

# The Teaching of Research and the Research on Teaching: Two Frameworks and Their Overlay in Architectural Education

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**Abstract:** The *teaching-of-research* as systematic inquiry can provide a specific home in architecture curricula for 1) nurturing numerous underserved aspects of designerly thinking and 2) complimenting the more freeform intuitive pursuits that usually typify design inquiry. Those benefits will be elaborated in this paper via the presentation of the six year development of one such undergraduate course. This paper also correspondingly examines *research-on-teaching* in the architecture academy as an equally underserved and increasingly vital activity. The same six year history of one course will be given as a viable model for the synergy of these two activities: teaching-of-research, and research-into-teaching.

- Common Ground: *definition, proposition, and wisdom in design inquiry and research inquiry*
- The Teaching of Research: *a sample course on Architectural Research Methods*
- The Research on Teaching: *pedagogy, scholarship, and assessment*
- The Classroom and Studio as Teaching Laboratories: *data collection, analysis, and application*
- One Course on the Teaching of Research

## Common Ground: Two Frameworks for the Teaching of Architectural Research Methods

One means of orientation to architectural research inquiry is to set it in context of what students are already more acquainted with as design inquiry (Figure 1). While student engagement in design inquiry is often more pragmatic and less theoretical than the research construct, design inquiry is nonetheless a reasonable way to begin considering research inquiry because the similarities and differences tend to illuminate thinking about both activities. Figure 1

compares the two modes of inquiry as simple linear processes for the sake of coherent conversation and clear illustration. In practice of course, both activities are more complex and messy, but the underlying theories concerning them both can be more readily examined if the basic relations are clearly stated as a conceptual framework.

What research and design share as modes of inquiry are three common punctuation points: beginning in problem definition, working toward a transitional midpoint proposition, and ending in new wisdom that advances the pursuit of architecture. At the beginning there are common bases in theory and quest for innovation. At the midpoint the shared emphasis is on identifying a propositional goal that is, hypothetically at least, something unique, situated, and provocative. This midpoint is critical in that it reveals the rich and complex essence of what was at first just a problem statement but becomes the "big idea" behind the entire project. In the sense of problem space, this midpoint is where the pregnant ambiguity of the situation has been identified and distilled. It is in this region of ambiguity that both design and research operate most creatively. Finally, as their common ultimate goal, both research inquiry and design inquiry strive to achieve an artifact that embodies new, useful, accepted, and generalizable wisdom... hopefully in both cases leading to validation through replication by others.

Where these two modes of inquiry differ is in the processes between those punctuations. While both can be described in the conventional problem-defining and problem-resolving sequence of analysis of the problem followed by synthesis of the solution, other aspects are actually reversed. Most fundamentally different are the roles of creative-philosophical versus generative-methodical thinking. In design inquiry, the process between beginning problem definition briefing and midpoint propositional design intention can be described as generative-methodical in terms of the analytical thinking it usually entails: programming, site analysis, precedent reviews, code analysis and other aspects of strategic planning. Once this generative-methodical process leads to an adductive proposition midpoint, design then continues with the more creative-philosophical process of physical design from conceptual to schematic and on toward the endpoint of a realized work of novel architectural wisdom.

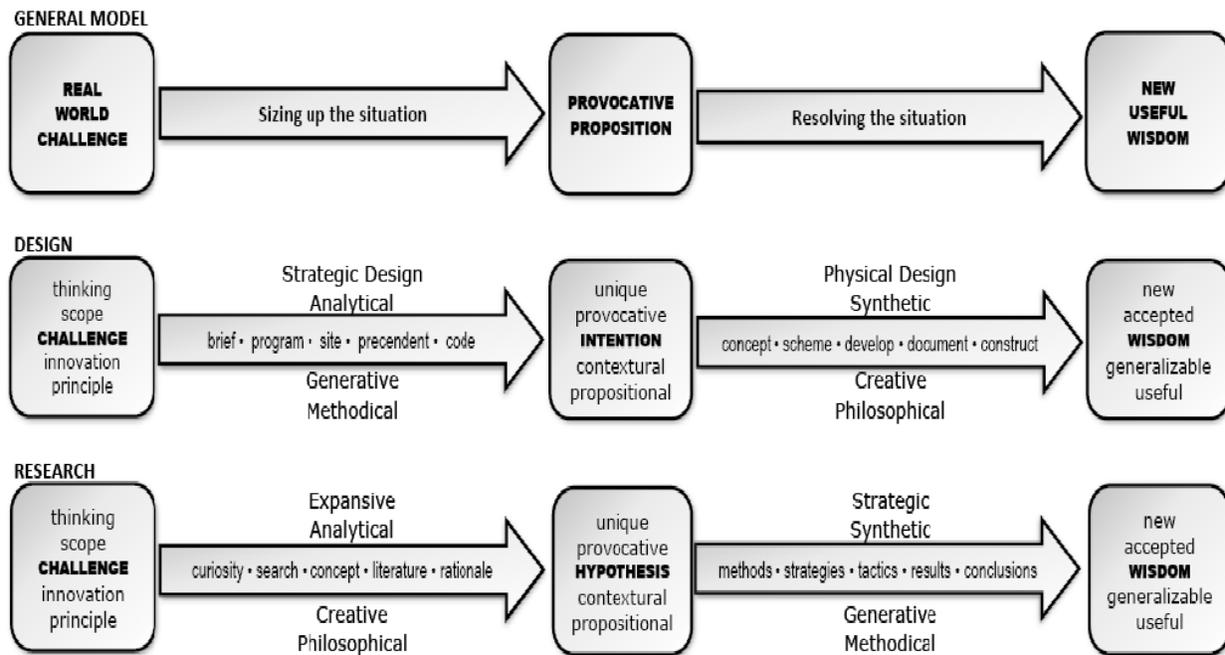


Figure 1. A framework for problem space models in design inquiry and research inquiry showing reversed roles of generative-methodical and creative-philosophical processes (by author)

In broad conceptual terms, research-as-inquiry reverses those two processes. Here the initial span from beginning doubt and curiosity to midpoint research propositional hypothesis is the creative-philosophical one. This is where a significant gap in existing knowledge is identified by analysis and exploration of existing knowledge. Everything after that in research is essentially methodical-generative towards the synthetic results and findings published for peer review.

Now this is not to say in absolute terms that the generative-methodical modes of design programming or those of research methods do not require creativity and inspiration. Clearly the strategic planning aspect of a design challenge requires much imagination and novel thinking as does the experimental design phase of a research project. It would also be wrong to suggest that either the researcher or the designer ever works with only half of their cognitive skills activated at any one time. The main point here is that the authorship and creative credit of research lies in a reversed formulation of processes compared to that of design. It is through this sort of conceptual understanding that the

common ground and varying processes of design and research can illuminate one-another.

This first framework of the general argument aligning research and teaching corresponds to Walter Gropius' term "the accumulated wisdom of architecture." As already noted, this is the ultimate goal of both design inquiry and research inquiry. An inquiring intention of adding to the accumulated wisdom of architecture thus serves to bond the value sphere of research-as-inquiry with that of design-as-inquiry. It might be claimed, for example, that differentiation of a good but normative building from critically worthy architecture is staked on identifying what new wisdom the subject work adds to our thinking about what architecture can be and do. "Commodity, firmness, and delight" are not enough; new and better ideas are always required to advance the cause. Research inquiry is likewise grounded in the pursuit of new knowledge, understanding, or wisdom.

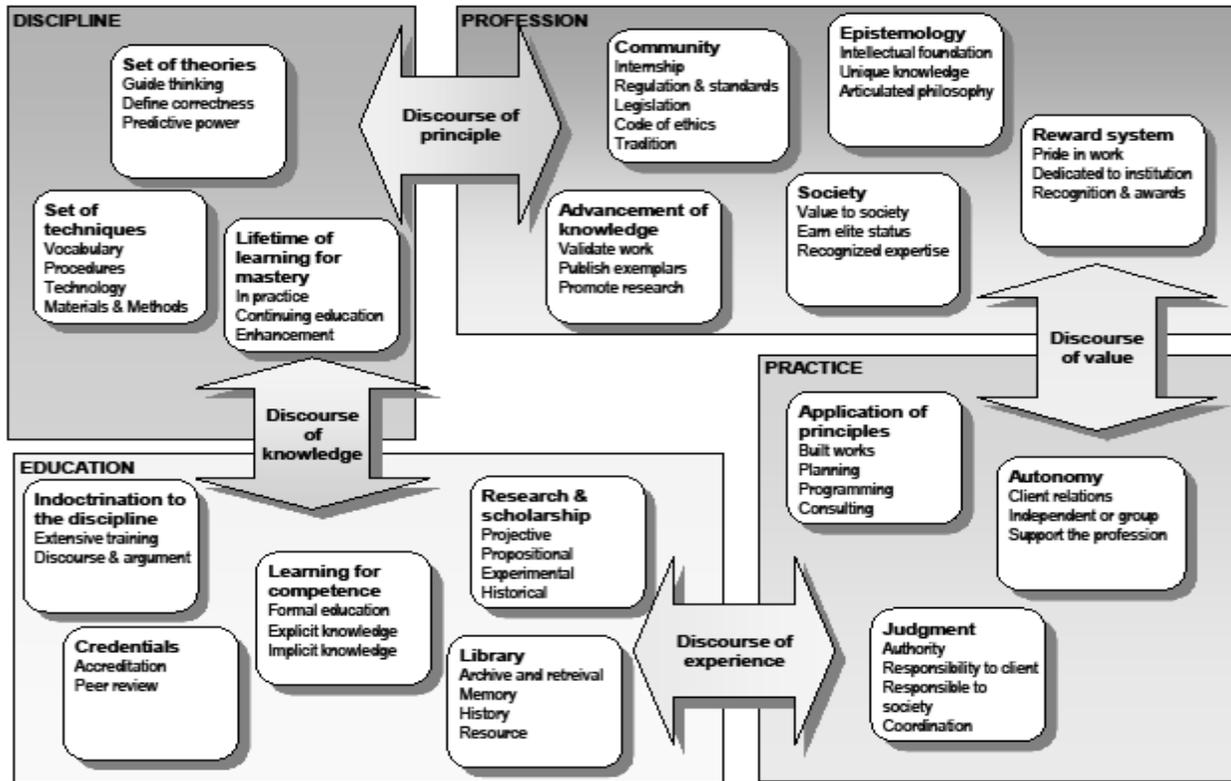


Figure 2. Domains of architecture showing four realms and four discourses, after Snyder 1977 (by author)

This commonality frames many parallels between the analytical - synthetic, generative - creative, and methodological - philosophical matrix of processes shared by design and research. It also demonstrates a potential shortcoming in the erroneous substitution of intuition in place of analysis. As Figure 1 diagrams, taking intuitive leaps of faith from design brief directly into design intention misses the generative-methodical identification of the rich, opportune, and unique essence every new design challenge presents. The corresponding sensitivity of research inquiry to such intuitive shortcuts is even easier to grasp. Without the exploration of a literature review critique of existing knowledge, for example, it is unlikely that the proposed question or hypothetical basis of such work would actually contribute to new architectural wisdom. More likely it results in self-serving exploration and is summarized as a report. Leedy (2001) has more to say on this threat.

A second framework (after Snyder, 1977) is offered to situate research-inquiry firmly in the complete domain of

architecture (Figure 2). Like any such professional domain, architecture is comprised by realms of professional principles, occupational practices, educational orientation, and disciplinary knowledge... all connected by discourses in knowledge, experience, principle, and value. Given that architects are allowed a monopoly on this particular domain of the built environment, it is incumbent on them to master a "large and difficult body of knowledge" (Snyder). That mastery includes attaining such difficult knowledge (education), service to society (profession), application in practice (occupation), and the nurturing and growth of relevant knowledge (discipline). Research represents the requisite disciplinary nurturing of architectural wisdom.

Overlaying these two frameworks in a single classroom pursuit activates the alignment of research-as-inquiry with design-as-inquiry. Whether for theory building or episodic practice, for rhetorical argument or empirical testing, or for performance versus aesthetics... research and design are equal, compatible, and commensurable means toward that shared ultimate end: new and novel architectural wisdom.

Table 1: Course calendar for Architectural Research Methods

Week	Topic	Mon. Team Meeting	Wed. Online Quiz	Fri. Interactive Topic	Due Fri. 9am
1	Information Literacy	Introduction	Focus Groups online	Scholarly Literature	Focus Group
2	Research Tools	Film: William Whyte	Quiz 1: Syllabus and Intro	Research Tools	Article Review 1
3	Literature Reviews	<b>Labor Day</b>	Quiz 2: Preface, Chapters 1&2	Literature Review	Article Review 2
4	Research and	Team Building	Quiz 3: Chapter 3	Research into Theory	Bibliography
5	Research and	BIM, and IP	Quiz 4: Chapter 4 & 5	Research into Design	Literature Review
6	Logical Argument	Concept Map of Topic	Quiz 5: Chapter 11	Logical Argumentation	Literature Review
7	Case Study Methods	Facts, Ideas, Opinions	Quiz 6: Chapter 12	Case Study Methods	The Question
8	Emancipatory	Argument Map	Quiz 7: Mid Term	Emancipatory Methods	Rationale
9	Historical Interpretive	Argument Map:	Quiz 8: Chapter 6	Historical Interpretive	Introduction
10	Qualitative Methods	Strategy, Tactic	Quiz 9: Chapter 7	Qualitative Methods	Methods 1
11	Simulation Research	Outline of Proposal	Quiz 10: Chapter 10	Simulation Research	Methods 2
12	Correlation Methods	Concept Map:	Quiz 11: Chapter 8	Correlation	Discussion
13	Experiment Methods	First Draft of Poster	Quiz 12: Chapter 9	Experiment	Proposal
14	Review	Review for final exam	<b>Thanksgiving</b>	<b>Thanksgiving</b>	Poster Draft 2
15	Poster Week	Review for final exam	Present in Atrium	Present in Atrium	Poster
16	Final Exams	Study Period	Final Exams	Final Exams	
17	Final Exams	FINAL EXAM	Final Exams	Closing of Semester	

## The Research on Teaching

One specific course is used here to illustrate and call for attention to the increasingly important but still greatly underserved topic of research on the pedagogy of architecture. While there is a great deal of well reasoned argument in print, the amount of empirical measurement on which to base and advance such arguments is slim and wanting (Bachman and Bachman, 2006, 2009, 2010b). Aside from the inherent value of using such research to better understand how the teaching and learning of architecture can be advanced, there are at least two other significant stimuli that will encourage this activity.

The first stimulus is best captured by the Carnegie Foundation's Academy program for the Scholarship of Teaching and Learning (SOTL or CASTL) which was launched in 1998. Part of the stated mission of this major initiative is explicitly to "bring to faculty members' work as teachers the recognition and reward afforded to other forms of scholarly work. (Carnegie Foundations, 2010)" Additionally, by making the usually private act of innovative teaching into a public discourse the program seeks to

"render teaching public, subject to critical evaluation, and usable by others in both the scholarly and the general community."

In short, the Carnegie Foundation is encouraging architectural educators to use their classrooms and studios as teaching laboratories, to publish the data and findings from those labs, and to claim scholarly accomplishment for the research such work entails. Currently, more than 200 universities, disciplinary societies, and higher education organizations are affiliated with CASTL in a "commitment to the scholarship of teaching and learning by exploring the place of such work in their settings, and undertaking activities that provide support and recognition for ongoing inquiry into evidence-based improvement of student learning."

*Table Two. Student learning objectives in Architectural Research Methods (from course syllabus)*

Use library and internet tools to search, locate, and collect appropriate and current information
Distinguish between primary and secondary literature as well as scholarly, peer reviewed, professional, and popular literature
Distinguish between research inquiry and design inquiry by comparing their variously differing and parallel endeavors of analysis, proposition, and synthesis
Given a particular work of architectural research: Identify its techniques of inquiry in the continuums of quantitative to qualitative and positivist to naturalistic... Describe its means of evidence and truth value... and delineate the position of the researcher as embedded, involved, or detached
Work within a team setting to produce a research proposal by use of shared discourse and critique, including the documentation of team discourse and the collaborative construction of concept maps
Write article reviews to analyze published works of architectural research and identify their essential components: primary question and sub-questions, situation against previously published work, epistemological and ontological assumptions, method of investigation, findings and limitations, and their generation of new lines of inquiry
Identify the role of research inquiry in the practice of architecture as episodic problem solving, programming, strategic planning, precedent analysis, commissioning, post-occupancy evaluation, and other empirical activities
Distinguish between personal subjective bias and shared basis of architectural critique, including the distinctions of heuristics, fallacy, qualitative versus subjective, adductive versus inductive, normative versus positive, and other relevant philosophical canons.
Identify the components of theory development in architecture, including explanatory frameworks and compelling truth value, Kuhn's principle of scientific evolution, and Popper's principle of falsification
Write a literature review of a discrete and specific architectural topic by organizing relevant publications into themes, critiquing each theme, and constructing a gap statement identifying potential new questions within the topic
Identify a novel, unique, and useful research question and write a logical argument to illustrate its generalized merit, anticipate reasonable objections, and to indicate how the question can be practically addressed
Link the nature of a research question to appropriate research methods of addressing it by selecting an appropriate mix of logical argument, case study, historical interpretive, qualitative, correlational, simulation, and experimental strategies as befits the respective characteristics, strengths and weaknesses of each strategy.
Construct a written plan for addressing a research question and describe the methods, strategies, and tactics involved
Continually use instructor's written narrative critique of recent submissions as feedback (generalized to the entire class); compare that feedback to the personal or team score received along with the published criteria for evaluation; correct the corresponding submitted work and reflectively refine personal thought processes and learning outcomes

The second imperative toward evidence-based research in architectural education is that of program assessment, evaluation, and accreditation. The new National Architectural Accrediting Board (NAAB) 2009 Conditions for Accreditation, for example, is clearly shifted toward an alignment with the Commission on Colleges (COC) annual reporting policy (COC 2010):

"The institution engages in ongoing, integrated, and institution-wide research-based planning and evaluation processes that incorporate a systematic review of programs and services that (a) results in continuing improvement, and (b) demonstrates that the institution is effectively accomplishing its mission."

The 2009 NAAB Conditions for Accreditation and 2009 Procedures for Accreditation require annual program reports with both statistical and narrative components that describe ongoing changes to the program. Section I.1.5 of the 2009 Conditions specify a culture of research and self assessment closely parallel to the COC policy of evidence-based research. Note how the following describes a research process of collecting data, organizing it into information, processing the information, and inferring new knowledge from it:

"The APR must include the following (NAAB 2010 p. 13):

- A description of the school's self-assessment process, specifically with regard to ongoing evaluation of the program's mission statement, its multi-year objectives and how it relates to the five perspectives.
- A description of the results of faculty, students', and graduates' assessments of the accredited degree program's curriculum and learning context as outlined in the five perspectives.
- A description, if applicable, of institutional requirements for self-assessment.
- A description of the manner in which results from self-assessment activities are used to inform long-range planning, curriculum development, learning culture, and responses to external pressures or challenges to institutions
- Any other pertinent information."
- An extra credit end of semester student survey using the validated Teacher Behavior Checklist (Keeley and Smith 2006)
- Student course evaluations (SCE) now completed online and digitally available as datasets for correlation and factor analysis
- Peer evaluation rubrics on final poster presentations
- Guest critic evaluation rubrics on final poster presentations
- Detailed item analysis from machine scored, 30 item, standardized final exam; including difficulty, validity, and discrimination index for each item and frequency distribution of each answer foil

It is critical to note here, that by incorporating the institutional requirements for self-assessment, the COC policy dictating continual internal research and curricular refinement becomes a mandatory component of NAAB reporting in all accredited programs.

### **The Classroom and Studio as Teaching Laboratories**

In the case of the subject course here on architectural research methods, several sources of data are mined and used for comparative measures of improvement. These data are typically available in most such courses. Note that much of the data collection is largely automated by the use of a course learning platform such as, in this case, Blackboard™:

- A required entering student course survey on prerequisites, expectations, resources, and interests
- Student performance against grading rubrics across the semester
- Itemized and categorized student performance statistics from online quizzes
- Student feedback from classroom response systems (CRS) on clicker survey questions given for attendance credit
- Student CRS scoring on interactive topic session clicker questions (automatically uploaded to Blackboard Grade Book)
- Student file access statistics on the course learning platform
- An extra credit end of semester student exit survey

Naturally such data are used to improve the course in the traditional mode of student course evaluation data and relative student performance on different course topics and the related learning objectives. Furthermore, the data collection process should contribute to the Institutional Effectiveness reporting to COC and NAAB (Table 3). Most importantly to the central argument of this paper however, the data are also the basis of scholarly research and the transition from the aforementioned "usually private act of innovative teaching into a public discourse." This present paper is the second such research publication to come directly from this course; the first being a study of benefits derived from the implementation of a classroom response clicker system (Bachman and Bachman 2010a). Given the background culture of assessment and accountability, the complimentary roles of design and research inquiry, and finally the growing public discourse on the scholarship of teaching and learning... the direction seems both valid and desirable.

### **One Course on the Teaching of Research**

Background for this entire discussion focuses on a required course in Architectural Research Methods, as taught in an undergraduate professional degree program in the third year of study. The prerequisite courses are two conceptual level technology courses and two Survey of Architectural History courses.

*Table 3. Template for a course data reporting form that would feed into COC and NAAB reporting data*

Instructor Name and Rank	Leonard R. Bachman, Associate Professor														
Course Number, Section & Name	ARCH 3365 10102 Architectural Research Methods														
Semester and Year	Fall 2009														
Average GPA Grade Given	x.xx (y.yy if only calculated for those who completed the course and took the final exam)														
Date this Report was Submitted															
Grade Distribution: enter frequency of each grade earned (number of students in course awarded each grade) and average GPA of all students who passed the course															
2009 Current Semester (from PeopleSoft records)															
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F	Drop	W	Total	GPA
Cumulative 2004 -2009 inclusive... cumulative GPA for those who passed course is x.xx															
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F	Drop	W	Total	GPA
2008 (from PeopleSoft records)															
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F	Drop	W	Total	GPA
<b>Overall course goal as subset of the college's defined program learning outcomes (PLO) and mission:</b>															
Students successfully completing this course will have demonstrated the collateral abilities of finding and evaluating relevant project information, composing a worthy question that potentially expands the "accumulated wisdom of architecture" (Gropius), defending and critiquing the worthiness of such questions, and of formulating a systematic approach to addressing those worthy questions. Underlying development of teamwork, argument, discourse, critique, and reflection on one's own thinking processes are inherent in this process.															
<b>Student performance criteria from current NAAB accreditation standards that are addressed in this course:</b>															
<b>Course student learning objectives (SLO) including behavior, condition, and criteria of evaluation (minimum of twelve):</b>															
Primary SLO's (at least two or three) examined this semester, preferably different from SLO examined in the previous three semesters:															
Changes implemented in this course since last time it was reported on:															
Description of data acquired in measuring SLO this semester and the instruments used to collect it:															
Description of other data collected in this course this semester for use in improving teaching and learning:															
How is the integrity of all the data validated? How reliable is the data? Describe for each data set collected this semester:															
Interpretation of the data as a diagnosis of course productivity and directive toward indentifying potential areas of improvement:															
Critique of the course learning productivity this semester in terms of its goals and SLO in the context of the college's PLO and mission:															
Summary of most recently received Student Course Evaluation data and comments, including workload management and learning culture:															
Plan to improve this semester's reported SLO and other SLO for this course, including workload management and learning culture:															
List all attachments, including data and data analyses:															
How is the reported data archived so that it is permanently available for administrative review?															
How is the privacy of the data being permanently secured in compliance with FERPA, the family educational rights and privacy act notice of student's rights? <a href="http://www.ed.gov/policy/gen/quid/fpc/ferpa/index.html">http://www.ed.gov/policy/gen/quid/fpc/ferpa/index.html</a>															
Extenuating circumstances encountered this semester:															
Narrative:															

This is a hybrid format course with Monday team meetings, Wednesday online quizzes, and Friday interactive topic sessions using "clicker" classroom response systems (Table 1). Students also work in about 20 groups of six each to collaboratively prepare a research proposal in weekly phases of submitted project work following the typical "personal curiosity, impersonal organization, and transpersonal methods" approach (Zeisel 1984). Work is submitted through TurnItIn™ plagiarism detection software on a Blackboard learning system. About half of the semester is spent in literature gathering, the literature review, formulation of a "gap statement", and finally getting to the research question. The process of preparing a proposal rather than a complete research project circumvents the issue of simultaneously learning about research and actually conducting it at the same time. It also avoids the actual time and resources necessary to conduct a full research project.

Groat and Wang's *Architectural Research Methods* (2003) is the textbook for this course. Student Learning Objectives (SLO) are given in Table 2. Taken as goals to which the SLO are tactically aimed, the course seeks to enhance a number of abilities specific to the realm of architecture and the general mission of architectural education:

- Information literacy
- Logical argument and discourse
- Teamwork collaboration
- Face to face interaction as well as online collaboration
- Self-critique and metacognition
- Shared critique and intersubjective agreement

The strategies of the course thus involve a plan based on interaction and shared outcomes (Table 1). A mixed format is employed:

- An opening focus group discussion is conducted online with randomized groups of students from the class to identify what students feel should be pursued as new architectural wisdom... within a theme developed for that semester's course offering
- Focus group response data is chunked into general areas of interest around which a research topic list is generated and for which individual students sign up into teams, usually two or three teams per topic
- Blackboard™ discussion web pages are established on the course learning platform for hosting and

documenting each team's "asynchronous" interaction outside of actual meeting time

- Monday class time team meetings are held during which a collaborative product (often a concept map) is produced each week toward development of a research proposal
- Wednesdays are given back as outside "hybrid format" time for twelve weekly, required, online, open book, reading exercise quizzes... these are "due" during what would normally be scheduled class time each week, but may be taken at the students' convenience up to the closing date... one quiz is a mid-term
- Friday interactive topic sessions are held using classroom response clickers with four or so clicker questions sprinkled into the topic PowerPoint™... these topics are the same as the ones covered on the Wednesday quiz (Bachman and Bachman, 2010a)
- An end of semester poster session is organized as a public display of the work and as an organized critique both peer to peer and with expert guest critics...
- A comprehensive 30 item final exam is given: multiple list answers, Scantron™ machine scored with detailed item analysis, and standardized questions have been developed across several years so that essentially the same exam is given each time and results can be compared

## Conclusions

Our postindustrial evolutions increasingly engage the value of proactively creating a better future through collection, interpretation, and strategic implementation of information. This is the basis of our information society, knowledge economy and learning organizations. The corresponding motivations to provide architectural research education in an era of increasingly evidence based and interdisciplinary driven design environments is matched in the profession by the advent of Building Information Modeling, Integrated Practice, and the increasingly cybernetic ability to see complex and dynamic relations that have been heretofore beyond both visualization and comprehension. The same thrust of proactive and knowledge based inquiry has created a culture of strategic planning, assessment and accountability into how we teach in the first place. This paper attempts to show how those activities intersect in the model of one course: the teaching of research and the research on teaching.

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