

Gesamtkunstwerk in Design: Interdisciplinary Design and Pedagogy

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<http://dx.doi.org/10.5659/AIKAR.2013.15.3.111>

Abstract This paper examines the interdisciplinary practice within design realms including urban planning, architecture, landscape architecture and interior design. It discusses the pedagogical approaches at design schools to foster designers capable of design challenge with interdisciplinary skills. As the complexity of contemporary multicultural society increasingly requires a higher level of expertise in professional service, no individual designer can be expert in all fragmented expertise across the whole design and associated engineering areas. A designer, therefore, should rely on the expertise of other practitioners in areas where he or she doesn't possess proficiency and educational background. From this sense the need of interdisciplinary approaches across diverse range of design and engineering through the collaboration is rising. Historically most of discussion made on interdisciplinary approaches is limited to collaboration between architecture and supporting engineering. This paper focuses on the collaboration with design realms. Three case studies done in an interdisciplinary firm are explored, focusing on design process that is non-linear and complementary. Finally the integrative pedagogical approaches to provide students with more exposure to allied disciplines are navigated with exemplary student work from interdisciplinary design studio.

Keywords: Interdisciplinary Design, Collaboration, Pedagogy

1. INTRODUCTION

Interdisciplinary design firms are becoming increasingly recognized as leaders in the profession as their built works draw more attention and publicity. Their work cohesively covers both large and small scaled projects in areas as diverse as urban planning, architecture, landscape architecture, interior design and engineering. The approach that interdisciplinary design involves having a team with differing design backgrounds look at a project concurrently promises a better quality of final work. The idea of this interdisciplinary approach is not new. The German composer, Richard Wagner, used the term "Gesamtkunstwerk" meaning "total work of art" or "synthesis of the arts", in his 1849 essay "Art and Revolution" and "The Artwork of the future," where he spoke of his

ideal of unifying all works of art through the theater. The notion of Gesamtkunstwerk in an architectural context was employed by Michelangelo during the Renaissance, the Austrian architect and sculptor John Bernard Fischer von Erlach in the Baroque, Otto Wagner and Henry van de Velde during Art Nouveau, and by the members of the Bauhaus in the modern era. It is well known that the notable architects Frank Lloyd Wright and Alvar Aalto envisioned every aspect of a project including building, furniture, lighting fixtures, and even textiles. These examples of Gesamtkunstwerk, however, were performed by a sole designer within an architectural realm, though their work showed a very diverse sense of creativity regarding many aspects of design. As an increasing complexity required by the contemporary multicultural world demands an increased level of expertise in professional service, no individual designer can be an expert in all areas of expertise across the whole design and associated engineering realms. A designer should depend on the expertise of other practitioners in areas where he or she doesn't have proficiency or an educational background. From this reality, it can be seen that an expanded idea of Gesamtkunstwerk, one that includes a diverse range of design and engineering professionals collaborating together on the completion of projects is needed. Most discussions about the interdisciplinary approach thus far have been about the collaboration between architecture and engineering in areas such as structural design and sustainability. This paper delves deeper into interdisciplinary practice within the design realm including urban planning, architecture, landscape architecture and interior design, as well as the needs of an interdisciplinary pedagogy at the schools

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The author would like to acknowledge Nathan Andrew Butt, AIA at Sasaki Associates Inc. who shared valuable ideas on interdisciplinary practice; HyoungSub Kim and Youngjun Jo at Design Schools, University of Pennsylvania who provided interview and their studio works.

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where future designers are educated. In Section 2, the definition, the need and the methodology of interdisciplinary design are discussed. Section 3 introduces the interdisciplinary design process through specific projects done in an interdisciplinary firm. Section 4 investigates the need for a change in the academic structure to nurture designers capable of facing design challenges with an interdisciplinary mindset, and then introduces an example of interdisciplinary design studio.

2. INTERDISCIPLINARY DESIGN

(1) Definition

Regarding the collaboration among different disciplines, there are a couple terms which need to be defined. The words multidisciplinary and interdisciplinary have been used consistently to denote scientific research that involves a number of disciplines. In multidisciplinary research, each discipline works in a self-contained manner, while in interdisciplinary research an issue is approached from a range of disciplinary perspectives integrated to provide a systematic outcome (Bruce et al., 2004). The final knowledge is more than the sum of its disciplinary components (Despres et al., 2004).

(2) Needs

There are subjects that each design area should consider when designing a project in order to cover all areas from the urban scale to the building interior scale. These subjects can be categorized according to the inherent scale of design areas (Table 1). It is noted that each design area explores the design subject at its distinctive scale to be shared among other areas.

Table 1. Category of Design subjects by design areas

Design area	Design subjects
Urban design	Socio-cultural evaluation at macro scale Block program assessment Building scale, orientation and layout Open space scale and connection to urban fabric Circulation patterns at macro scale Sustainability at macro scale
Architecture	Socio-cultural evaluation at local scale Building program assessment Building scale, orientation, layout and proportion Open space shape and connection to/from building Exterior and interior material Sustainability at building scale
Landscape architecture	Socio-cultural evaluation Connection to/ from building and urban fabric Open space character, scale and material Sustainability at outdoor space
Interior architecture	Socio-cultural evaluation at micro scale Building program assessment Spatial dimension Spatial layout per use patterns Interior material Sustainability at indoor space



Figure 1. Establishment of team framing on design subject among design areas

As our rapidly changing socio-culture redefines the perimeters of the basic idea that the design areas of urban design, architecture, landscape and interior architecture provide for humanity's needs, the boundaries between these design areas in combining functional space and experiments with creativity are rapidly blurring. Additionally, the complexity of current design issues in relation to urban planning, architecture, interior architecture, sustainability and even graphic design require problem-solving approaches based on the unique methodology of each design area with increasing expertise rather than a single approach to cover all. As can be seen by overall trends in contemporary design, it is almost impossible to separate the design of a building from the urban setting and the design of its interior. The architectural design corresponds with larger ideas of urban planning. The interior space and its impact on human behavior evolve directly from the conceptual ideas of the building as a whole and its role within the urban realm. The landscape design is seen in the context of the urban frame, creating an urban-scale landscape that extends into the building, forming interior and exterior spaces. Different design areas that were understood independently in the past have already become closely related. The change of relation between socio-culture and design among different design areas requires designers to look at the world through multiple lenses. In order to keep up with this change, an interdisciplinary approach needs to be employed.

(3) Methodology

Schön (1987) argues that design is a socially constructed activity and 'frames' shape design activity as ways of 'seeing'. Frames are considered sense-making devices that establish the parameters of the design problem, its solution, or both (Gray, 1996). When studying the individual designer, framing is a cognitive process that directs a designer's actions; when studying the design team, team framing is a collective activity that is performed through knowledge exchanges between team members (Valkenburg & Dorst, 1998). Dong et al. (2012) maintain that frames are discursively constructed during the collaboration process and encapsulate the knowledge shared by the team. Since frames are a 'share way of seeing' at a specific moment in the design process that directs the team's actions, they allow for orchestrated design team activity. Teams focus their efforts as they collaboratively frame the problem and

solution space together. In particular, frames form the context of what is being considered and form a 'rationale' detaining why an artifact was designed the way it was (Dong et al., 2012). Generally designing the built environment requires forming of the design team, which implies a weaving of the individual areas of expertise of each specialist designer. Team framing, therefore, is critical to the performance of teamwork in built environment design areas. A difference exists between the traditional and interdisciplinary design process in terms of establishing team framing. Traditionally decisions on the design approach are made from the large scale to small scale: urban planning to architecture to landscape and interior architecture. Under this linear top-down decision-making process, the design framework that is developed and decided by one design area of a large scale is given to other areas of a small scale: the urban approach provides architecture or landscape architects with an overall framework to follow; they then give a smaller framework they define to interior or landscape architects. The main idea often can be distorted or lost during delivery. It is hard to expect that design areas of large scale can reflect the ideas of those at smaller scales. The linear top-down design process doesn't contribute to the establishment of team framing, which results in less design consensus and incohesive design solutions among different areas. In contrast, the interdisciplinary design approach involving multiple disciplines can allow a team to look at a project in the big picture. Not a tree, as the saying goes, but the forest. The team framing established during the redefinition of problems outside of the normal boundaries at an early stage to reach solutions based on a new understanding of a complex situation can direct the team's actions and allow for a cohesive solution through goal-directed approach.

The relationship among the different design areas can produce a different quality of design. Steel et al. (1999) showed in the experiment of workshops that teams that were not provided with a design framework tended to progress in a number of iterative bursts and the use of a pre-defined design framework did not lead to better design proposals, nor reduce the time taken to complete the project. There is general agreement that a great number of design iterations can enhance design quality and a design framework given by others can limit the creative potential of the team members. The aforementioned top-down process employed by the traditional design approach provides other areas with the pre-defined framework into which they hardly can incorporate their needs, area of expertise and insight. This relationship makes design areas of small scale subordinate to others of large scale. The interdisciplinary approach, on the other hand, allows the different design areas to find multiple frameworks in common con-

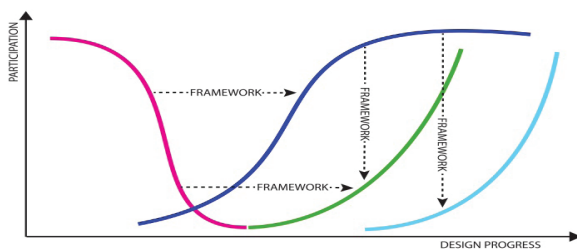


Figure 2. Workflow of traditional top-down process

currently through knowledge exchanges between team members with different areas of expertise. Since all different and coordinative areas look at the project to find a common solution, a variety of ideas can be introduced through the different lens of each area with numerous iterations, increasing the quality of the overall design solution. In regards to the time taken for the whole design process, the non-linear interdisciplinary approach requires more time and effort in finding a design framework in common at an early stage through team framing compared to the linear and top-down process of the traditional approach. Team members in an interdisciplinary environment, however, can draw on their own knowledge to realize actions that are consistent and congruent with their teammates', which expedites subsequent processes. Setting up the design consensus at an early stage can minimize the design changes caused by inconsistent design direction later on, which can be discovered until late in the process when it is expensive or even impossible to change in the traditional process. Another impact on the design process is the client's input. The traditional design process presents the design proposal to clients at design milestones when they provide feedback and make a decision. In the traditional way, clients are informed of design progress independently for each design area, which disallows them to review the project from a comprehensive and integrated perspective. The clients' fragmented feedback to designers and the incorporation of it into the design solution can make a critical impact on the whole project schedule and budget.

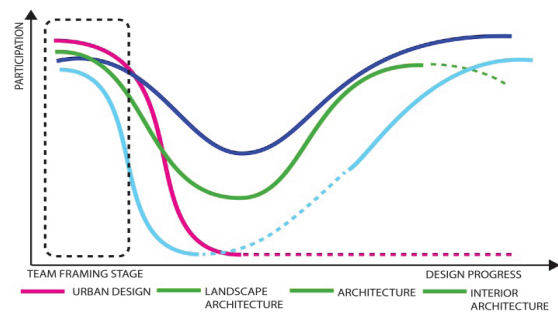


Figure 3. Workflow of interdisciplinary process

(4) Collaboration environment

Effective design activity relies on all of the team members supporting each other and the interaction of every member of the project team. Design solutions emerge not only from flashes of inspiration by individual team members, but also through interactions and negotiations among team members (Steele et al., 1999). The interdisciplinary approach involves multiple disciplines redefining problems outside of the normal boundaries to reach solutions based on a new understanding of a complex situation. With the resourcefulness of having urban planners, architects, interior designers, landscape architects, civil engineers and graphic designers available, an interdisciplinary approach will allow a team to look at a project in the big picture. In order to maximize the benefit of interdisciplinary practice, collaboration among the different disciplines needs to begin at an early stage and remain continuous. From this perspective, an interdisciplinary firm that has diverse professionals in house is better than the organization of

a team with individual outside consultants. Having engineers in the office full-time benefits the firm through insights that emerge from impromptu meetings and casual conversations. These are less likely to occur if, as with outside consultants, meetings are infrequent and tightly scheduled (Novitski, 2009). den Otter and Emmitt (2008) also argue that in their collaboration patterns, team members prefer face-to-face interaction through direct design dialogues instead of asynchronous technology-mediated communication. Leading design firms are practicing interdisciplinary design and providing these services to their clients who are seeking a single source for all design services. Employers consider these integrated services as an added value of the firm and a way to increase its marketability. Working in an interdisciplinary firm helps team members see and respect what the other discipline's needs and areas of expertise are. Professionals can learn from each other. The interdisciplinary design environment is immensely educational for everyone involved.

3. CASE STUDIES

(1) Interdisciplinary environment

The firm in which the author has been working for over 6 years is an interdisciplinary firm in Boston founded in 1953 by a former head of the landscape architecture department at Harvard University. The firm now has more than 240 employees in urban design, landscape architecture, architecture, interior design, civil engineering and graphic design. It is organized around the concept of Studios. Each studio is comprised of an interdisciplinary design group focusing on a broad range of project types within the studio area of expertise: Campus, Urban, Sports, and International. Simultaneously providing organization and flexibility, project management is firmly based in one Studio, while the creative team is often comprised of members of multiple studios to insure the success of complex projects. In order to encourage the collaborative and interdisciplinary spirit across the firm, the studios have an open and democratic format with multiple pods to accommodate project-based designers from diverse disciplines with multiple communal areas to spur intellectual investigation and discussion. Landscape architects meet with urban planners; architects strategize with specialists in eco-technology; interior designers seek to learn from graphic designers and vice versa. Designers are encouraged or even required to step outside the normal boundaries of their own professional disciplines. In the next sections three case studies of specific projects completed via an interdisciplinary process will be presented.

(2) Case study 1- Beirut Water Front Park: seaSCAPE

This international competition for a new urban park (Beirut, 2011) is inspired by the sea. The new Waterfront Park seeks to reconnect the diverse people of the city to each other and the water. It offers a significant new public landscape that will both catalyze the district and begin to fill the void that now exists of active, green spaces in the city. From the beginning of the project urban planners, landscape architects, architects and civil engineers form a team. The design idea that the entire team came up with at the brainstorming session is to express the culture of the sea, to embody the cosmopolitan collective, to restore the spirit of the sea, to provoke cycles and systems, and to revitalize the social and cultural fabric.



Figure 4. Site Plan, Beirut Water Front Park

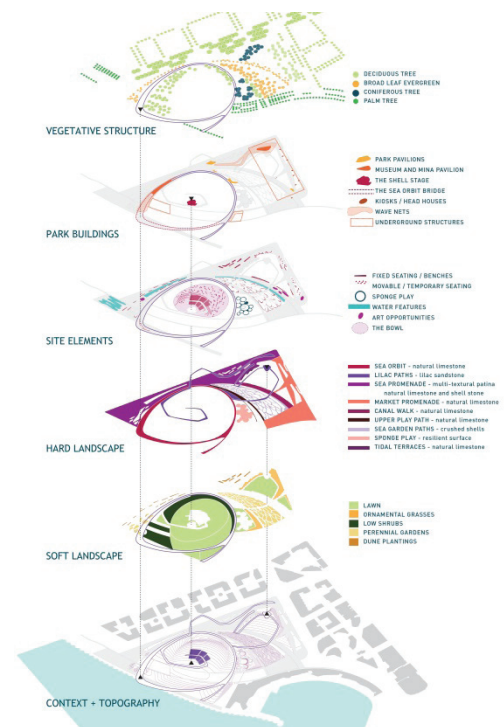


Figure 5. Diagram of Site elements, Beirut Water Front Park

The first priority is to identify the character of the urban park within the Waterfront district to provide a major platform for the creation of a great new mixed-use destination in the city. Urban planners investigate socio-cultural and economic research to determine the overall scale of the park and establish which architecture and landscape programs would be in demand. Landscape architects also explore socio-cultural aspects focusing on the vernacular landscape. Then the character of the urban park, seaSCAPE is created. It provides a green oasis for the whole community within a dense city fabric, a distinctive and iconic destination in an emerging

district, and a place for individual delight, respite and community within the context of urban living. The next step is the concurrent feedback-loop among the different design areas: urban planners explore the location and shape of the overall planning approach in relation to urban circulation. Landscape architects propose pedestrian paths as well as the shape and size of landscape features that correspond to the urban planners' ideas. Architects study building program, size and location based on urban planners and landscape architects' research. From the standpoint of sustainability the civil engineers review the interim design solution and suggest the most functional direction to landscape architects. This process is nonlinear and very iterative. One design proposal from urban planners affects both architects and landscape architects. Agreed upon solutions between civil engineers and landscape architects may not work with the function of an architect's building design. Negotiations through team interaction narrow down the design direction and continue until an optimal design solution that meets all areas' needs is discovered. After the main design direction is settled upon, the role of the urban planners decreases but they still participate in regularly scheduled meetings to provide feedback as the design progresses. Architects and landscape architects focus on developing the overall design at a detailed level with team framing that helps team members adhere to the established design direction and pursue work accordingly to fulfill that goal. Designers from the different disciplines brought their own expertise and unique perspective to regular meetings twice a day in order to experiment with integrated design through an iterative process. Casual conversation among team members or even with outside teams helped inspire the design approach. Numerous impromptu exchanges of information expedited the design process.

(3) Case study 2- University of North Carolina at Charlotte South Village and Dining Hall

The project team for the creation of this student housing village and a dining hall included an urban planner, civil engineer, campus program expert, architects, a landscape architect and an interior designer. The design team analyzed and applied the site constraints and priorities for building massing in developing a series of key design factors that organize the planning of the South Village. These include the creation of two neighborhoods, a pedestrian street linking them and a dining hall as a hub of village. The existing four residential towers, wooded draw and waterway that runs north-south through the South Village sector provide a natural delineation between the east and west sides of the site.



Figure 6. Visitor Center, Beirut Water Front Park

Table 2. Design contribution by design areas, Beirut Water Front Park

Subjects	Area				
	Urban design	Landscape architecture	Architecture	Interior architecture	Civil engineer
Socio-cultural research	●	○	○		
Program assessment	●		○		
Open space shape and scale	●	●			
Circulation pattern	●	●	○		
Building program assessment	●		●	●	
Architectural development			●	●	
Sustainability		●	●	○	●

The University wanted one large residential community to meet their 20-year expansion plan. First, the urban planner and campus program expert investigate the program types and sizes needed to accommodate the future expansion plan based on the University's feedback. Next, the team explored the feasibility of what would be implemented based on previous research on the challenging site conditions, and arrived at a solution suggesting not one community, but two neighborhoods bordered by the woods, the draw, and loop road to the south. Both neighborhoods enjoy shared access, views to the woods, and connections to paths that lead back to the central campus. On studying the building layout with the future and current circulation patterns as variables, the team is divided based on two schemes: an urban planner and architects propose the courtyard scheme that represents a strong community identity (Figure 7).

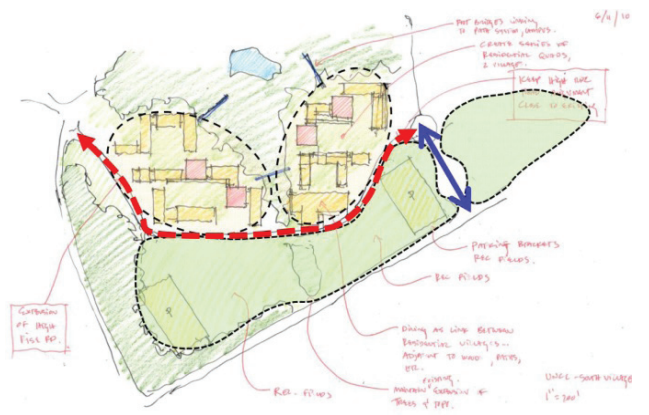


Figure 7. Building layout of courtyard scheme, UNCC.

A civil engineer and a landscape architect, in contrast, propose a linear scheme following natural contour lines in order to minimize the environmental impact on the challenging topography, which the courtyard scheme could not overcome. The team reaches a compromise between the courtyard and linear scheme as seen in

the final site plan (Figure 8). The ways to connect two villages reflecting that hybrid scheme are investigated in parallel by the different disciplines: An urban planner and architects propose a pedestrian- dominated “Interior Street” linking the east and west neighborhoods. A campus program expert and an urban planner propose orienting the academic and support program elements along this Interior Street, supporting integration of the various communities. A landscape architect suggests a series of open spaces linked to the Interior Street, fostering outdoor programs.



Figure 8. Interior rendering of Dining hall, UNCC.



Figure 9. Final Master Plan, UNCC.

The new residential dining hall is centrally located between the two neighborhoods. The dining hall serves as a hub of community interaction and a destination that integrates the South Village with the central campus. The need, location and size of this dining hall have been studied by the whole team from the early stage of the design process. Once the specific design of the dining hall started the collaboration between architects and an interior architect increases. The architects study an overall building program configuration corresponding to service access and students’ access at different levels. The interior architects explore serving patterns and various seating layouts with distinctive features. During a great number of these design iterations, the solutions of architects and interior architects affect each other. A landscape architect suggests an outdoor terrace dining space that responds to the wooded site. This whole design process is non-linear and interdependent within an educational atmosphere.

Table 3. Design contribution by design areas, UNCC.

Subjects \ Area	Area				
	Urban design	Landscape architecture	Architecture	Interior architecture	Civil engineer
Overall project feasibility study	●	●	●		
Program assessment at macro scale	●				
Circulation pattern	●	○	○		
Building layout, scale and orientation	●	●	●		○
Building program assessment	●		●	●	
Architectural development			●	●	
Sustainability		●	●		●

(4) Case study 3- Alabama State University Student housing implementation

This project (Montgomery, Alabama 2009-2011) evolves from the goals outlined in the Campus master plan (Figure 10) that the author’s firm previously completed. Key objectives of the plan include supporting enrollment growth, improving the quality of student and residence life, creating a pedestrian oriented campus and improving the campus image and identity. The Campus master plan identifies organizational principles that need to be considered on the site. The program for the architecture project is a 500-bed student residence hall and its associated common spaces. During early studies the architects discuss with urban planners the flexibility of the building layout within the site that the campus master plan had already defined. In contrast to the two previous projects, an interior architect is involved in the early design process because the University requires a very in depth consideration of the new types of living space that can successfully reflect the needs of student culture. The collaboration between architects and interior architect creates different unit types: All student beds are located within suites providing students with a small community within the University. The suites are programmed around a shared living room and bathroom facilities, each contained within the suite. With these given unit types, the architects begin laying out building massing options and configurations mixing the unit types to accommodate 500 beds. This stage also requires collaboration with landscape architects and campus planners. A series of discussions with them lead to placing entries at key locations relating to larger campus circulation patterns and incorporating immediate campus adjacencies including service areas, pedestrian walks and changes in grade into the design approach. In parallel with the landscape architect’s direction, the buildings are configured to define positive outdoor spaces such as plazas and tree shaded lawns to enhance and activate the exterior character of this campus district.



Figure 10. Initial Campus Master Plan, ASU

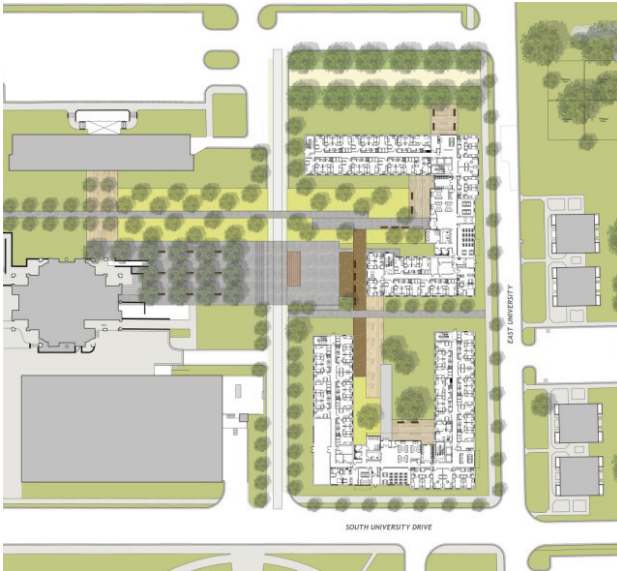


Figure 11. Final Site Plan of Student housing, ASU

Special attention, based on early discussions with urban planners, is paid to implementing the spatial configurations proposed in the master plan so that they function as a temporary condition and as a component of the completed plan. The design of the project continues development of the fabric of the campus. Based on the campus planners' research, architects articulate common spaces, including lounge and study spaces on each floor of the residence hall and interior lobbies on the ground floor, with lounge seating, group study rooms, computer labs and a visitors lounge, as well as a fitness room and laundry facilities. These common spaces provide opportunities for communities to meet and provide a link to the larger campus life outside the residence hall. The subsequent study of the building elevations requires the architects and interior architect to revisit the unit types because the horizontal and vertical repetition of unit types would decrease the richness of the building elevations. The architects and interior architect, therefore, revise unit types that directly affect building elevations where needed.

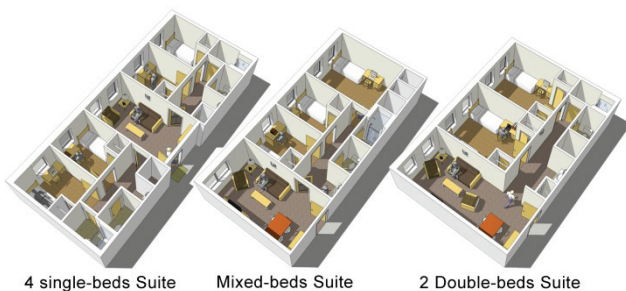


Figure 12. Unit types. ASU

Table 4. Design contribution by design areas, ASU.

Subjects	Area			
	Urban design	Landscape architecture	Architecture	Interior architecture
Socio-cultural research		○	●	●
Building program assessment	●		●	○
Circulation pattern	●	●	●	
Building layout	●	○	●	
Open space character and scale	○	●		
Architectural development			●	●

4. INTERDISCIPLINARY PEDAGOGY

(1) Paradigm shift

As explored in the previous section, complex projects are implemented by a team of specialists. Team members contribute their specific talents and competencies in relation to the scale at which they work. A difference exists between the professional requirements of designers and the education earned in design programs at many schools. Rigid curricular boundaries are placed between different disciplines to ensure that students achieve expertise in a specified domain. Unfortunately, this model exists in direct contrast to the interdisciplinary reality of the professional world since each specific discipline was taught independently (Fruchter, 1994). Senge (1990) points out the fragmented way that we have been trained to solve problems: From a very early age, we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price. We can no longer see the consequences of our actions; we lose our intrinsic sense of connection to a larger whole. When we try to 'see the big picture,' we try to reassemble the fragments in our minds, to list and organize all the pieces (Senge, 1990). Our traditional school curriculum has been largely based on the concept that instruction should be separated into distinct subjects for ease of understanding and then reassembled when complex applications are required. Although it is assumed that students readily re-connect their school knowledge and then use it in an applied context outside of the classroom, a recent research does not substantiate this belief (Crohn, 1983; Hawkins, 1982). The traditional pedagogy for design has not been an exception. The majority of design schools have used a studio-based approach as a standard model for design education derived from the atelier system of the education of architects at the École des Beaux-Arts in the 19th century. The studio asks students to become short experts on the areas outside

of their expertise and then propose solutions to simulated design problems by implementing their creative and technical skills. Since the average design student does not possess an extended knowledge of other disciplines, a lot of issues remain unnoticed, unresolved, and unquestioned, which eliminates room for innovation, unexpected positive results and extensive thinking outside of their own discipline (Farthshenko, 2012). Findeli (2001) maintains that design education is currently undergoing a paradigm shift that promised to revolutionize the field by articulating both a new methodology and a new end for realizing design projects. Findeli believes the entire design project needs to be conceived in a different way. Instead of problem and solution, there would be a system as it now exists and a system as it might exist in the future. The role of the designer would be to understand the system and to work with it, not against it, for a change. Findeli also argues that design education needs to develop a system theory that would allow an understanding not only of planned artifacts but also of the invisible relationship among the inner worlds of designers and the client and the outer worlds of society and the biosphere. Under such a paradigm the end of design would become an open horizon of values and possibilities-not a solution to a problem (Findeli, 2001).

(2) Interdisciplinary approach

The contemporary complex and multi-layered nature of design requires increasing interdisciplinary professional collaboration. This requires the academic structure in design schools to evolve in order to create designers capable of meeting design challenges with interdisciplinary capabilities. The integration with different design disciplines is very important so that study in the different design realms enables students to work in the collaborative method that they would confront in the professional world. Students are seeking a broader exposure to allied design disciplines: architecture, furniture design, graphic design, industrial design, as well as the specialization of their own discipline (Coleman (Ed.), 2002). The integrative and interdisciplinary curricular approaches among urban planning, architecture, landscape architecture, and interior design education aim to help students understand the correlation of how different school disciplines are tied together and how each subject builds on the other. By breaking down the autonomy among those disciplines, students can realize that there is a relationship between the knowledge in one discipline and that gained in another. Examining this critical relationship will enable students to better understand the applicability of the different design areas in approaching a complex project. Harris et al. (2004) observe the recent growth of interdisciplinary programs in higher design education to correspond to this change. This education can result in broadening a student's design horizons and helping them understand the interdisciplinary process in practice. Farthshenko (2012) asserts that collaborating and being exposed to a wider range of disciplines can produce innovative results. The benefits shown below are found through a survey of 86 design institutions in Canada.

- Students improve conceptual and critical thinking.
- Students have a better perspective of design as an interdisciplinary subject.
- Students develop skills that are transferrable across disciplines.

- Students become better designers.
- Students can be more motivated working on interdisciplinary projects.
- The interdisciplinary approach promotes creativity by reducing imitation.
- The interdisciplinary approach provokes more experimentation.
- The interdisciplinary approach improves communication skills.
- The interdisciplinary approach helps to determine a student's particular areas of interest.

Farthshenko observes a concern as well:

- Collaborative thinking can suppress individual ideas.

(3) Case Study: Design Schools, University of Pennsylvania

This section introduces the interdisciplinary studio at the University of Pennsylvania as one of the design schools successfully offering interdisciplinary studios, and then investigates a specific studio; focusing on the general studio structure, approach, example of students' work and an interview asking their experience of the whole design process. Founded in 1868, the school of design of the University of Pennsylvania has a school of architecture, city & regional planning, fine arts, historic preservation, landscape architecture and urban spatial analytics with 633 students. The school of design has been running interdisciplinary studios for five years. Based on the belief that the power of cross-disciplinary education allows students from different departments to share their visions and design approaches that converge on the territorial/urban arena, this exposure provides participants with tools to successfully perform future interdisciplinary professional work. There are six interdisciplinary studios offered amongst the school of architecture, city & regional planning and landscape architecture in the spring semester 2013, as shown below:

1. The Pueblo World: Setting, Continuity, and Change in the Indigenous Culture of the Southwest
2. Megastructural Landscape: Jersey Shore
3. PondHouseSpring HousePond 2
4. Philly Playscape Potentials
5. (Anticipating) The City that never was
6. An international, Collaborative and Open Studio

The students in the given studios are from the school of architecture, city & regional planning and landscape architecture. Instructors of each studio consist of faculty of each discipline plus other external specialists including governmental authorities, artists, engineers and hydrologists, depending on the special topic of each studio. Generally these interdisciplinary studios start at understanding the large scale: regional processes, identifying places of potential for urban growth, conservation, and culling more specific design strategies. Then, work is undergone at a smaller, local scale, making from their overall fabric a set of detailed architectural proposals. Students are asked to express cohesive proposals with a unique quality, integrating both building and landscape. The studio Pueblo World: Setting, Continuity, and Change in the Indigenous Culture of the Southwest will be investigated regarding the general studio structure, the approach- with examples of students' work and an interview on their experience through the whole design process. The studies and studio work provide the opportunity for

direct collaboration between landscape and architectural students and faculty, in the investigation of new programs and inhabitation in a place of cultural meaning and resonance, as well as specific and challenging environmental conditions. Students will investigate the productive and learning potential of work across disciplines, and interact over issues such as site design, site and building ecology and their relationships, cultural form and practice, historic and cultural landscape, conservation and sustainable development. The projects include the identification and (re)development of a cultural district and the design of a new (revived) settlement with housing for 300-400 families and regional services. The studio will investigate site design, new housing prototypes, commercial and transit oriented development at this unique location, and at the same time study the long history of settlements that might inform and guide contemporary settlement patterns and ecological sustainability in the arid southwest (course syllabus 2013). Three students from architecture, city & regional planning and landscape architecture are required to form a team and to begin research on the individual subjects including history and human social environment in a collaborative way. Then, teams begin an initial project of a shelter design, as a small object-like residence, which enables architecture

students to consider the surrounding site and landscape architecture students to think the engage in the architectural design of the structure of residence. The subsequent projects ask teams to investigate issues from the urban scale to the local scale; from planning a 400 family housing community to planning a 20 family housing cluster to specific living unit designs. For the planning of the 400 family housing community teams are encouraged to lay out the community based on an analysis of the landscape, referencing the historical character of Pueblo inhabitations corresponding to topography and the layout of institutional and commercial programs in an axial configuration (Figure 13 & 14). At the next level of planning, 20 family housing clusters and living unit design, teams have the opportunity to consider the interface at which architecture and landscape meet, focusing on the organization of courtyards and arcades of the commercial district, backyards, parking spaces, and a cohesive sustainable approach through roof gardens, courtyards, and community parks (Figure 14, 15 & 16). At the weekly review during design development, instructors from architecture, city & regional planning and landscape architecture provide critiques together to provide students with comprehensive feedback. At the end of the semester authors of an example project described the value of the interdisciplinary efforts and process:



Figure 13. Site plan of 200 households, The Pueblo World



Figure 15. Housing Unit Concept, The Pueblo World



Figure 16. Hierarchy of outdoor space, The Pueblo World



Figure 14. Diagram of Building program, Sustainability & Open space, The Pueblo World

“Our team members have different disciplinary backgrounds that result in a different base knowledge and point of view towards the project. Except for the time when we need to split efforts into individual specialties during times of rapid production required due to time constraints, mostly we work together from scratch and orchestrate ideas brought to the table instead of informing other team members of what one person does in his/her expertise. Of course this can be time-consuming where critical communication is required. The success of this studio to us is twofold: The final quality of our work has a higher degree of completion. This project required a diverse set of viewpoints to work through the entire process. No single person can figure out all issues at different scales. We are team members with different design outlooks

and competencies, so collaboration provides a complementary approach that creates a cohesive whole. Secondly we learn to understand what other disciplines involve through the collaborative process. Although it is not necessarily an in-depth analysis of different disciplinary approaches, this learning is very valuable. Within the large framework through which we create a cohesive process from large scale urban design to interior design, having a universal general sense of understanding might be more important than expertise in specific disciplines. This universality, understood through the distinctive lens of each area of expertise, can give distinction to each discipline. This interdisciplinary studio enabled us to develop a universal sense of design from working with each distinct discipline. Where expertise of one discipline meets the universal approach of collaboration, we can find opportunity to further develop our own area of expertise". (From interview with students of The Pueblo World Studio)

(4) Challenge

Since this interdisciplinary approach in design schools is a recent and growing shift, there must be room for discussion on the benefits, concerns, and the ways to integrate it with curriculum. In order to build these interdisciplinary curricular approaches, teachers and administrators among different disciplines are required to have a commitment to integration, innovation in curricular design, and the coordination of an integration plan. If one believes that a more aligned and collaborative practice is in our future, then the process for getting there can either be unilateral or collaborative. It may be more productive in the long run to promote a dialogue between the professions in pursuit of a new collaborative model that does a better job of supporting disciplinary specialty (Weigand, 2013).

5. CONCLUSION

As an increasing complexity of the contemporary multi-cultural world requires an increased level of expertise in professional service, no individual designer can be an expert in all areas of expertise across the whole design and associated engineering realms. A designer should depend on the expertise of other practitioners in areas where he or she doesn't have proficiency or an educational background. From an understanding of this it can be seen that an interdisciplinary approach across a diverse range of design and engineering professions through collaboration are needed. Interdisciplinary design has been observed historically, but most of the discussions thus far concern collaboration between architecture and engineering on issues such as structure and sustainability. This paper more deeply examined issues of interdisciplinary practice within a larger design realm, including urban planning, architecture, landscape architecture and interior design within an interdisciplinary firm environment. Three case studies showed design approaches and process through collaboration across diverse disciplines with varied areas of expertise. They are non-linear and complementary within efficient cycles of design experimentation. In order to educate future designers who are capable of design challenges with interdisciplinary skills, a change in academic structure is required. The exposure to allied disciplines will lead to the creation of design generalists, but rather promote a better understanding of what others can bring to the table.

6. DISCUSSION

This paper looked at the example of an interdisciplinary firm that accommodates in-house professionals from different design areas. It can be pointed out that increasing the number of in-house staff in multiple disciplines could harm the viability of small specialized offices. It is also impossible for all design firms to realistically be interdisciplinary practices. The creation of a new business model to protect small specialized offices needs to be investigated. Establishing new relationships with outside consultants to meet the principles of an interdisciplinary approach should be considered as well. Further research on curriculums at design schools would develop a better understanding of the dynamics of interdisciplinary design and its pedagogical benefits to students. The integrative and interdisciplinary curricular approaches among different design disciplines would not be an easy task from the standpoint of the administration. Most notably, how professional accreditation organizations, professional associations, registrations, etc. can promote this cross-over should be investigated.

REFERENCES

- Bruce, A., Lyall, C., Tait, J. & Williams, R. (2004) "Interdisciplinary integration in Europe: the case of the Fifth Framework programme." *Futures*, 36(4): 457-470.
- Coleman, C. (Ed.). (2002) *Interior design handbook of professional practice*. New York: McGraw-Hill
- Crohn, L. (1983) *Technological literacy in the workplace*. Portland, OR: Northwest Regional Educational Laboratory, Education and Work Program.
- Dong, A., Kleinsmann, M. S., & Denken, F. (2013). "Investigating design cognition in the construction and enactment of team mental models." *Design Studies*
- den Otter, A. & Emmitt, S. (2008) Design team communication and design task complexity: The preference for dialogue. *Architectural Engineering and Design Management*, 4(2), 121-129.
- Despres, C., Brais, N., & Avellan, S. (2004) "Collaborative planning for retrofitting suburbs: Transdisciplinarity and intersubjectivity in action." In R. J. Lawrence & C. Depres (Eds.), *Transdisciplinarity*. *Future*, 36 (4 special issue): 471-486
- Farthshenko, L. (2012) "Using an Interdisciplinary Approach to Promote Creativity: Investigating Canadian Post-secondary Design Education" University of Alberta.
- Findeli, A. (2001) Rethinking design education for the 21st century: theoretical, methodological, and ethical discussion. *Design Issues*, 17:5-17
- Fruchter, R. (1994) "The Virtual Atelier." *Proceedings of the International Workshop on the Future Directions of Computer-Aided Engineering*, Pittsburgh, Pennsylvania, June: 9-14.
- Gray, B. (1996). *Frame reflection*, *Academy of Management Review*, 21, 576-579.
- Harris, R., Giard, J. & Pijawka, D. (2004) "Interdisciplinary Doctoral Education in Environmental Design: Assessment of Programs, Issues, Structure, and Vision" Arizona State University, Graduate College
- Hawkins, R. (1982) *Business and the future of education*. Sacramento, CA: Sequoia Institute.

- Novitski, B.J. (2009) "In-house engineers make sustainable design work better." *Architectural Record*, October is-sue.
- Schön, D.A. (1984) "The architectural studio as an exem-plar of education for refelction-in-action" *Journal of Architectural Education*, 38:2-9
- Schön, D. A. (1987).*Educating the reflective practitioner*. San Francisco: Jossey-Bass. 153-199
- Schön, D.A. (1988) "Toward a marraige of artistry and applied science in the architectural design studio" *Journal of Architectural Education*, 41:4-10
- Senge, P. (1990) "The fifth discipline: The art & practice of the learning organization. New York: Currency.
- Steele J., Austin S., Macmillan S., Kirby P. & Spence R. (1999) "Interdisciplinary interaction during concept design." *Proceedings of the 15th Annual Conference of the Association of Researchers in construction man-agement*.
- Valkenburg, R. C., & Dorst, K. (1998). The reflective prac-tice of design teams. *Design Studies*, 19, 249-271.
- Weigand, J. (2013) *Interior Design and Architecture, Design Intelligence*, March.
(<http://www.di.net/articles/interior-design-and-architecture/>)
(Received May 7, 2013/Accepted July 16, 2013)