution to the field of education and recommends using the studio model to help reinvent undergraduate education. Journaling and graphic note-making are critical parts of this educational model. They help foster the high levels of self-reflection that Boyer and Mitgang observed in their 30-month study of architectural education in the United States.

Design education prepares students to integrate rational, analytical, and intuitive thinking in the development of meaningful, creative, and beautiful places, buildings, and objects. Boyer and Mitgang (1996) found that "the study of architecture is among the most demanding and stressful on campus, but properly pursued it continues to offer unparalleled ways to combine creativity, practicality, and idealism" (p. 5). Architectural methodology requires designers to consider questions from multiple perspectives and to continually synthesize new information, components, and concerns in the creation of complex objects (NAAB, 2004).

The architectural design studio represents an optimal example of how to teach holistic, critical thinking to students (Boyer Commission, 1998; Boyer & Mitgang, 1996; Coates, 1974). The ability to synthesize emerging information through an iterative process constitutes one of the most essential skills instilled in students through architectural education (NAAB, 2004).

Mastering this type of learning appears to be critical for our society as a whole (Coates, 1974). Jackson and Ward (2004) explain that developing knowledge in areas where levels of agreement are low and uncertainty is high, or where situations and contexts are emerging or transient, requires a process of continual renegotiation. Kunstler (2005) argues that today technology and interpretation are changing, categories of knowledge are changing, and the overall nature of information processing and cognition is rapidly evolving.

The Boyer Commission's (1998) report recognizes these changes and describes interdisciplinary programs and studio-based models as effective ways to prepare students for emerging challenges. Understanding and managing student development in these types of programs remains critical (King, 2005; Koch, Schwennsen, Dutton, & Smith, 2002).

Although scholars recommend wider application of studio pedagogy, many also cite the need to refine this model (Boyer Commission, 1998; Boyer & Mitgang, 1996; Koch, Schwennsen, Dutton, & Smith, 2002). Architectural education has been successful with regard to student performance outcomes (such as design proficiency and critical thinking) due to pedagogical practices that seem to have their own pitfalls. Perry (1970) and his successors maintain that educators should let students mature at their own natural pace. In contrast to this recommendation, architectural education seems to force students to operate at very cognitive high levels from the outset (Bloom, 1956; NAAB, 2004). Architectural curricula virtually drag architecture students to high-level stages… and this happens much earlier than typical among college students.

Developmental theorists agree that few students cross the threshold of revolutionary restructuring or make The Great Accommodation during their undergraduate years (Love & Guthrie, 1999). On the other hand, architectural educators urge students to cross this threshold as early as possible. It appears that student development theory can help architectural educators understand their students' intellectual progression. In doing so, educators can become more purposeful and intentional in their instructional practices.

A study of process journals promises to shed light onto the way novice architects make decisions and how their approach to knowledge changes as they develop expertise in design. Further study holds the promise to (a) improve architectural education, (b) enhance student development theory, and (c) improve studio pedagogy so that it can be more effectively incorporated into other disciplines.

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