INTEGRATED PROJECT EXPERIENCES AND STUDENT PERCEPTION

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1 ABSTRACT

Professional projects in landscape architecture require a broad spectrum of knowledge and skills for their successful execution. In particular, design theory, sociology, grading and drainage, plant materials, and construction are vitally interrelated in the creation of successful spaces. Realizing students' struggle to integrate knowledge from these several sources within the confines of a typical curricular structure, the authors have embarked on an innovative strategy to foster the connection of knowledge areas. Beginning in 2012 faculty at Purdue University began to address the shortcomings of a traditionally structured curriculum by leading juniors in an integrated project experience: the integration of several course topics in our junior-level curriculum through a single, encompassing, iterative project. This single problem asks students to integrate knowledge from four different technical and creative areas-- design studio, grading and stormwater design, plant material, and construction documentation—to create a project that is a seamless whole, replicating the complete project process and iterative nature of a professional office setting.

The pedagogical literature has indicated the potential for an integrated project approach to address some of these concerns and to assist in the achievement of student learning outcomes (Levy 1980, Steinitz 1990). Furthermore, the project process seemed to have the potential to present and encourage student work habits and design processes that more closely mirror the expectations of professional offices. The authors have measured the degree to which this method is effective in improving student perception of knowledge, skills, and abilities. A trial study which used pre- and post-condition evaluative surveys to measure student preferences and response to the integrated project process (Rotar, Barbarash, et.al. 2014) showed promising trends; this more complete study's results indicate a statistically significant increase in student perception of their abilities to integrate these four topics into stronger design solutions.

This paper reviews the project process and presents the results of our study of student responses to that process. Furthermore, we will reflect on the successes and challenges encountered during the project and discuss next steps in determining whether or not actual improvements in student learning outcomes are measurable.

1.1 Keywords

Integrated project approach, student perception

2 INTRODUCTION

The integration, synthesis, and application of a disparate range of knowledge areas to inform and enrich design has long been a goal of design education. In most visions of landscape architecture education, the design studio is seen as the hub of a curricular system in which knowledge gained in many disparate areas all feed the work of the central design studio course. In the studio, students are asked to integrate the knowledge and skills acquired in other courses, including the vital understanding of the technical and theoretical knowledge that makes up other aspects of curriculum, into design problems. While ideal, however, this understanding of the studios role is difficult to realize in standard curricular settings; often leading to the frustration and disillusion of all faculty and students.

However, the complexity of design problems requires that a broad spectrum of knowledge and skills be applied to develop a successful and creative solution. A given design problem may require knowledge of design theory, geology, geography, grading, drainage, plant materials, construction techniques, and manifold other areas. The judgment and ability of the designer to select the important knowledge areas and to properly apply the information gathered seems to be the most determining factor in the success of a design problem.

Writing in 2014, the authors noted three student attitudes that make it difficult for students to integrate knowledge areas into a design problem: first division of bodies of knowledge as silos; second student habits that prevent integration, including the attempt to develop solutions as quickly as possible due to time and other constraints; and finally the inability of students or reluctance of students to review design solutions, self-criticize, and refine the solution. The authors observation of the difficulties of integration and the necessity of knowledge integration in creating stronger deeper design solutions, led to a method to force students into integration despite the barriers provided by a traditional curricular structure. In addition to student attitudes that hinder integration of knowledge areas there are structural and administrative barriers under traditional course methodologies. Here at Purdue University, as in many institutions, course assignment and instructor of record designations coupled with faculty specialties and scheduling issues tend to lead to separation of knowledge areas from each other within their own course modules. This status quo works in direct opposition to the real-world integrated processes of landscape architectural design. (Rotar, Barbarash, Dahl, & Hildner, 2014)

2.1 Integrated Problem Structure

Beginning in fall of 2012 faculty teaching courses in the junior year at Purdue University began to collaborate in leading juniors through an encompassing iterative project. This single problem extends across two semesters and four courses -including the design studio, a course in earthworks and stormwater design, a course in planting design, and a course in construction documentation. While other coursework could benefit and enhance the integrated project experience, courses held during the junior year were selected for an integrated approach to maintain common skill and experience levels across participating students and to avoid major scheduling conflicts with non-integrated classes. Previously acquired knowledge in plant identification, materials and detailing, landscape history and theory courses along with various studio projects was expected to be part of participating students baseline knowledge at the start of the integrated experience.

The project was structured around three goals: first, to integrate the various knowledge and skills areas inherent in these four courses seamlessly throughout a single project. Second, the authors intended the project to break the typical structure of student studio projects in which the master plan or illustrative plan is seen as the end result of a design problem. This typical process includes virtually no time for reflection and revision or for technical aspects of design investigation to have any impact on the design work itself. Finally, the project’s pedagogical scaffolding was structured to be iterative in order to make clear the impact of each knowledge area on the others and on the design as a whole. (Rotar et al., 2014)

Furthermore, faculty sought to present the students with the opportunity for client interaction as part of the integrated project. For this reason each of the project sites chosen was part of a service learning project which included a real client. As we show, however this requirement also led to disparity of project type and scope that needed to be mitigated in creative ways in the objectives and outline of the project in order to provide similar experiences that met the above goals.

Two separate groups of junior-level students participated in the integrated project process. In

2012, the pilot integrated project involved the design of a small public open space in the center of an historic urban neighborhood in Lafayette, Indiana. This approximately 10 acre site is bounded by several streets including an abandoned dead-end with a moderate slope of 7 to 15% and this site seemed to offer great potential as it was neither too large nor too complex to allow students to apply these knowledge areas to its design. Students initially worked in teams to develop a program and design concept, leading to an illustrative master plan. Students then were asked to refine the initial concepts as individuals, taking the project through completion which included a revised illustrative site plan, grading plans and planting plans.

In 2013, a very different project site and potential program was used: a 100 acre site surrounding a new transmission facility for the Chrysler Corporation in Tipton, Indiana. Here students also worked in teams to develop goals, program, conceptual, and schematic designs for the entire site, leading to an illustrative master plan. Each student was then responsible for selecting a smaller study area of 5-7 acres within the site to further refine and revise. In this way the individual student site design closely replicated the size and scale of the previous year's problem, though unlike 2012, each student team member would develop and refine an individual study area rather than each team member working in individual design of the same area. However, students would be responsible for a revised illustrative plan, planting plans, and grading and stormwater plans, as in the previous year's problem.

3 LITERATURE REVIEW

3.1 Traditional Teaching Methods and Issues

Design education can be considered radically different from many traditional classroom models and programs. Traditional education methods tend to isolate knowledge into easily digestible bits that are easy for a student to memorize, and while this concept is not without its merits, students often find it difficult to connect new content with previous lessons or work being performed in concurrent courses. This is especially at issue in the design studio where core material is presented separately from a design task yet is expected to inform and be integrated into design methodologies. Traditional education methods can limit a student's perception and process expectations, maintaining the divide between technical or scientific knowledge and creative exploration in design. This can be especially damaging to a design students capabilities when immersed in the professional world on internship or in an entry–level position after graduation. (Altomonte, Rutherford, & Wilson, 2012; Levy, 1980; Teal, 2011)

3.2 Justification for Integrated Teaching Methods

In design there can be no such thing as a skill in isolation; all skills, decisions, and choices stem from prior experience and learning and influencing one another. This extends beyond design coursework, with history, theory, and hard sciences influencing and creating a richness in design that would be missing without their inclusion. A difficulty in modern design education with its necessary emphasis on technical information—sustainable design practices, growing urban areas, and performance based design, etc. —is to address the divide between connecting technical and scientific material with creative exploration and expression.

A robust design education process is one of applied learning, where previously gained knowledge and skills are the filter through which a project is viewed and worked through. This knowledge should be supported by empirical research and case study analyses, where critique (both of self- and other works) and iterative reflection integrate and inform the final creative product. "In so doing, students should develop a deeper awareness of the subject under exploration and indeed, from early stages in projects should be able to appreciate the many interdependencies that contribute to the success of the task, and thus take an informed view of the likely outcomes of a project." (Altomonte et al., 2012, pg. 8) This multi-level integration of knowledge and skill should encourage a depth of critical and creative thinking that would likely be missing under traditional education processes.

As the purpose of architectural education is the training of future architects and designers, a combining of theoretical "learning" with hands-on "doing" provides opportunities for more permanent concept retention and behavioral change. "Lacking flexible skills, students will find the nonlinearity, a-rationality, and ambiguity that are fundamental to both design and life confounding, overwhelming, and unnecessary. However, without such skills, they will find it nearly impossible to recognize or engage the intricate relations and interdependencies that exist in any real world context." (Teal, 2011, pg. 37) The use of active-learning methodologies, where students are able to take ownership of their education and projects, seeing the interconnected value of the disparate courses they are required to take realized in a single project or process, often results in a more complete and robust final product. (O'Brian, Soibelman, & Elvin, 2003)

The common approach of architectural education in which experience grants expertise can only benefit from a coordinated and integrated multiple viewpoint methodology. In a non-integrated course system, students often receive a single point of view and material may therefore be presented in a limited number of ways. Integrated course methodologies can demonstrate the multitude of successful approaches and opinions to solving a design problem through the voices and expressions of a faculty body. A unified faculty, focused on a single "complete" project, foster and support the seldom spoken about student-instructor relationship, supported by Austerlitz et al's claim that the this relationship is "at least as important as other areas for understanding studio processes and pedagogy". (Austerlitz, Aravot, & Ben-Ze'ev, 2002, pg. 106) This allows for varying voices and angles of approach to cater to multiple learning styles and personality types inherent in a diverse student body.

3.3 Studio as the "Master" Course

In a multi-course integrated approach to architectural education, the design studio should serve as the catalyst or "master course" as it "…is the only environment in which all aspects of architectural ideas and skills - formal aesthetics, building technology, theory, history, and drawing - can be learned", (Levy, 1980, pg. 29) though it is important that the non-studio courses are not seen as being secondary or "lesser" by students. All learning goals, methods, and outcomes should be structured around and focused through a studio design project that forces creative endeavor to be influenced by technical skills presented in supporting courses. This material can also be presented in the studio course itself as redundancy, with studio related content discussed in the technical courses in order to keep the integrated project goal in mind throughout the student learning process.

3.4 Results/Issues in Integrated Teaching Methods

A robust set of learning outcomes should be introduced at the start of an integrated project so that each course understands their place in the larger system and each can work towards the shared set of goals. This requires a cohesive and congenial faculty willing to work with the delays and scheduling issues that can arise during the semester. Blurred boundaries between courses regarding presentation times and shared due dates can reinforce the importance of the integrated process for students while reducing the impacts of the process on a design studio's schedule.

An integrated project allows students to use knowledge gained in parallel courses immediately in a design project. As faculty in the non-studio courses filter content through the grand vision of a shared design problem, students are more likely to perceive the overall project as "real" and "unique", where required tasks and assignments are "practical" with students performing better and remembering material longer than the knowledge presented in isolation. (Ozimek & Ozimek, 2011) The complex relationships between skill and knowledge areas foster iterative non-linear thinking that allows a student to approach a problem from multiple angles, activating knowledge in ways traditional teaching methodologies often lack. Integrated course processes and active learning methods change student design work from creating individual isolated objects and programs to more complex and "complete" works that better simulate the realities of the design world, preparing students for the lifelong learning process necessary in professional design. (Altomonte et al., 2012; Teal, 2011)

4 METHODS

With its multi–faceted problem solving approach, this study used the design studio as the organizing class in the integrated system. A studio design project typically asks students to consider the breadth of knowledge and skills gained in related coursework and experiences. Under this integrated system, faculty actively reinforced the links between studio and concurrent technical coursework in grading, stormwater management, and planting design. Faculty were able to focus project expectations and discussion topics around the knowledge and skill level of the students at that time across all integrated courses. The pacing of each individual skillset was timed to coincide with an analogous area in parallel courses, to effect, turning the disparate courses into a single master class.

The initial iteration of the integrated project experience in Purdue University's landscape architecture program saw students grow frustrated with inconsistent assignment goals and final product between courses (Rotar et al., 2014). After a period of reflection and refinement, the involved faculty broke the standard format of student design projects where the master plan is typically the final product by requiring an iterative series of assignments in each concurrent non–studio course after the "final" master plan design was completed. Students were then asked to revisit their design and make adjustments based on the new knowledge they acquired in supporting coursework.

This study used surveys as the primary method to determine the project's effectiveness. Three different but similar survey instruments were employed to assess student perception of the value and product created through the integrated course methodology. In order to create a baseline for study, seniors who had taken the courses through traditional individualized methods were used as a pre–condition control group. Juniors were first presented with a project following traditional "silo-ed" knowledge areas while basic concepts of grading, stormwater, and planting design were introduced in the technical courses. Following completion of this project, a final project following an integrated methodology was completed. Students were surveyed after each of the aforementioned projects to assess their perception of the interrelationship of knowledge and skill areas under both pre-and post-integrated conditions.

The survey instruments (as seen in Tables 1 and 2) themselves were a refinement of those employed in the pilot (Rotar, Barbarash, Dahl, & Hildner, 2014) with the data gathered used to guide and shape the integrated project used in this study. Individual course knowledge areas were separated out into their own questions to better gauge the effectiveness of each course within the larger integrated system. Students were asked to assess how one course's content as applied to the integrated project influenced the thinking and production of work related to a different course within the integrated project. In addition, they were asked to rate their perception of the value of an integrated project methodology towards project success and "completeness". Survey responses were placed along a 5 point Likert scale and were analyzed through a one–way ANOVA with Bonferoni post–hoc tests to measure significance ($\alpha \leq .05$).

Table 1. The Junior level Pre–Integrated course project survey.

To what extent has your knowledge of:	Lack of knowledge Hindered a lot	Lack of knowledge Hindered a little	Knowledge/ Lack of knowledge Neither helped nor hindered	Knowledge Helped a little	Knowledge Helped a lot
earthwork & drainage influenced and/or improved your studio design?	❍	❍	❍	❍	❍
earthwork and drainage influenced and/or improved your planting design?	❍	❍	❍	❍	❍
planting design influenced and/or improved your studio design?	❍	❍	❍	❍	❍
planting design influenced and/or improved your earthwork & drainage design?	❍	❍	❍	❍	❍
studio design influenced and/or improved your earthwork & drainage design?	❍	❍	❍	❍	❍
studio design influenced and/or improved your planting design?	❍	❍	❍	❍	❍
	Not at all important	**Not very important**	**Neutral**	**Slightly important**	**Very important**
How important to a successful project is the relationship between design, earthwork & drainage, planting, and CDs?	❍	❍	❍	❍	❍
	No benefit at all	**Not much benefit**	**Neutral**	**Some benefit**	**Of great benefit**
To what extent do you believe that the integration of your Junior year coursework would result in a more "complete" project?	❍	❍	❍	❍	❍

Table 2. The Junior level Post–Integrated course project survey.

To what extent do you believe the integrated project experience allowed you to:	**No benefit at all**	**Not much benefit**	**Neutral**	**Some benefit**	**Of great benefit**
create a more "complete" project?	○	○	○	○	○
become competent in the individual skills necessary to create a complete project (grading, drainage, planting, etc.)	○	○	○	○	○
understand the iterative and adaptive process of design	○	○	○	○	○
Better manage time due to shared deadlines and expectations	○	○	○	○	○
To what extent has your knowledge of:	**Lack of knowledge Hindered a lot**	**Lack of knowledge Hindered a little**	**Knowledge/ Lack of knowledge Neither helped nor hindered**	**Knowledge Helped a little**	**Knowledge Helped a lot**
earthwork & drainage influenced and/or improved your studio design?	○	○	○	○	○
earthwork and drainage influenced and/or improved your planting design?	○	○	○	○	○
planting design influenced and/or improved your studio design?	○	○	○	○	○
planting design influenced and/or improved your earthwork & drainage design?	○	○	○	○	○
studio design influenced and/or improved your earthwork & drainage design?	○	○	○	○	○
studio design influenced and/or improved your planting design?	○	○	○	○	○
	Not at all important	**Not very important**	**Neutral**	**Slightly important**	**Very important**
How important to a successful project is the relationship between design, earthwork & drainage, planting, and CDs?	○	○	○	○	○

5 FINDINGS

Results demonstrate a statistically significant response in the comparison between traditional and integrated course methodologies, but not for all categories (see figure 1). Notably, seniors in the control group and juniors in the post condition show a significant response with knowledge of earthwork and drainage influencing planting design. Both seniors and juniors in the pre-integrated condition demonstrated a positive influence compared with juniors in the post-integrated process between knowledge of earthwork and drainage with studio design. Perhaps most importantly, juniors also showed a realization at the importance of the relationships between the four study course areas (design studio, earthwork and drainage, planting design, and construction documentation).

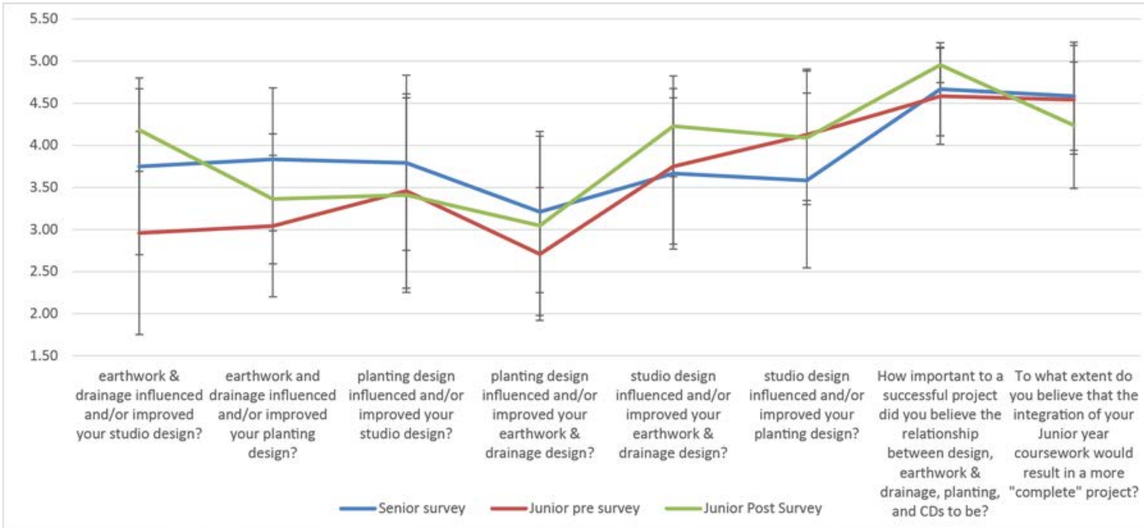

Figure 1. Mean student responses by experience with standard error.

6 DISCUSSION

6.1 Results

The significant results where knowledge of earthwork and drainage influenced studio design demonstrates that students perceived that they learned the values of an integrated methodology and that the two process and concept areas are intrinsically linked. The shared opinion between seniors (who have spent a full year on a managed co-operative internship before returning for their final year of academic programming) and juniors regarding issues in the pre-integrated project condition is of interest as there was no relatable correlation to the post-integrated process. In this case, students might not have received enough direction to differentiate the two methodologies; alternately, it is possible that this individual group of students was already starting from a more advanced point within this specific skill and knowledge area. Seniors' recollection of skills may not be accurate and is influenced by their experience in their yearlong cooperative internship.

An interesting difference between the student perception of the value of this project for the two technical knowledge areas—earthworks and drainage vs. planting design-- cannot be explained by the data. The authors hypothesized that the two technical areas included in the integrated project would see similar results related to student perception of their connection to the project process and outcomes. However, students perceived a deeper connection between site design and earthwork and drainage than between site design and planting, as seen in Figure 2, despite these concepts being given equal weight and time in the integrated coursework.

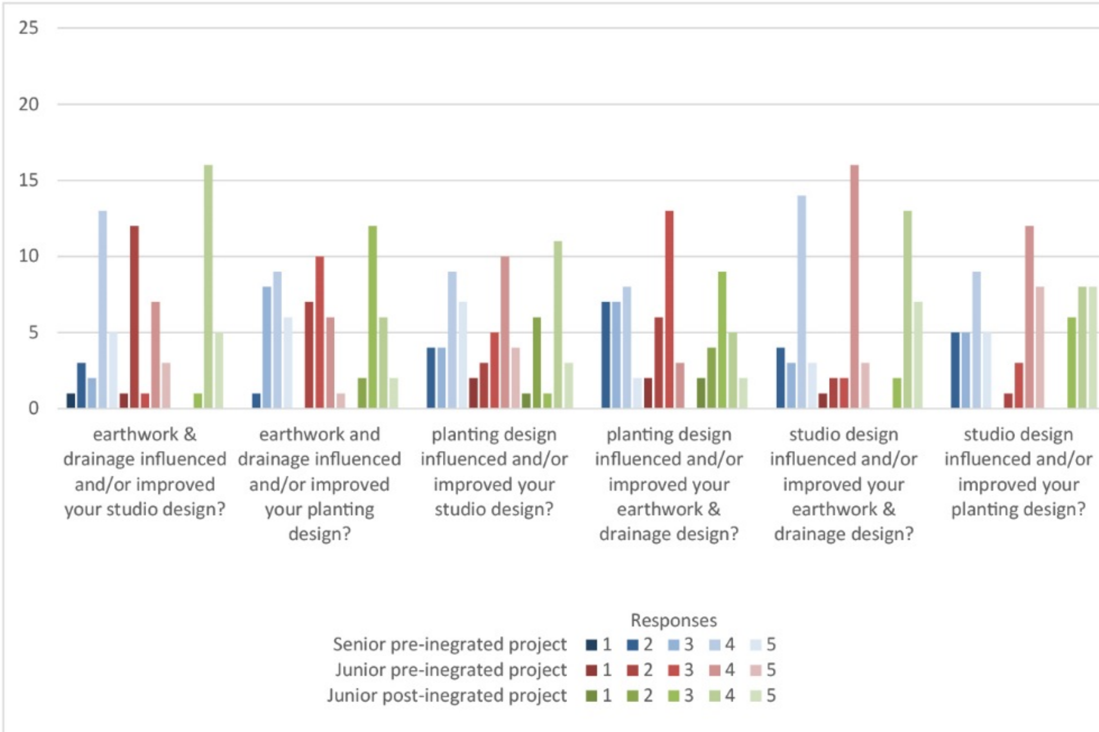

Figure 2. Student responses by experience.

The authors hypothesize that this difference may be due to student reactions to the differences in teaching styles or personalities of specific professors. However, as the planting design course used as part of the integrated study is the second of two courses required in that knowledge area in the curriculum, it is possible that the difference can be attributed to greater pre–existing understanding of the interrelationships between planting design and overall site design, which would limit the impact of the integrated process by reducing the pre and post measure to non-significant levels.

Another possibility may be at work as well: in one of the academic years in which the integrated process was employed, the planting design course was taught by an adjunct faculty. While this study cannot affirm or deny this hypothesis, it seems likely that student perception of that knowledge area was negatively impacted. The issues demonstrated with the perceived value of integrating planting design content, may have been a factor in the reduction of responses relating to total integration for juniors participating in the project process. However, the data also demonstrates an increased belief in the importance of content integration to the success of a “complete” design project (see figure 3).

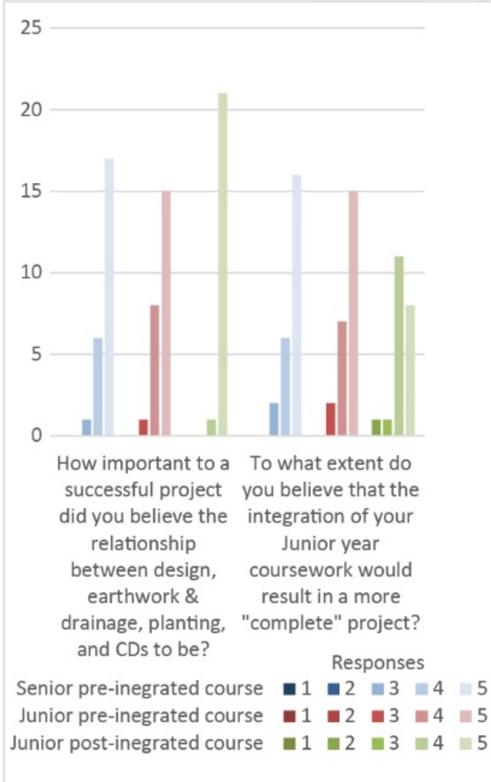

Figure 3. Student perception of integration effectiveness.

6.2 Challenges Faced and Lessons Learned

Having completed both a pilot study and a full iteration of the integrated course project process, the authors are able to draw some conclusions regarding the challenges that this kind of project process presents to students and faculty, as well as strategies that may mitigate those challenges or turn challenges into positive factors. While unable to implement all of these strategies, let alone test the validity of these assumptions in improving student learning, the authors hope that this discussion will prompt further experimentation and reflection by others.

Possibly the largest challenge faced in a an integrated project process is simply that the structure of university course curricula do not envision these kinds of learning experiences and as a result faculty, students, and administrators may all have different expectations for the structure and responsibilities for curriculum delivery (Rotar et al., 2014). While not insurmountable, it is clear that in order for an integrated project to be successful all faculty involved must be equally committed to the success of the project. Seeking success in the project involves considerable flexibility on the part of the faculty in regard to course schedules and due dates, as well as finding a balance between faculty expectations for student deliverables and the desired outcomes in the individual courses vs. the needs and expectations of the integrated project. In order for these expectations not to compete, faculty communication is vital. Extensive planning through a pre-scheduled series of meetings for coordinating activities, due dates, and knowledge delivery will help mitigate the difficulty faculty find being on the same page in the project process and presenting a unified program for students.

In order for the integrated process to be successful, faculty must also manage the interplay between the delivery of knowledge and skills and areas and their application into stained aspects of be integrated project. Students cannot be expected to apply their knowledge of grading and stormwater to a design solution before they have the knowledge of those technical areas and the ability to apply those skills to a separate problem. Therefore, the scheduling of lectures in the supporting courses and project delivery and due dates in the integrated project has to be a careful collaboration among faculty members.

Finally, the authors have observed the tendency of students to prioritize input from particular faculty over others. This prioritization leads to some faculty members having an outsized voice in the design process. As a result, students' perception of the importance of subject areas presented by some faculty might be minimized and therefore the overall goals of the integrated project not realized. In addition, less visible or more passive faculty might find themselves and their subject areas with a smaller voice in the process, possibly leading to a feeling of marginalization. A lesson that can be learned from this observation, however: it is unrealistic for four faculty to have equal impact in the studio, and perhaps a single strong mouthpiece that is able to communicate ideas well may be necessary for the project's success. Unfortunately, reliance on a single mouthpiece negates the value of one of the unintended but important discoveries of the process: that hearing multiple and disparate points of view will ask students to make judgments and apply critique in a way that parallels a professional project process with multiple clients and inputs.

Upon reflection, the authors are certain that the strongest faculty voice should be the studio professor acting as a catalyst, clarifying the overall design input, and working to ensure that other voices are heard, if not equally, than strongly in their own rights. In the iterations of the project studied, lack of a strong studio professor who acted in this way was a factor in the student perception of limited success.

7 CONCLUSIONS AND FUTURE RESEARCH

The study of integrated project process and their effect on student perceptions of knowledge integration and design outcomes has some general delimitations. Because the study is about integrating technical knowledge areas to increase their effectiveness as a foundation for design, the study does not look at several surrounding factors, including the specific order of the courses leading up to the integrated experiences, their time/ location in the curriculum at Purdue, or other similar variables. By design, the authors excluded these factors not because they do not play a role in the education objectives of a university program, but because they have little to do with this study, the specific courses and knowledge areas to be integrated, and students' perception of their effect. In this way, the authors hope that the findings may be more generally understood, by looking holistically at student perception of integrated projects and not at specifics of curriculum and outcomes for a particular program. It is clear that the findings of this study provide an affirmation of the value of an integrated approach to strengthening student responses. However, it is also necessary to point out that the project study is testing student perception—perception of the growth of their skills in each of these areas, the impact of each of the three areas upon each other, and the value of the process in strengthening the final design product.

This study realizes that the conclusions gathered are the results of student perception of achievement and understanding, with results as yet unfiltered through the lens of a more practiced eye aware of the larger system that is professional practice. The authors do not intend that curricular changes should be made based solely on the reflections of student perception of a process or outcome. What we can gather from this exercise is fodder for investing a student body into their work on a deeper more meaningful level, with the interplay and relationships between skill and knowledge areas becoming second nature. The perceived gains inherent to an integrated project methodology may or may not result in a higher caliber of student product, but it does better simulate the depths of a "real" project, preparing students for professional positions in the future.

The results of this and previous works (Rotar, Barbarash, et. al) have demonstrated a positive shift in students' perception of the depth and quality of their work when following integrated course methodologies. However, whether or not the integrated project process has made a measurable improvement in the actual quality of the design work has not been evaluated as a part of this study. In order to test whether integrated course procedures allow students to create deeper more "complete" work, projects need to be assessed by an independent panel of experts (professionals and non-course associated faculty) and rated in a series of key categories to weigh the value and expression of designed elements across both integrated and non-integrated projects. In many ways this professional level rubric can follow the patterns of previous student surveys with room for additional qualifying questions to measure specifics of design outcomes within the educational goals embedded within the four participating integrated courses. The authors have compiled four years of student works, three of which have projects following both an integrated and non-integrated process, for assessment towards discovering the real world efficacy of integrated project methodologies in a cooperative academic setting.

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