Educating Architects: Integration as a Learning Process

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Expanding the idea of integration in architectural education as a learning strategy instead of just a question of content has the potential to better prepare students for the profession. Integration is a means of processing knowledge where the new knowledge is organized in the short term memory, and the learner retrieves relevant knowledge from the long term memory, then connections are formed between the existing knowledge structure and the new knowledge.[1] This process, also called active learning, allows for better recall, application, adaptation, and expansion of these knowledge structures.[2]

Active learning suggests that through the direct interaction with problems, neural connects are made, higher levels of thought are achieved and methods are internalized.[3] In their book Changing Architectural Education: Towards a New Professionalism, authors David Nicol and Simon Pilling emphasized this learning method, explaining that students make knowledge meaningful by "actively constructing and reconstructing information input—by modifying, revising and extending it, relating ideas to each other and what they already know—in an effort to make personal sense of it." [4] The design studio environment and the pedagogical strategies should reinforce this. Active learning requires the knowledge of something and the ability to apply it.[5]

In the context of architectural education, integration processes, or active learning, is the way a student fosters their individual design approach. "For designers, knowledge is experience and experience facilitates the process of design." [6] The need to process and apply knowledge was recognized in the Boyer Report, along with other architectural education studies. Authors Nicol and Pilling call for a "lifelong learning" approach to education. Architecture is shifting and growing so rapidly that one cannot keep up with all the knowledge content in the field. Integration processes are an important key for approaching issues of specialization and globalization in practice as well. The authors explain:

> Students will need to acquire skills and attitudes that are transferable across contexts and permit continuous and lifelong learning. In this changing context, architecture students do not just need to learn about architecture and acquire design skills; they must also learn how to learn, learn how to manage and take responsibility for their own learning throughout life.[7]

Theories of active learning and the theme of "lifelong learning" support the need for integration processes in architectural education, as a method of preparing students to become professionals. Because there is no specific set of goals to achieve it, the studio model is not utilized to its full potential as the center for integration processes.

Architectural education has been centered on some version of the design studio environment as dictated by early architecture schools such as the Ecole des Beaux-Arts and the Bauhaus.[8] It took the place of the apprenticeship model and is intended to develop a student into a professional. Students are taught rigor in conceiving and carrying out a design concept while utilizing self-discipline to complete projects. Authors Ernest Boyer and Lee Mitgang define the design studio as not only a place where student work, but also a way of thinking about design that ties together architectural curriculum.[9] The Ameri-

can Institute of Architects (AIA) has also defined the activity of studio. The AIA's *Architects Handbook for Professional Practice* describes the intent:

> Each studio project is a vehicle for investigating and discussing design questions. In making their design proposals, students are challenged to identify the key issues, synthesize relative knowledge and experience, and consider how their proposed buildings and places will be shaped, constructed, and inhabited. In arriving at their proposals, students learn to make decisions based on fact, rationale, and insight.[10]

Again, the potential of the design studio model depends on the ability of the students to integrate related knowledge into a design proposal.

Architectural practice has become more specialized in recent years. This increases the challenge for preparing students for entering practice. Authors Boyer and Mitgang state:

> There is no single way of practicing architecture and there should not be a homogeneous architectural curriculum. Schools should not expect that all students will become licensed professionals, although they must prepare students to be so if they choose … An architectural education educates a student in a way of thinking and trains a student in particular techniques and practices.[11]

Utilizing integration as an educational strategy is applicable to different studio types and firm types, a direct response to modern practice.

The shift in priorities after World War II due to booming population caused uncertainty through the 1990's for the future of architecture.[12] A landmark study about the issues of inconsistency in the discipline, by Ernest Boyer and Lee Mitgang, *Building Community: A New Future for Architecture Education and Practice*, was published in 1996. The study, also known as the "Boyer Report," explains this time period:

> We found, in short, a profession struggling both to fit in, and if possible, to lead, within a social and economic context that in a number of crucial respects has been dramatically altered. We also found a profession whose faith in its own future has been shaken.[13]

As a whole, practice contended with market pressures and political agendas in order to turn a profit. Architects had to address differences in expectations of architectural services, development of related industries and changes in technology. These contemporary debates within the profession ultimately affect the quality of the built environment. Architects who are active knowledge producers will bring the expectations of the discipline more closely into alignment, elevating the profession.[14] Communication bringing clarity about the goals of education and a decreased focus on the factual or technical knowledge students possess would benefit both entities. The concern should not be about what students learn, but instead how they learn.

The Boyer Report suggested integration processes as a solution, stating "architectural education is really about fostering the learning habits needed for the discovery, integration, application, and sharing of knowledge over a lifetime." [15] The rate of change in architecture today requires a mental construct that a student can learn, practice, and apply to future design projects.

Methods of integration as a learning process are currently utilized in education, but determining their success is a complex question due to the amount of flexibility left to individual architecture programs. The goal of this research is to find the best practices in the areas of curriculum structure, pedagogical goals in studios, and physical learning environments that specifically support integration processes.

METHODOLOGY

The research was conducted through field observation and interviews, as well as through comparing statistical data. School visits to University of North Carolina at Charlotte (UNCC); University of Tennessee, Knoxville (UTK); and North Carolina State University (NCSU). UNCC studios were visited 4 times each while UTK and NCSU studios were each visited for one studio class. Observing a second year studio and a fifth year studio in a Bachelor of Architecture degree program at each institution offered a snapshot of early design work as well as work of those close to entering practice as interns. In advance of each visit, a rubric was completed with general information about the program and its curriculum structure, and a review of the course syllabus was completed. During the visits, observations were recorded via hand-written notes, audio recordings, and photographs. Interviews were conducted with two students from each studio and with each observed instructor.

Curriculum Types	2005-S1	2005-S2	2005-S3	2005-S4	2005-S5	2005-S6	ARE 2005 MC	2005-S7	2005-S8	2005-S9	ARE 2005 Graphic	2006-S1	2006-S2	2006-S3	2006-S4	2006-S5	2006-S6	ARE 2006 MC
TYPE I																		
Southern California Institute of Architecture	71	47	74	71	72	79	69	75	59	62	65.33	100	50	50	67	50	25	57
TYPE I-II Hybrid																		
University of North Carolina, Charlotte	94	83	82	81	79	93	85.33	64	62	67	64.33	N	50	67	100	50	50	63.4
Carnegie Mellon University	92	89	87	100	93	82	90.5	90	71	71	77.33	100	50	100	50	100	0	67
TYPE II																		
Georgia Institute of Technology	76	83	100	94	80	83	86	89	73	70	77.33	N	100	100	100	100	67	93.4
Columbia University	80	75	77	74	55	71	72	72	66	67	68.33	71	100	67	80	79	80	79.5
Illinois Institute of Technology	33	75	58	50	77	72	60.83	72	44	61	59	100	100	25	71	29	80	67.5
University of Texas, Austin	95	97	85	90	92	98	92.83	82	67	69	72.67	100	100	100	100	100	100	100
North Carolina State University	93	81	92	84	100	89	89.83	81	55	72	69.33	100	100	83	100	80	100	93.83
University of Tennessee, Knoxville	74	60	44	50	73	93	65.67	67	50	68	61.67	100	100	50	100	100	75	87.5
TYPE II-III Hybrid																		
Massachusetts Institute of Technology	95	100	82	86	100	91	92.33	76	66	63	68.33	100	100	N	25	100	100	85
TYPE III																		
University of Cincinnati	95	95	94	100	95	100	96.5	90	68	81	79.67	100	67	100	100	100	50	86.17
NATIONAL AVERAGES	76	75	76	68	77	77	74.83	73	63	66	67.33	78	75	75	70	77	77	75.33

Average of the multiple choice sections pass rates
Average of the graphic sections pass rates
Consistently above average scores
Averages of both Multiple Choice and Graphic Sections below national average for that year
Averages of either MC or Graphic Sections below national average for that year
XX Individual section rate is below national average rate

Figure 1. The effectiveness of an architectural curriculum with regard to integration processes and preparing a student for practice are difficult to measure and compare. One possible method of evaluation is through the Architect Registration Examination (ARE) Pass Rates published by the National Council of Architectural Registration Boards (NCARB). In a comparison of the ARE Pass Rates to the models of curriculum, some educational programs fell consistently above or below national average scores. Both of the models that were consistently above average were Type II models. A broader application of this method could yield strong results in supporting which curriculum type more consistently produced licensed professionals.

The need to better understand and substantiate the current differences in expectations for the content taught in collegiate education led to a survey of architectural professionals. Those polled were currently working in the field with a range of experience and graduated anywhere from less than a year ago to 10+ years ago. This data revealed that there were statistically significant differences in expectations between those who worked prior to graduation, those who had graduated more recently, and those who were participating in the Internship Development Program (IDP) process for example.[16] The expectations of practitioners also vary from the architecture education standards set forth by National Architecture Accrediting Board (NAAB) and National Council of Architectural Registration Boards (NCARB). The survey yielded about 60 responses and a broadened application could potentially help better pinpoint the differences in expectations and aid in bringing a stronger connection between education and practice.

The NAAB provides a framework in education standards that allow for flexibility of individualized programs.[17] The NAAB released the 2009 Conditions for Accreditation in which the Student Performance Criteria are structured into three "Realms." Realm A, entitled "Critical Thinking and Representation," and Realm C, "Leadership and Practice," require students to demonstrate abstract skills somewhat unrelated to issues of content. Realm B, "Integrated Building Practices, Technical Skills and Knowledge" addresses the content topics that students should be able to assimilate into a design project.[18] This research may be viewed as a response to how these "Realms" might be achieved within any architecture program.

CURRICULUM STRUCTURE

Curriculum structure provides the framework for integration processes through a connected curriculum. [19] Curriculum was classified as one of three types based on the way knowledge built up through the course sequence. Type one curriculum coordinated courses across a single semester, integrating parallel coursework into the design studio project. The second type, the most common, included parallel and highly coordinated tracks through design work, history and theory, and technology that are not necessarily tied directly to the studio.

Some hybrids between the first and second types were found, where attempts at coordination both across the same semester and in semester sequence were made. The third type allowed proficiency to occur in an area through coursework and followed with a studio where the knowledge was applied.

A basic understanding of the curriculum types allowed for further investigation of what the successes might be. Curriculum with potential for integration processes to be better supported, was evaluated through two methods: (1) the number of chances to practice integrated design process, and (2) whether parallel coursework is directly coordinated with a studio project. The ability to practice this integration process in multiple design problems reinforces the flexibility of the mental constructs and the process of analyzing a design problem and being able to apply knowledge to form a solution.[20]

The "comprehensive design" project promotes the ability of the student to reach a detailed-level of investigation in a design.[21] Many of the "Realm B" requirements are through documented student work on these comprehensive design projects.[22] This studio is important for allowing the student to prove to his/herself that they can apply the skills they have been taught in prior courses and incorporate it into a design, according to Professor Patrick Rand of NCSU.[23]

Support for the integration of knowledge and internalization across coursework is stronger when parallel courses are coordinated as well.[24] Professor John Nelson at UNCC coordinated his second year studio with his students' concurrent materials course. The students were permitted to utilize materials in their designs only if they had covered them in the materials course.

PEDAGOGICAL GOALS

The curriculum structure provides the framework, and the activity of the individual studio lends more support to integration processes. Criteria set forth by course syllabi and the NAAB Student Performance Criteria the course aimed to meet were the basis for analyzing the activity within the studio. The following objectives are best practices based on field observation to help focus pedagogical goals on integration processes within the studio.

1. Fostering active learning and increased self-guidance in the design process

In each observed studio, the structure of the problem was carefully balanced with the open-endedness. The students pursued an individual design investigation that required seeking information and incorporating it in their design within the curricular framework and with the guidance of the instructor. As discussed, active learning is the basis for integration processes.

The increased level of self-guidance in studio left the responsibility with the student to take the initiative in developing an approach to a design problem. The second year studios were subject to strict levels of instruction with fewer variables in order to focus on the learning objectives of the studio. The tightly scripted instruction focused heavily on development of a schematic design concept through precedent study, formal analysis and site response.

Fifth year studio projects required a high level of investigation but projects often varied fundamentally by site and program within a studio. The level of self-guidance and research in these studios is comparable to that of a project in practice. Both the Student Performance Criteria and the course syllabi required fifth year students to be proficient in design communication and formation of concept, as well as carrying concept through design development.

2. Forcing recall of knowledge gained in prior or parallel coursework

At the second year level, students were held accountable for things they learned in foundation studios and seminar courses. The interviewed faculty members from all three institutions agreed that some students naturally assimilate knowledge from outside or previous courses into their studio project. Others required direction on recalling the information.

Some instructors were explicit in making these connections across curriculum. The success of this objective required awareness of prior and parallel coursework on the part of the instructor. This was achieved through communication between faculty members at minimum, and in the examples of fifth year at both UNCC and NCSU, through a direct coordination of coursework between faculty, as suggested by the best practices in curriculum.

3. Promotion of visual, verbal, and written design communication

The success of the studio model hinges on the ability to communicate through design. This corre-

sponds directly with learning theory. A study often quoted about learning states:

> Students retain 10 percent of what they read, 26 percent of what they hear, 30 percent of what they see, 50 percent of what they see and hear, 70 percent of what they say, and 90 percent of what they say as they do something.[25]

According to these statistics, studio learning that includes physical creation of design artifacts combined with speaking about designs provides an effective vehicle for internalization of process. Consistency of thought among communication methods supports integration processes.

Students learned to discuss design through hearing their professor speak about it along with speaking to the instructor and to peers in Professor Matt Hall's second year studio at UTK. He facilitated discussion among his students to encourage them to become comfortable speaking about design.[26] Verbal presentation skills develop in parallel with design skills to strengthen design ability. Both verbal and visual skills must be satisfied in accordance with the NAAB Student Performance Criteria.[27]

Students who are able to communicate through a clear visual presentation in a formal jury illustrated stronger internalization of design concept. For example, a female student in a fifth year midterm review at UNCC was able to verbalize her concept in terms of her site and program research and critics commented that it showed in her visual presentation. A male student showed inconsistency in his verbal ideas and the critics pointed to cues in his visual presentation to guide his concept forward.

Both verbal and visual communication skills are vital to the success of an architect in practice. In addition to these two methods, writing can bring further clarity to an integrated design process. Architects often convey design ideas through writing in practice. Written communication can bring further clarity and precision, reinforcing a process.

4. Bringing clarity and purpose to design exercises

In the second year studios, a series of design exercises built upon one another to achieve specific skill sets and knowledge. In order to connect these exercises, John Nelson at UNCC and Jessica Johnson Moore of NCSU continually reminded students how the current work informs the next assignment or connects back to a previous assignment. Emphasizing an understanding of a studio problem in a broader context, as opposed to a problem in isolation, supported future application of knowledge.

5. Promotion of integration of knowledge through critique and evaluation

A common critique of the studio model is the objectivity of evaluation methods. Critiques happened often in both informal and formal settings in field observation. Evaluations brought clarity to what has been learned and applied in a few examples.

A formal critique that included synthesis and reinforcement helped students to advance in their design process. Professor Matt Hall at UTK concluded each review in his second year studio with commentary summarizing the jury response and giving further direction to the student. Synthesis may also come after a formal critique in a private set-

Figure 2: Informal desk critiques and small group critiques occurred, reinforcing verbal and visual design communication. These sessions helped guide students in advancing their design process through open discussions and through directed examples in the form of research or precedent.

ting. The fifth year students at NCSU participated in individual meetings following their mid-semester reviews. They discussed the comments received with the professor, how to move forward, and their personal strengths and weaknesses in the studio. This time of reflection directed the work of the student for the second half of the semester.

Audio recordings provided a starting point for analyzing the communication between faculty and students in the studio setting. They allowed for measurement of lengths of time each party spoke during formal review presentations and informal pin-ups. The recordings showed that the structure of the overall presentation sequence was dominated by the comments from the jury.[28] Students, other than the presenter, never participated in the formal review.

6. Engaging professionals beyond the formal review

Allowing the students to collaborate with professionals on a more equal level gave students a similar experience to that of working with a superior in practice. The survey results showed that expectations of practitioners about education were not aligned with the requirements set by the collateral organizations. Involving professionals in education gave them exposure to current education practice. In David Thaddeus' fifth year studio, county code officials sat down with students to review their life safety and accessibility strategies. The officials commented on seeing the innovative designs in the studio. Thaddeus also invited local professionals to jury presentations, as did Matt Hall at UTK.

These six objectives begin to outline pedagogical methods to support integration processes in design studio. Though teaching methods vary, having goals will bring a greater consistency to the success of the student in internalizing design process.

PHYSICAL ENVIRONMENTS

Physical environments were studied through observation and photographs and were a subject of interview questions. Research revealed that architectural education did not have the ideal space to facilitate integration processes. Author Ashraf Salama suggested that traditional studio space is not flexible enough to accommodate these processes.[29] The studio environment that best supports integration processes

Figure 3: DudaPaine in Durham, North Carolina modeled their design process after that of Cesar Pelli. Regular design reviews take place in this space with the design team and firm principles. The space is flexible with tables for working and storing models as well as pin-up space. Those working in their desks adjacent to this space are also exposed to the ideas from reviews and from design artifacts.

focuses on visual access, support for technology, and collaborative and communicative spaces.

Architecture firm offices were part of early case studies with particular concern for how design process and physical environment informed each other. Firms such as LITTLE in Charlotte, NC and DudaPaine in Durham, NC found that collaborative spaces with visual access to projects and technological resources were most suitable.

Visual access to ongoing projects is important to the consistency and strength of a design process. An example of this was observed at UNCC where the second year studio had a pin-up space that each student kept updated. This is similar to the condition found at DudaPaine, where adjacent to the studio desks, there is a flexible workspace with models, drawings, and renderings of current projects. This solved one problem acknowledged by Professor Jessica Johnson Moore at NCSU who acknowledged that the lack of wall/pin-up led her students to store their previous drawings and forget to bring those ideas forward in their projects because they cannot visually reference them. This may have resulted in a disjointed process for her students.

Providing flexible workspace for technological resources also aided in integration processes in studio

Figure 4: The open studio, such as this on at NCSU, better supports integration process through allowing visual and auditory connection among peers and instructors. The desks utilized by the upper level studios at UNCC are a bad example due to high partitions that isolate students and deprive them of studio activity.

spaces. Professor Patrick Rand at NCSU utilized an external hard drive in his desk critique sessions to show students precedent images. An example of this in practice was also seen at LITTLE, where the firm utilized a large open table for group workspace. The employees worked on laptops to do training of new software. Spaces that support computers and projection would aid in collaboration utilizing software technology and exposure to visual ideas.

The goal of creating a collaborative and communicative space brings the studio to its full potential. According to some practitioners, the best workspaces are open, though vertical partitions between workspaces are still commonplace in architecture firms.[30] Some progressive firms found in case studies chose a more open studio environment, similar to some educational studios.

Support for knowledge integration as a learning process is applicable to the architectural discipline beyond collegiate education.[31] A mapping of the requirements for architectural licensure followed the NAAB Student Performance Criteria to the Internship Development Program (IDP) training areas and through to the ARE testing topics. While much of the content-related material set forth in the NAAB Criteria was carried through to the ARE Testing Topics, many of the Student Performance Criteria related to application and skills were left unaddressed.[32] Continuing to foster active learning through the internship, licensure and beyond would strengthen the professional process.

Many architectural firms utilize educational programs. The programs often include lunchtime sessions that help professionals satisfy continuing education units for the AIA. These sessions, often in a lecture format, are not the most effective means of teaching. FreemanWhite in Charlotte, North Carolina has an award-winning education program in their firm called the FreemanWhite Academy that utilizes active learning methods.[33] Another firm in Charlotte, Neighboring Concepts, held critique sessions similar to those in studio to engage employees in ongoing projects. These examples are the beginning of how ideas about integration processes could extend to the profession to support lifelong learning.

The goal of creating a curricular framework that allows for coursework to be integrated into studio projects, and to allow for the level of detail in a comprehensive design project to be reinforced

Figure 5: Functionally, educational environments are progressing towards practice as computer-aided design becomes more of a focus. The need for drafting boards that dominate workspaces, particularly in upper level studios will fade and workspaces will be geared towards the use of technology.

through subsequent projects will create a strong framework for possibilities of integration processes. Setting pedagogical goals for instructors will create a baseline for integration processes in design studio. And finally, creating environments conducive to integrative learning that respond to technology and collaboration and are similar to progressive practice offices will provide spaces where learning can occur effectively. These three aspects support the goal of bringing a greater clarity to architectural education through a focus on integration as a means of processing knowledge.

ENDNOTES

1. Mayer, Richard E. *The Promise of Educational Psychology*. Upper Saddle River, New Jersey: 1999, 18-19.
2. Mayer, 20.
3. *Bonwell, C. & Eison, J. (1991). Active Learning: Creating Excitement in the Classroom AEHE-ERIC Higher Education Report No.1. Washington, D.C.: Jossey-Bass. The use of active learning in instruction was popularized by this writing but it has been supported by several groups of theories in educational psychology.*
4. Nicol, David and Pilling, Simon. *Changing Architectural Education: Towards a New Professionalism*. New York, NY: Spon Press, 2000, 14.
5. Active learning requires a balance between education and training. Training a student in a behavior allows them to put a technique into practice. Students determine through their education the appropriate technique to employ, and then employ it based on a practiced behavioral response. An architecture student needs both education and training to internalize methods for solving design problems.
6. Powers: 18.
7. Nicol and Pilling: 11.
8. Kostof, Spiro. *The Architect: Chapters in the History of the Profession*. **Berkley: University of California Press, 2000: 209-217, 320-325.**
9. Boyer, Ernest and Mitgang, Lee. *Building Community: A New Future for Architecture Education and Practice*. Princeton, NJ: The Carnegie Foundation for the Enhancement of Teaching, 1996: 85-86.
10. Demkin, Joseph A. *The Architect's Handbook of Professional Practice*. Wiley, 2001: 44.
11. Boyer: 77.
12. Gutman, Robert. *Architectural Practice: A Critical Review*. New York: Princeton Architectural Press, 1988: 33.
The traditional independently practicing architect was diminishing and larger firms developed in order to serve clients demanding complex buildings.
13. Boyer: 13.
14. Boyer: 109-111. The report summarized the complaints that education and practice have had about each other that have prevented an open dialog. Practitioners blame schools for students' lack of technical knowledge, little experience with teamwork, and not having opportunities to participate in education. Educators accuse practice of being unsympathetic and forgetting that students should be educated and not just trained, and also for not providing internships to extend the collegiate education. The report also states, "The worlds of architecture practice and education depend on each other for their purpose and vitality. Both bear responsibility for preparing students for gainful employment and for continuing the lifelong professional education of architects."
15. Boyer: xvi.
16. The survey was conducted through a free survey-hosting website and was sent out via email. The results were compiled in a spreadsheet and the responses compared to find statistically significant correlations between responses. The survey results distinguished between graduates of UNC Charlotte and graduates of other programs. This allowed for specific trends in responses from the graduates of one institution to be compared to the general responses. The survey questions were geared towards finding what professionals expected to learned in collegiate education versus what they expected to be learned in practice. These responses were compared to what they actually learned as well as what they thought they should learn at different points in their career. These topics were chosen based on a mapping of NAAB Student Performance Criteria, IDP training areas, and ARE testing topics. There were also specific questions on degree types, years of experience, internship, continuing education, licensure, and rating their collegiate education. Some of the most significant correlations are listed here:
   1. UNC Charlotte program graduates survey. People with 10+ years work experience since graduation are more likely to think that response to clients is better learned in the educational setting than people who graduated more recently. People who had professional experience prior to graduation think computer skills are better learned in practice, while those who did not have experience prior to graduation think they are better learned in an educational setting. People who are currently licensed think that it's better to learn about sustainability in an educational setting, but that it's better to learn about structures, site planning, and materials and methods in practice. People who have begun IDP are more likely to have been asked to apply schematic design in practice.
   2. General program graduates survey. People who have begun IDP are more likely to think that their responsibilities progressed reasonably in their internship than those who haven't. Students with 0-3 years of work experience since graduation are more likely to think that schematic design should be learned in education, while students with 4-6 years of work experience since graduation are less likely to think so.
   3. Overall. Bachelor's students are more likely to think that computer skills should be learned in practice, and 2-year Master's students are less likely to think so. People with 4-6 years of work experience since graduation are less likely than people with 0-3 years work experience to think that schematic design should be learned in education. People with 4-6 years of work experience since graduation are less likely to think that client response should be learned in education than people with 10+ years of work experience. People with professional experience prior to graduation are less

likely to think that client response should be learned in education.

4. Differences between UNCC and General surveys. UNCC students are less likely to think that structures, site planning, MEP, computer skills, and team skills should be learned in education. They are less likely to think that client response should be learned in practice.

17. *NAAB 2009 Conditions for Accreditation*. http://www.naab.org/news/view.aspx?newsID=34 The Conditions for Accreditation state, "While the NAAB stipulates the student performance criteria that must be met, it specifies neither the educational format nor the form of student work that may serve as evidence of having met these criteria. Programs are encouraged to develop unique learning and teaching strategies, methods, and materials to satisfy these criteria. The NAAB encourages innovative methods for satisfying the criteria, provided the school has a formal evaluation process for assessing student achievement of these criteria and documenting the results."

18. *NAAB 2009 Conditions for Accreditation*. http://www.naab.org/news/view.aspx?newsID=34 PART TWO (II): SECTION 1 – STUDENT PERFORMANCE -- EDUCATIONAL REALMS & STUDENT PERFORMANCE CRITERIA.

19. Boyer: 75. The report claims that curriculum structure could aid in supporting knowledge integration processes, stating: "A connected curriculum would encourage the integration, application, and discovery of knowledge within and outside the architecture discipline, while effectively making the connections between architectural knowledge and the changing needs of the profession, clients, community, and society as a whole."

20. The UTK program locates the "integration studio" and the "integration seminar" in fall of the fourth year, which is followed with topical studio courses. Though the "laundry list" of drawings is not necessary in the topical studios, the design is expected to be thought out to this level of detail. The NCSU program locates the comprehensive design in fall of the fifth year and the fifth year design project follows in the spring. Again, the subsequent project requires the same level of detail.

21. Typical structure of a comprehensive design project requires specific drawing types to be completed on a strict schedule and stipulates that each drawing allows the design to further develop. The final design is expected to be at the level of design development documents produced in architectural practice.

22. *NAAB 2009 Conditions for Accreditation*. http://www.naab.org/news/view.aspx?newsID=34 PART TWO (II): SECTION 1 – STUDENT PERFORMANCE -- EDUCATIONAL REALMS & STUDENT PERFORMANCE CRITERIA.
The criteria encompass two levels of accomplishment:
Understanding—The capacity to classify, compare, summarize, explain and/or interpret information.
Ability—Proficiency in using specific information to accomplish a task, correctly selecting the appropriate information, and accurately applying it to the solution of a specific problem, while also distinguishing the effects of its implementation.

23. Professor Patrick Rand is an experienced fifth year studio instructor and his studio was observed during research at NCSU. During his interview, he explained that the comprehensive studio was important for students to take what they had learned in previous coursework and apply it. He stated that going through this process allowed them to become more sure of what they had been taught. Interviewed NCSU students agreed that they were able to design with integrated content in mind more successfully in the second project.

24. This was seen in the foundation design coursework of all three institutions. Coursework in basic design skills is often coordinated across multiple courses because of the amount of material covered.

25. Stice, J.E. 1987. "Using Kolb's Learning Cycle To Improve Student Learning." *Engineering Education* 77: 29 1-296. <http://www.ncsu.edu/felder-public/Papers/FLAnnals.pdf>

26. During interviews with Matt Hall's students, they acknowledged a level of comfort with speaking about their design concepts. This was confirmed during an observed formal review. Verbal communication of designs was vital to the success of the students in formal presentations.

27. *NAAB 2009 Conditions for Accreditation*. http://www.naab.org/news/view.aspx?newsID=34 PART TWO (II): SECTION 1 – STUDENT PERFORMANCE -- EDUCATIONAL REALMS & STUDENT PERFORMANCE CRITERIA.

28. A presentation checklist for formal reviews observed in both second year and fifth year studios revealed that criticism focused on the strength of the design concept and the ability of the student to consistently apply the concept in design decisions. The critiques focused less often on issues of verbal presentation, visual presentation, or technical knowledge.

29. Salam, Ashraf M. "A Theory for Integrating Knowledge in Architectural Design Education." International Journal of Architectural Research. 02.01.03 (2008): 121.
One solution to this problem, offered by Salama, implies a new environment for design studio that allows other parts of the curriculum to be present. He describes it in this way: "This occurs by reconciling lectures and studios through the introduction of a "new setting: -- an alternative to classroom and studio settings where bodies of knowledge are delivered by different teaching staff, while at the same time students apply what is delivered to them in specific design assignments facilitated by the same staff."
This suggestion is broad and seems a bit chaotic, but is worth consideration. A new type of space would allow for different types of interactions to occur yielding more of the needs and desires for this integration of knowledge.

30. Jim Williams, partner at LITTLE in Charlotte, North Carolina explained how the workspaces within their office were being converted to open studios with low partitions between desks. The renovated spaces in the office were open, whereas older studio areas still used cubicle style desks with high partitions between employees. He explained that this was due to the need for communication between project team members.

31. The breadth of the data collected in this research was limited due to time and travel constraints. Ideally, more schools would be visited using the same

methodology for observation and the comparative data would support stronger conclusions. Similarly, the survey data and the curriculum classification methodologies would be extended.

32. The following criteria from the NAAB 2009 Conditions for Accreditation Student Performance Criteria are not specifically addressed in either the IDP training areas or the ARE testing topics:

A 1. Communication Skills
A.2. Design Thinking Skills
A.3. Visual Communication Skills
A.5. Investigative Skills
A.6. Fundamental Skills
A.7. Use of Precedents
A.9. Historic Traditions and Global Culture
A.10. Cultural Diversity
A.11. Applied Research
C.1. Collaboration
C.2. Human Behavior
C.3. Client Role in Architecture
C.6. Leadership
C.8. Ethics and Professional Judgement

33. FreemanWhite received the AIA/CES Award for Excellence (large firm) for their "strong continuing education program that benefits all employees and bolsters the bottom line."
<http://www.aia.org/education/providers/AIAS076177>
The firm also received the North Carolina AIA Firm of the Year award in 2005.
<http://www.prleap.com/pr/95003/>
FreemanWhite has been named "Best Places to Work" by both the Charlotte Business Journal and Modern Healthcare.
<http://www.freemanwhite.com/working-here/>