Process Based Learning in Planning Studio Pedagogy: A Theoretical Model for Planning Education

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PROCESS BASED LEARNING IN PLANNING STUDIO PEDAGOGY
A Theoretical Model for Planning Education

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Despite the central role of the studio course in the planning curriculum, there is a lack of consensus on the appropriate learning outcomes, pedagogy, and assessment methods for these courses. The core problem is that while many models have been put forth, they are all deficient in some way and don't fully capture the learning process that happens in studios. Instructors need a model pedagogy with which to structure their studio and a theoretical model with which to assess the learning process as it occurs throughout the course of the studio. In this paper I propose a new model for understanding the studio learning environment, which I call the process based learning (PBL) model. After a literature review, I created the PBL model in an attempt to marry traditional learning theories to the planning studio experience. PBL is made up of three elements: the process of discovery; interdisciplinary collaboration; and metacognition (reflection). To demonstrate its effectiveness, I use the PBL model as a lens through which to observe two studio courses and one non-studio course at the UW. These observations are augmented by student interviews and surveys as an additional means to capture the studio learning experience. From my literature review, classroom observations, and student interviews, I describe what the PBL model consists of and illustrate how it exists in

urban planning and interdisciplinary studios in the built environment. This proposed pedagogy can be adapted to a variety of curricular content to elicit all elements of the PBL model. It is my hope that the PBL model will inform a more robust and intentional studio pedagogy. Once we understand how students learn in studios using this model, further research is needed to develop and standardize a studio curriculum and learning outcomes assessment.

Keywords: Process based learning, planning studio pedagogy, process of discovery, interdisciplinary collaboration, metacognition

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DEDICATION

To my grandmother, Rosemary Hostetler.

PART I: A THEORETICAL MODEL FOR STUDIO LEARNING

Chapter 1: Introduction

Over the past century, learning goals for schools have undergone many changes, thus requiring new pedagogical approaches in the classroom (Bransford et al., 1999). Numerous learning theories attempt to explain how and when learning happens to better design our learning environments around teaching content, style, and assessment (Bransford et al., 1999). The Urban Planning field is among those schools that are attempting to understand and measure new types of learning in its graduate degree programs. This thesis focuses on one specific learning environment required by most urban planning degree programs, the studio course. In this thesis I develop a model to understand the learning that occurs in planning studios, which I call the *process based learning (PBL)* model.

My interest in the learning styles present in planning studio courses arose from my own educational experience in studios during my UW Master of Urban Planning Degree program. I began my research with a literature review of significant educational psychology learning theories. Next, I extended my literature review to include planning education literature, specifically relating to the studio course. After extensive analysis, I created my own theoretical model of the type of learning I believe exists in planning studios. I named this type of learning *Process Based Learning* (PBL) because of its emphasis on process over product. Once I had established my PBL model and rooted it in the appropriate literature, I grounded the model by applying it to three case studies.

I used the PBL model as a lens to explore the student experience in two University of Washington (UW) studio courses using personal interviews and participant observations. I used my findings to suggest proper planning studio pedagogy and subsequent curriculum design. It is

my belief that the exploration of PBL will suggest answers to the important questions about "what is taught, how it is taught, and how it is assessed" (Bransford et al., 1999, p. 131) in what I believe to be one of urban planning's most important learning environments.

My research identifies an alternative theoretical model that attempts to highlight the most important learning processes in planning studios. In the next chapters I describe a typical planning studio and its role in planning education. Then in chapter 4, I present the three main components of the PBL model – the process of discovery, interdisciplinary collaboration, and metacognition – and connect them to the learning theories of Bruner (1977), Vygotsky (1978), and Bransford et al. (1999) to studio specific pedagogical theories and proposed frameworks, such as the one by Yocum et al. (2012). In chapter 5, I then analyze and discuss my PBL model in the context of three case studies at the University of Washington. I hope that my illustration of the PBL model will help planning educators be more intentional in their curriculum design and studio facilitation. Although this is designed to improve the pedagogy, instruction, assessment, and outcomes of planning studios, I believe it can also be adapted to other courses in the curriculum that have similar learning goals as studio courses.

Chapter 2: The Importance of Studio Learning

2.1 Introduction

The planning profession is inherently dynamic, innovative, holistic, diverse, and applied. It is a diffuse discipline (Goldstein & Carman, 2006), which makes planning students open to new ideas and more adaptable to change (Goldstein, 2012). A graduate degree in planning is considered a professional degree, and seeks to teach marketable skills (i.e. geographic information systems, visual communication, site planning, policy analysis, economic base analysis, etc) as well as a generalized knowledge based in theory, history, and ethics that can be applied to different contexts. As a professional degree, there is great value placed on hands-on experience in planning education. Some planning students feel that the hands-on experience is what distinguishes their professional degree (Vakil, Marans, & Feldt, 1990, p. 62) and studio courses are one of the primary ways that planning programs provide this experience. The confidence in the studio learning process is evident among top ranked planning programs: twenty-two of Planetizen's (2009) top twenty-five programs require that students take at least one studio course to graduate (Németh & Long, 2012). While a given studio's content is different and its problem undefined, the process is what can remain the same.

Because a studio's content is variable and its final product is complex, there is no agreement among planning educators on the precise learning outcomes that studios should provide, even though the Planning Accreditation Board (PAB) requires that programs report on learning outcomes. This is due largely to the difficulty in defining the valuable but unique type of learning that occurs in planning studios (Németh and Long, 2012). If the PAB and studio instructors around the country were better able to understand and recognize the type of

learning occurring in their studios, planning educators could improve their studio pedagogy to foster better learning.

2.2 The Typical Planning Studio

Generally, studio courses are much more hands-on than a typical lecture course. Students are forced to define, interpret, and create a product that can take a wide variety of forms and projects. Common studio projects address issues such as community resiliency, urban agriculture, economic development, urban design standards, and urbanization impacts on peripheries. Though the site area and topics vary, all planning studio topics require students to assess social, environmental, political, and economic conditions in order to come up with applicable solutions to real needs and problems. Studios require students to work together with peers, professors, and clients to define a problem, develop a solution, and continually refine that solution throughout the course.

Studios range in size from 5 to 35 students. The typical planning studio has around ten students who work individually and as a group throughout the course. In studio courses, the professor becomes a facilitator, rather than an instructor. He/she aids the learning process but ultimately the students define the problem and product themselves. Often, studio courses can feel disorganized or messy because of the emergent nature of the final product. Presentations to peers, professors, or clients provide structure through feedback and direction; but this ambiguity empowers students and mimics the real world in the planning profession.

Planning studio pedagogy differs from traditional design studio pedagogy. This is evident in both the structure and outcomes of the learning process. Typically, a design studio asks

students to brainstorm and create solutions individually, which are then shared with the class, critiqued by the group, and sent back to the student for revision. Partial solutions are developed, tested with one another, and combined into a comprehensive solution that emerges at the end of the course process (Van Herzele, 2004, p. 200). Design studios are good for perfecting individual design techniques, but their individualistic nature lessens the challenge of and need for collaboration and undercuts the practice of looking at the “big picture”. Designers can be compared to puzzle-makers, because they put pieces together without recognizing the effects these pieces will have on each other (Archea, 1987). This method often hinders the holistic approach necessary for "big picture" problem solving. Conversely, planning studio students typically brainstorm as a group, divide the scope of work into sections, individually develop these sections in more detail, and then bring the pieces back together. In planning studios, students can specialize without individualizing. Thus, planning students try to be continuously cognizant of the greater whole and the problems at hand.

2.3 How Students Learn in Studios

Studios are hands-on, team-based, interdisciplinary courses that often involve a local client and project. In planning studios, the learning outcomes often focus on the learning process of both the individual and the group (Higgins et al., 2009; Grant and Manuel, 1995). In planning studios, the site's problem is often undefined and the content variable, so greater attention must be devoted to the understanding and characterization of the learning process. As one student put it, “I don’t think what I learned in this studio would reflect what the studio title and description was. What I learned focuses on the people, the collaboration, and

answering to someone else. On the people solving skills" (Student Interview, March 2014). It is evident that this student values the "soft skills" taught in studio courses; skills that, in my opinion, are sometimes undervalued due to their difficulty to measure.

In planning studios, the learning relies less on the product and more on the process. In planning studios, critiques and subsequent revisions are constantly being made on a product, thus continually improving upon an individual's idea with the classroom's collective knowledge. The social learning that takes place in studios is not direct or predictable, but relies on internalization of ideas and processes through interaction with peers, instructors, and often clients. There is growth in the "systematic nature of discourse" (Bruner, 1996, p. 68), meaning that experience a great deal of mental growth through interaction with others. This discourse is inherent in planning studio pedagogy because of studio's collaborative nature.

The importance and construction of hands-on practice and application in the planning curriculum is often deliberated in education literature. The importance of learning with understanding (Bruner, 1996) asserts the need for students to acquire basic facts, but then understand the structure and application of these facts so that they can be applied in a wider context to solve new problems. Learning with understanding is interwoven in studies of knowledge transfer. Knowledge transfer is imperative for understanding how people acquire certain competencies and apply knowledge of one context to new contexts (Bransford et al., 1999). Knowledge transfer is best viewed as an active, dynamic process (Bransford et al., 1999, p. 53), and typically includes important aspects of self-discovery (Bruner, 1977) and active learning. Active learning is also referred to as metacognition, and asks that the student reflects on his or her own learning process and progress (Mayer, 1992; Bransford et al., 1999; Monson,

2005). All of these types of learning exist in planning studios, and I used these theories to create the PBL model in order to understand which learning processes in studios and most important.

That said, these learning process and expectations aren't always understood by the students enrolled in the studio course. It is imperative that the students and professor have a clear understanding of the learning goals and studio learning, as the quote below illustrates.

> Some [planning students] don't respect the studio process – the point is not for a grade, it is to bring something to the table to share, get critiqued, and made better. In planning studios, students come from all different [educational] backgrounds so this process isn't always understood.
>
> - Student Interview, January 2014

2.4 The Need for a New Model of Studio Learning

There is a need to describe and define the important learning processes happening in planning studios before appropriate learning outcome assessments can be enacted. The first step the PAB must take in creating learning outcomes assessment standards is to understand the universal learning processes that occur in planning studios. Prior research on studios has identified common characteristics of the learning cycle. One four stage learning process includes concrete experience, reflective observation, abstract conceptualization, and active experimentation (Roakes and Norris-Tirrell, 2002; Kirschner et al., 1997; Kolb, 1984). Another investigation highlights the five C's that must be present in planning studios, namely creativity, criticality, contemplation, collaboration, and citizenship (Higgins et al., 2009). These investigations are valuable and highlight important characteristics of planning studios, but they do not connect these with traditional education theories. Without this connection to education theory, we may understand *what* a student is learning, but not *how* they learn it. Parts of these

theories are present in PBL but are re-conceptualized as the model attempts to illustrate how and when students learn in studios.

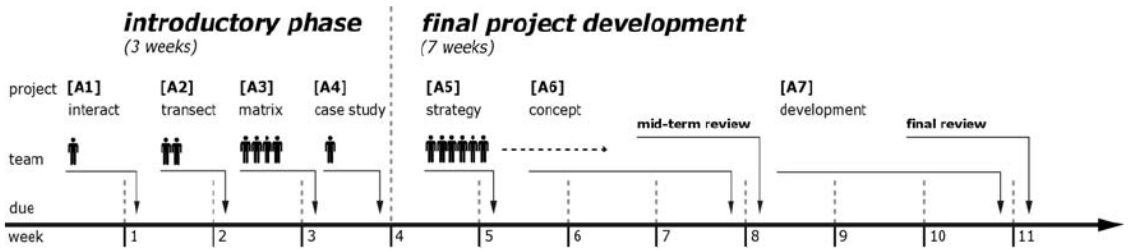
In my opinion, just as it is important for students to be aware of their own learning styles and those of their peers, it is necessary for students to understand the studio learning process. If students are able to understand and appreciate this studio learning process as it is happening, they will have a positive learning attitude instead of frustration. Students' frustration in studios, in my view, seems to stem from the fact that the students can't see the learning that is going on. This could be rectified by having a model of learning that the instructor explains at the onset of the studio.

Chapter 3: An Alternative Studio Model

One such proposed pedagogy that I used as a lens for my own inquiry into the studio learning environment and the development of the PBL model was an interdisciplinary studio pedagogy put forth by Yocum et al. (2012). Yocom et al. (2012) developed a pedagogical approach for studio courses based on an interdisciplinary studio in the built environment (BE) at the University of Washington. The topic for the studio was vertical farming and sustainable site design, which was chosen because of its inherent complexity.

In order to address this complexity in a structured framework, Yocom et al. (2012) developed a pedagogy that can be used in a variety of interdisciplinary studios, regardless of the specific project being pursued.

This studio pedagogy reflects three educational themes Yocom et al. (2012) believe elicit important learning outcomes: collective understanding; rigorous forms of experimentation; and interdisciplinary collaboration. The introductory phase of this framework was meant to promote collective understanding. The assignments (A1-A4 in Figure 1) prompt students to ask the right questions so that they understand the complexity of the studio project and define the problem at hand. Essentially, the introductory phase takes them through the process of defining the problem, which is a necessary step in the learning process in all planning studios. As shown in Figure 1, the introductory phase relies on rigorous forms of experimentation and interdisciplinary collaboration. The process of discovery appears in A1 and A2 as students discern characteristics of the site that will inform their inquiry. Interdisciplinary collaboration exists in A2 and A3 as students are forced to work in teams to identify the complex relationships that exist between different systems and influence the site. It is not clear if



Introductory phase:
Developing a disciplinary perspective for generating collective understanding
[A1]: Interact – an individual exercise conducted in class requiring students to define urban agriculture as it relates to a specified list of biophysical and social systems.
[A2]: Transect – in interdisciplinary teams, the students traversed the site identifying and representing the relationships between a set of biophysical and social systems.
[A3]: Matrix – in interdisciplinary group of four, the students developed an organizing framework that highlighted the relationships identified in [A2] for the entire site.
[A4] Case Study – an individual exercise in which the students explored precedent cases for the integration of agricultural practices in urban environments.
Final project development:
Project development and interdisciplinary collaboration
[A5]: Strategy – in their final interdisciplinary team of six, the students used the knowledge gained in previous studies to develop a guiding strategy for the development of their final project across all spatial scales and phases of the project.
[A6]: Concept – each team was required to extend their strategy into a conceptual foundation and organizing framework for all planning and design decisions.
[A7]: Development – Based on the feedback from the professional panel each team began to further develop and refine their ideas through an iterative process of experimentation and assessment to develop their alternative proposal.

Figure 1. Example pedagogy for a University of Washington interdisciplinary studio in the Built Environment (Yocom et al., 2012).

students are asked to reflect on their learning process and style in this introductory phase. The final assignment, A4, uses the knowledge gained on the project site and asks students to compare it to case studies of similar sites. With a new knowledge base, this assignment allows students to think critically and transfer ideas from previous case studies to their project site.

The final phase of this studio framework has three assignments that all center on interdisciplinary collaboration. These assignments ask students to first develop a strategy and timeline for their final project deliverables. As mentioned earlier, this is often the case in studios because students are tasked to define their own deliverable. The process of

collaborating with classmates to define the direction a project will take and the final deliverables it will produce is incredibly valuable to the learning process in planning studios. When these students are professionals in the planning field, they will constantly be asked to collaborate and define a strategy to solve complex urban problems. A structured studio framework elicits a similar collaborative process of defining a problem, strategy, and solution(s).

While this studio pedagogy adequately addresses some important learning elements in studio courses, it struggles with the balance between structure and freedom. The framework itself is rigid and doesn't allow for the learning that occurs in planning studios when students are given the responsibility to structure the studio learning goals, deadlines, and deliverables for themselves. Some structure is necessary, to prevent too much frustration, because too much frustration inhibits learning. For example, in Yocom et al. (2012)'s framework, there are designated assignments that spur rigorous forms of experimentation. Really, experimentation, or something similar to it, should be happening constantly throughout the studio learning process.

While Yocom et al. (2012)'s model adequately recognizes the importance of interdisciplinary collaboration; it lacks opportunities for students to reflect on the learning process itself. Reflection allows students to step back from the production of product to critically reflect on the processes that shape the work and shape the student's own learning. Some sub-elements of reflection are captured in collective understanding, but greater awareness of the individual and collective learning process is needed.

I would suggest adding two assignments, one at the very beginning of the studio and one at the very end. The first assignment would give the students a brief introduction to studio learning and the desired studio learning outcomes. This would help students become more aware of the types of learning that exist in studios so that they can identify their own learning styles and therefore become better learners. The second additional assignment would ask students to reflect back on the quarter with these learning types in mind. It would allow them to reflect on their own learning process and identify when and how they learned best during the course. Though this studio pedagogy is not perfect, it lays out a common framework for interdisciplinary studios to use to bring about important learning processes such as rigorous forms of experimentation, interdisciplinary collaboration, and collective understanding. This model's shortcoming is its excess of structure and its lack of of reflective learning.

Chapter 4: Key Elements of the PBL Model

Since other models of studio pedagogy and learning are insufficient, I have developed a new one. The *Process Based Learning* (PBL) model includes three key elements of learning that occur in planning studios: 1) the process of discovery; 2) interdisciplinary collaboration; and 3) metacognition. Put simply, the process of discovery is a way in which people learn through initial understanding and personal inquiry. Interdisciplinary collaboration is a way in which people learn through their interactions with others. It is a means to accelerate and expand knowledge acquisition. Metacognition is awareness of how one learns. All of these elements combine to form an ideal learning environment in which knowledge acquisition, retention, and future application are maximized. What follows is a detailed description of each of these elements and how they interact in the studio environment. In chapter 5 I will ground this model by applying it to three case studies.

Figure 2 (next page) attempts to illustrate how the three elements of PBL can exist individually and how they overlap during the studio learning process. In order to elicit true PBL, all three elements must be present. The black text in the figure is examples of pedagogical tools that might elicit the various elements of PBL.

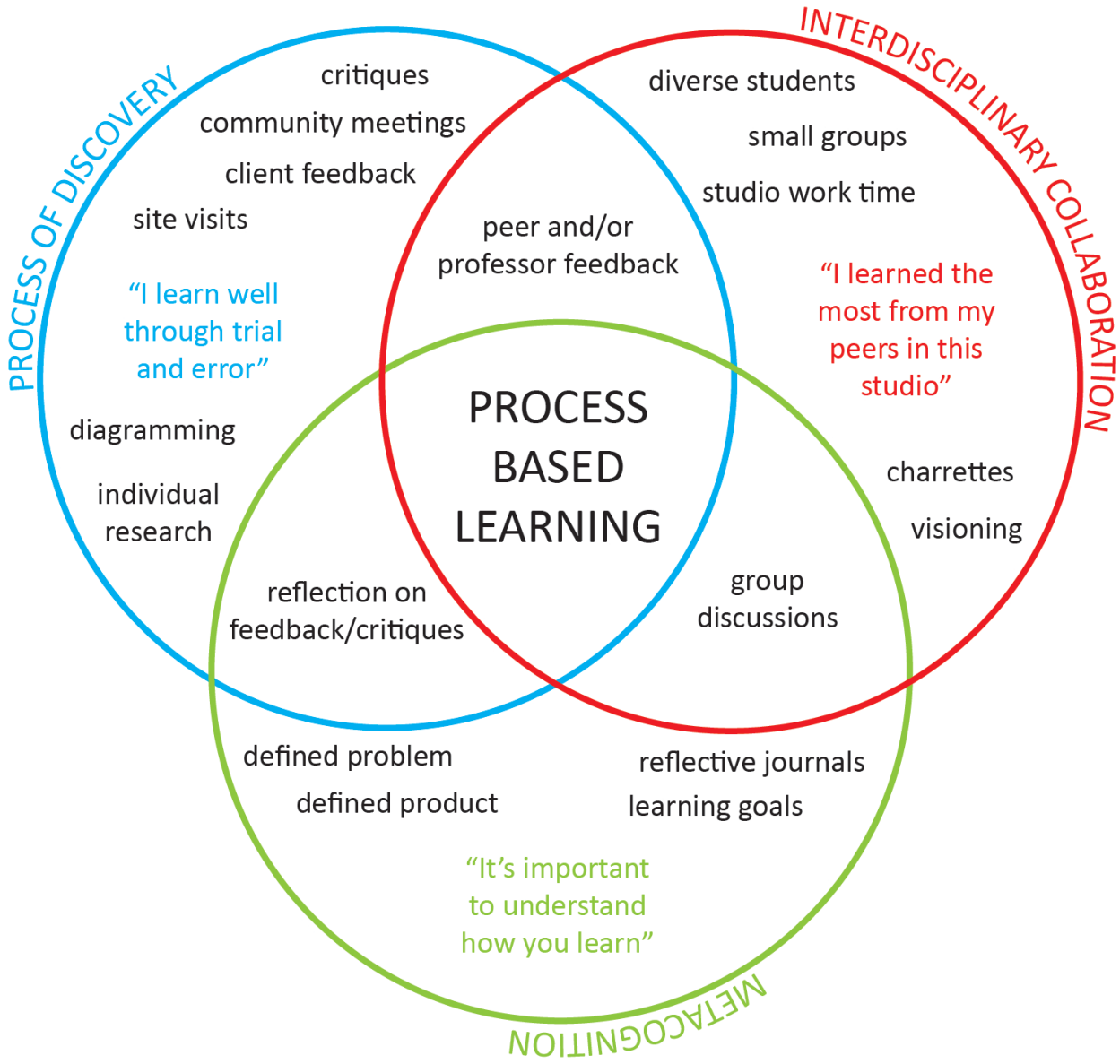


Figure 2. The key elements of process based learning (PBL). All quotes are from student interviews. Source: author

4.1 Process of Discovery

The first element, the *process of discovery*, is a way in which people learn by understanding basic principles and applying them to create new solutions. The process of discovery can occur at an individual or collective level. The process of discovery is about independence, unstructured inquiry, trial and error, collaboration, and frustration. It exists

within a loose structure that allows for freedom of student inquiry beyond what knowledge is given. The learning in process of discovery occurs when students apply given knowledge to new problems and find new solutions.

The process of discovery positively influences how much knowledge is understood, retained, and then applied to other subjects (Bruner, 1977). Learning theorist Jerome Bruner (1977) believes in teaching the fundamentals of a discipline, but then allowing students the opportunity to discover more on their own. This process of discovery allows students to grapple with the ideas they already know, discover new truths about a subject and apply these truths to other disciplines. Often in planning studios, this fundamental knowledge includes data on the site, which can be gathered by the students themselves, and knowledge about problem solving techniques and design skills that can be taught by the professor. Once students grasp the fundamentals, they can apply them to greater, unknown subjects because they "discover[ed] the generalization that lies behind a particular operation" (Bruner, 1977). The process of discovery is not just about discovering site-specific information; it is about discovering general principles, working through ambiguity, and learning from mistakes.

One example that denotes the process of discovery from Yocom et al. (2012)'s rigorous form of experimentation is one involving building blocks. Student 1 is given blocks and he/she begins rigorous experimentation and/or trial and error to build a standing structure without understanding the fundamentals of structural engineering (such as the importance of a foundation and the strength of arches). He/she may eventually build a standing structure, but without knowledge of the principles he/she applied to this structure. Conversely, learning through the process of discovery includes initial knowledge about a subject, in this case

structural engineering. Student 2 learns the basic principles, and then applies them when he/she builds a structure. It is similar to trial and error learning, but it is with intention and understanding. Because the principles are understood and then applied, it is easier to translate these skills and apply them to other projects in the future.

The process of discovery is challenging to elicit in a planning studio because it requires a balance between structure and freedom. According to Yocom et al. (2012), it is important that studios maintain a "dynamic balance between creative exploration and experimentation and a more structured framework for enquiry." In my opinion, Yocom et al. (2012) provide too much structure in their framework to elicit the process of discovery. Much of the learning during the process of discovery comes from grappling with difficult concepts and applying them in new contexts. Much of the process of discovery comes from not being told what to discover or how. Instead, students are given the tools (knowledge), and decide for themselves how to use them. Too much structured guidance will detract from the student's process of discovery, while too much freedom can undermine the specific goals and quality of the final product.

Often, the process of discovery manifests itself in the steps students take to define the problem at hand and the appropriate product to produce for the client. Below is a conversation between the Professor and two students in an urban design studio (508A) that illustrates this point.

> Professor: It seems to me that though you are working on the same area, you are dealing with different issues still.
> Student 1: Well, we approached it as one site analysis.
> Student 2: And we included a discussion on groundwater purification, but that isn't our entire focus.
> Professor: That's okay. The important thing to get out of this for both you and for the client, is to know the issues you are dealing with and the solutions you are presenting. What are the issues? What are the solutions? And where are they useful in the city?

The dialogue in this example shows that there is no defined content or problem these students must solve, but instead they are learning through the process of discovery as they seek to define the solution for themselves (see Image 1 below). The professor's role in studio courses can vary, but often it resembles a facilitator or a mentor. In this example the professor guided students in their discovery process, but did not give them solutions or answers. The professor did this by turning the table on the students and asking questions of them. The professor's questioning directs the students towards new paths of enquiry but does not tell them which path to take. The process of discovery occurs when working on one's own, but it can be further enhanced when working in a group, where each person is exposed to the ideas and critiques of others. This is where the next element of PBL, interdisciplinary collaboration, comes into play.

Image 1. Professors and students discuss site conditions and strategies during the Chandigarh Urban Lab (CUL) studio held in Winter of 2014.

4.2 Interdisciplinary Collaboration

This concept of fundamental knowledge of a subject and the process of discovery is closely related to Lev Vygotsky's (1978) Zone of Proximal Development (ZPD) and interdisciplinary collaboration. Vygotsky (1978) believed in socio-cultural learning through external interactions. For Vygotsky, "mental life first expresses itself in interaction with others" (Bruner 1997). In the ZPD, the student has a body of knowledge of tasks he can do on his own. Just beyond that body of knowledge, but still within the knowledge of the teacher, is the ZPD, representing what the student can't quite do on his/her own, but can do with the help of the teacher. Because learning through interaction with others pushes student development, studio courses that foster a process of discovery and interdisciplinary collaboration are most effective.

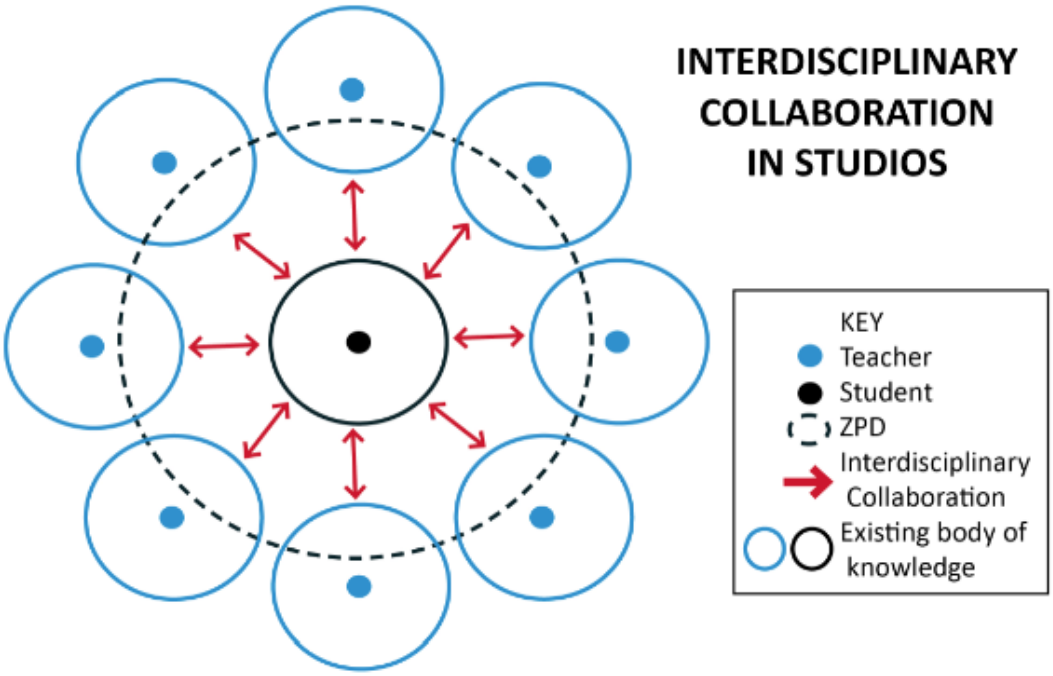


Figure 3. This figure shows the value of interdisciplinary collaboration in the studio learning environment.

Source: author

In this studio setting (Figure 3), the student's existing body of knowledge is represented by the solid black circle. Likewise, solid blue circles represent the existing bodies of knowledge of the teachers (who can be peers, professors, clients, etc). Diverse bodies of knowledge in the studio enhance the learning outcomes. Through interdisciplinary collaboration (shown by the red arrows), the student extends his/her knowledge to include some of the knowledge of his/her teachers. This newfound knowledge that can only be attained with the help of the teachers is the ZPD (represented by the dotted black circle). After enough practice and exploration of this new knowledge, the ZPD becomes part of the student's body of knowledge. Now the student can access this knowledge without the help of a teacher and has the ability to teach it to others. The potential growth for each individual's body of knowledge increases with interdisciplinarity. Studio environments offer this diversity and provide many opportunities for students to expand their ZPD because of their focus on interdisciplinary collaboration.

In the planning studio, as opposed to the traditional design studio, often includes a client and focuses heavily on group work (Forsyth et al., 2001). Therefore, "collaboration is a feature that has tended to distinguish the planning studio, emphasizing process as a professional skill" (Higgins et al., 2009). As urban planners, students need to understand how to enable diverse individuals and groups collaborate so they can understand problems and develop sustainable and innovative solutions. In the studio setting, these collaborative groups may be teachers and students, architects and planners, and/or citizens and professionals.

Educational courses that include interdisciplinary collaboration force students to develop teamwork and team integration skills (Yocom et al., 2012; Johnson et al. 2002). Though planning students are all studying the same discipline, it is a complex discipline so students

often come with diverse educational backgrounds and interests. Planners must routinely create solutions with people from a wide variety of backgrounds, ideological commitments, and professional skills. Additionally, many planning studios include dual degree students or landscape architects. This allows for a great deal of interdisciplinary collaboration in studios, even when most students are planning students. Interdisciplinary learning in studios creates solutions to complex problems facing our built environments by teaching students how to "combine analytical tools to tackle problems and questions that cross traditional disciplinary boundaries" (Youngblood, 2007). In turn, these efforts to work collaboratively across disciplines "demand new approaches that are more rigorous, more interactive, and transdisciplinary" (Johnson et al. 2002). Below I will describe the various means in which to elicit interdisciplinary collaboration in planning studios.

One way to achieve interdisciplinary learning is by shifting the role of student and teacher. ZPD and interdisciplinary collaboration go hand in hand. As described above, in Vygotsky's (1978) ZPD, there is a teacher who knows more than a student on a given subject matter. With the help of this teacher, whoever it may be, the student is able to understand and learn new ideas and concepts. Eventually, the student will be able to complete tasks that previously fell within the ZPD without the help of a teacher. In most classrooms, the role of the teacher is very clear. However, because of the structure of the studio learning environment, students are often teachers for their peers. For example, a student with an environmental science background might take on the role of teacher for another peer who has a design background, and vice versa. Students can also take on the role of teacher when presenting ideas to clients or peers. Similarly, the professor can take on the role of student in order to

facilitate the learning process by asking naïve questions. In a single studio students and teachers can shift between roles numerous times.

Another means to elicit interdisciplinary collaboration in studios is through a diverse student population. Studios are unique in that much of what we learn emerges from collaboration with our peers. Therefore, a diverse student population expands the number of learning opportunities. Even in planning studios, students come with various interests and diverse educational backgrounds that range from policy, science, engineering, technology, English, and so on. On top of those educational backgrounds, in graduate programs students often have prior professional experiences that inform their skill set and interests. One student summarized the purpose of the studio environment as one that "brings unique talents and strengths together in order to create a comprehensive and dynamic deliverable" (Student Interview, January 2014).

Finally, another way in which to achieve interdisciplinary collaboration is with the presence of a diverse body of knowledge. Instead of following a standard trajectory for knowledge acquisition, a student's body of knowledge is stretched in many different directions through interaction with their peers and professors. This interdisciplinary collaboration is show in the diagram below. It is important to remember that the student and teacher roles are not fixed. The professor and students fluctuate between these roles, and this diagram illustrates the learning that happens when an individual is in the role of student. This is not to say that the teachers themselves are not learning by teaching, but this diagram focuses on the learning by the student.

Interdisciplinary collaboration extends far beyond the studio environment, because it informs how we collaborate, educate, and innovate in a global society that is increasingly more connected and interdependent. Even at the local level, the challenges facing our cities are so complex that the best solutions always involve many collaborators. For these reasons, interdisciplinary collaboration is a key element in the studio learning process.

4.3 Metacognition

The final element of PBL is *metacognition*. Metacognition is the self-awareness of how one learns. When students are metacognitive, they are more self-aware of their own learning, which enables students to be more intentional about it. The metacognitive element of PBL helps students "take control of their own learning by defining learning goals and monitoring their own progress in achieving them" (Bransford, 1977). Technically, it is a process that occurs within the brain, but there is no reason why it can't be enhanced in a learning environment (Mayer, 1992).

Bransford et al. (1999) describes metacognition as an "internal conversation" (p. 18), and suggests that students can be taught strategies for thinking about learning and problem solving. Metacognitive learning is the externalization of this internal process. Schon (1985) described reflection-in-action in studios, which is essentially metacognition. When students reflect on how, why, and when their learning occurs within the studio course, they are able to retain more critical thinking and problem solving skills after the conclusion of the course. Metacognition has also been called "active learning" by Bruner (1977) because it requires students to be actively engaged in their learning process. Metacognition becomes more

important in PBL because by making students aware of their own metacognition, that internal conversation can then become an external conversation amongst studio peers and thus enhance the collective learning process. While traditional notions of metacognition emphasize the learning that occurs within the individual, PBL also recognizes the important learning that takes place within the group. Studio courses can help students achieve collective metacognition when they are in conversation and cooperation with their peers (Monson, 2005). The group, as well as the individual, learns to be cognizant of its own collective learning. For this reason, studios should elicit metacognitive practices in their curriculum.

Metacognition is reinforcement for the process of discovery, because metacognition allows students to take the time to understand how they solved the problem so that the same technique can be used again to solve a different problem. This type of reflection-in-action "converts tacit knowing-in-action to explicit knowledge for action" (Schon, 1985). This reflective learning includes "restructuring function, reshaping strategies, understanding of phenomena, and ways of framing problems" (Schon, 1985). The entire process has a quality of a "reflective conversation with the situation" (Schon, 1985). This metacognitive reflection is a necessary step in the studio learning process because it requires a marriage of problem setting and problem solving. Within the formal structure of a studio, it can link the first few weeks of a studio course with the last few weeks, but with the studio experience itself, it should be happening all the time. Studio critiques throughout the course illicit the reflection-in-action that Schon (1985) values. As a whole, metacognition solidifies the critical thinking strategies developed throughout the studio.

Pedagogical approaches can be taken to emphasize individual and collective

metacognition. Generally, this occurs at the individual level when "Instruction is geared toward helping the student and the collective to develop learning and thinking strategies that are appropriate for working within various subject domains" (Mayer, 1992, p. 407). These "processes of learning and the transfer of learning are central to understanding how people develop important competencies" (Bransford, 1999, p. 51).

Because of its inherent social learning structure, the studio relies on metacognitive development for students to learn from mistakes and improve on their product after feedback. According to Kuhn (2000), "a promising approach to fostering metacognitive development focuses on the idea of exercising, at an external, social level, the cognitive forms we would hope to become operative as well at the individual level" (p. 180). Though this cognitive process of learning is within the brain, it is externalized in PBL through conversations and collective learning, as if the studio class is one giant, learning brain. In many ways, studio courses facilitate Vygotsky's (1978) ZPD and social learning theories by making an internal conversation, external.

4.4 Process Based Learning: The Big Picture

The internationally famous architect, Le Corbusier, referred to the design and planning process as the "process of the meander," meaning there is no direct route to a solution, but rather it is a meander that eventually finds us at the best solution. As he put it, the solution to the crisis is in the law of the meander.[1] Process Based Learning includes an inherent process of wandering. The process of wandering manifests in each of the PBL elements. In the process of

[1] Le Corbusier's sketch describing the Law of the Meander is currently hung at MOMA but can be viewed online.

discovery, students take steps and missteps. Metacognition helps us reflect on the missteps before we take another step. Throughout this process of wandering, we are repeatedly collaborating with peers, professors, and clients in order to plan our next step or misstep. Even though I call these missteps, it is important to note that they are not incorrect. Reflection and collaboration on missteps transform these missteps into building blocks for the next step. PBL is more about the journey, and understanding how to convert missteps into steps. As one student put it, there is no one part of the studio learning process that is most important "because when I think of studio I think of the whole thing together because there are so many ups and downs with a project. It morphs so much that the greater whole is what's important" (Student Interview, March 2014). The studio learning environment is one of "two steps forward, one step back" (Student Interview, January 2014). Students who recognize the value of the one step back recognize the value in learning from mistakes. This back and forth learning process incorporates all three elements of the PBL model because students make mistakes (process of discovery), work with their peers (interdisciplinary collaboration), and are aware of the positive impact this process has on their learning (metacognition).

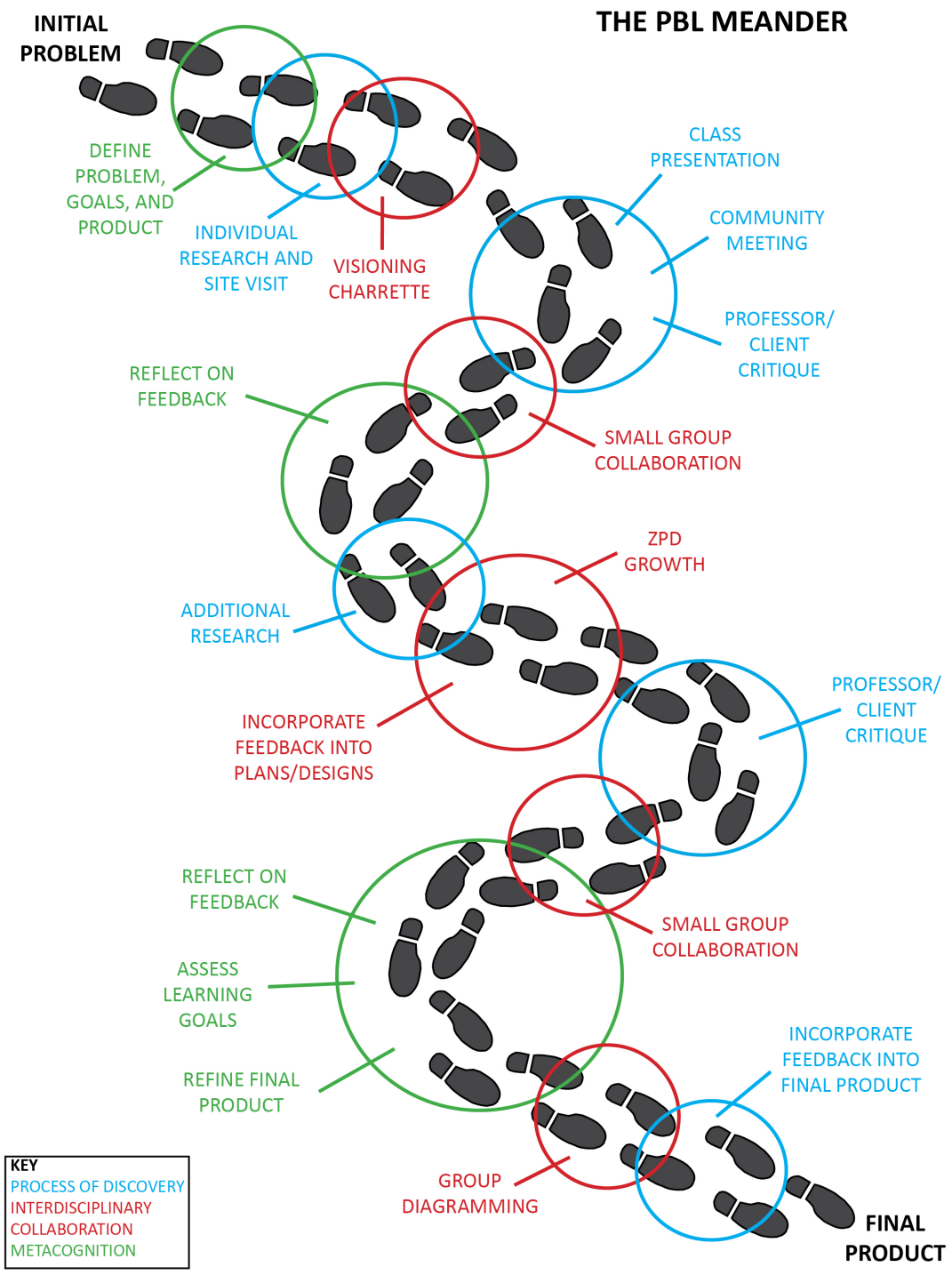


Figure 4. Similar to the process of the meander, the studio learning process is not always direct. Rather, it is curvilinear. This diagram is not one specific studio pedagogy, but rather a general idea of how PBL comes into play in a studio environment and how the three elements overlap. Source: author

Figure 4 illustrates the meander of Process Based Learning. It attempts to show how the three key elements are linked throughout the course of a planning studio. The text call outs denote activities that may be occurring in a given studio to elicit these learning elements. Often, critiques garner constructive feedback and cause students to recognize their "missteps". Students sometimes feel they are taking steps backwards when incorporating this feedback, but really, these are their most important steps. It is these steps that cause them to reflect on their learning, collaborate with peers, and discover new truths about their project.

It is becoming clear in this investigation that the three elements of PBL - the process of discovery, interdisciplinary collaboration, and metacognition - are interwoven and often occur simultaneously. In order to achieve PBL, it is imperative that all three elements are present. They are not phases of learning, because one does not always precede another. These are three elements of learning that occur in studios, and when they are understood and intentionally interwoven, they elicit the strongest learning outcomes. Though the structure and content of urban planning studios varies, the type of learning they elicit, PBL, remains the same. Since it is the learning process that is consistent and valued, rather than the product, we should measure learning outcomes based on this process.

PART II: PBL IN THREE CASE STUDIES

Chapter 5: Grounding the Theory in Three Case Studies

After creating my PBL model, I sought to ground this theory in practice. In order to truly capture the learning that exists in planning studios, it was necessary to observe that learning first hand. This investigation allowed me to analyze and illustrate my model, and further refine it. I found evidence to support the PBL model and its potential to improve planning education as a whole.

5.1 Methodology

The following methodology is based in part on qualitative classroom observation techniques by Fasse and Kolodner (2000) and from ethnographic field note techniques documented by Emerson et al. (1995). When observing the Learning By Design (LBD) curriculum, Fasse and Kolodner (2000) used standard qualitative research methods such as participant observation, surveys, and interviews to understand social interactions and figure out what is responsible for the student's learning. The LBD curriculum is similar to planning studio curricula because it asks students to be intentional, communicative, collaborative, and reflective. LBD is "designed to promote learning and acculturate students into an environment that values sharing of ideas, investigating for the purpose of informing a community, informed decision making, justifying based on evidence, building on what others have done, and critical evaluation" (Fasse and Kolodner, 2000, p. 193-194). Similarly, PBL promotes inquiry, collaboration, and both individual and group reflection. Due to these consistencies in the classroom observational settings, qualitative research methods such as participant observation, surveys, and interviews were deemed appropriate for observing PBL in the planning curriculum.

5.2 Three Case Studies

Three University of Washington (UW) classes were used in this research: a studio within the Masters of Urban Design and Planning Department (URBDP 508a), an Urban Design studio for both graduates and undergraduates taught on site in Chandigarh, India (URBDP 508 - CUL), and an undergraduate lecture course within the Community, Environment, and Planning Program (CEP 200). These two studios both involved graduate level planning students, but one provides a case study in a planning led and dominated studio (URBDP 508a), while the other was an architecture led and dominated studio (URBDP 508 - CUL). CEP 200 addresses the use of PBL techniques in non-studio based courses to understand where PBL components exist outside the studio course. Collectively, these courses reveal the components of PBL as they exist in both the undergraduate and graduate education within the planning and design based studios.

Two of the studio courses and the lecture course included classroom observations, personal interviews, and/or written surveys. All subjects in field observations, interviews, and survey responses are anonymous. As the researcher, my role in these classes ranged from observer, participant, and teacher, thus affecting my observational techniques in each classroom.

5.3 Classroom Settings and Subjects

URBDP 508a was held Autumn quarter 2013 in a studio space at UW. There were ten graduate students in the class: nine Master of Urban Planning candidates and one Master of Landscape Architecture candidate. One professor in Urban Design and Planning and one

teaching assistant led the class. My role as an observer was evident because I was not registered for the course. I let subjects know of my general research inquiries and sat in on the studio once per week.

URBDP 508 – CUL was held Winter quarter 2014 in Chandigarh, India. This was a faculty led, interdisciplinary urban design studio that was comprised of sixteen students, eight graduate students and eight undergraduate students. The class included five planning students, three landscape architecture students, eight architecture students, and was led by UW professor of Architecture and assisted by one UW professor of Urban Design and Planning. The international, interdisciplinary, and on-site nature of this studio makes it unique from my other case studies. This is intentional because it illustrates how PBL might look different under different conditions. I took this into consideration when considering interview responses and looking for patterns.

CEP 200 was held Autumn quarter 2013 in a large classroom at UW. There were 34 undergraduate students in the class and it met twice a week for two hours and twenty minutes each day. The lesson plans often included a 45 minute lecture, both small and full group discussions, followed by a student facilitation for the remaining class time. These facilitations often included design charrettes, group discussions, or problem solving activities. I was the lead instructor for this course and students were unaware of my research.

Image 2. CUL gathers outside of the Chandigarh College of Architecture on the first day of class. Photo used with permission from Vikramaditya Prakash.

5.4 Observer Role

As mentioned above, my role as observer varied for each course. The roles are defined as follows:

1. Participant

   For URBDP 508 – CUL, I was a participant in the studio. This reduced the total time I had available to observe, so some of my observations (labeled 'participant') were recorded after the fact, using my own discretion to determine that the observation was relevant to my inquiry and therefore worth transcribing.

2. Participant-observer

   In URBDP 508 – CUL, I was a participant-observer for approximately three hours per week. These times were chosen at random when my own group work allowed me to switch from participant to observer. This meant that my peers were unaware that I was observing their interactions and taking field notes, because they assumed I was

working on my own project for studio. This ensured no data was influenced by my presence as an observer. During these observations, all interactions were recorded, whether or not they were relevant to my inquiry.

3. Observer

   For URBDP 508a, I was an outside observer, which allowed me to simply observe numerous individual and group learning processes. I recorded conversations, interactions, reactions, and situational settings. My subjects were aware of my observations, which may have influenced some of the data.

4. Instructor

   For CEP 200, my role was lead instructor. This forced me to reflect on observations and learning processes after the lesson had concluded. Memory certainly influenced the data, as well as selectivity of the material recorded.

5.5 Data Gathering

During Autumn quarter 2013, I took field notes during one URBDP 508a class meeting per week purely as an observer. Field notes were taken as conversations and learning occurred. Due to location constraints, post-course surveys were conducted via email. Observations from CEP 200 were written after class meetings because my role as lead instructor inhibited me from recording observations during class. An informal, in-person question and answer session was held on the last day of class to assess the curriculum design and search for elements of PBL. During Winter quarter 2014, I was a participant in the URBDP 508 Chandigarh Urban Lab (CUL). In order to observe and participate in this studio I spent three hours of class time each week

taking field notes of the conversations and learning happening around me. The studio met three times per week for four hours each day, and for approximately one hour each class meeting I switched from participant to observer. At the conclusion of this course I conducted in person interviews with each student in the studio. This was the first time that they were aware of my research. My observations in the URBDP 508 CUL were restricted when I had to prioritize my own class work above my observations.

5.6 Investigative Tools

The same interview questions were used for all studios included in this research to maintain consistency in research design. To review the full set of questions asked, please refer to the appendix. As previously stated, URBDP 508a answered these questions in a written survey, instead of in personal interviews due to location constraints. The URBDP 508 CUL answered these questions during personal interviews during which I recorded notes on my laptop as they spoke.

5.7 Data Analysis

In total, I had 18 viable responses to either my survey or interview to analyze. There was not a large enough sample size to code the data, and that was not the intention. I wanted to understand where students believed their learning took place in studios. My questions sought to uncover how the three elements of PBL were being applied in studio courses. I used qualitative data analysis techniques to pull out key words and patterns from the surveys to see how the PBL model manifests in studios. One such technique included the web-diagram (Figure

2). This web diagram presents a network that shows how the different elements were experienced in relationship to one another in an actual student setting. Rather than numbers or percentages, I gathered personal stories, testimonies, and observations that helped me refine and ground my model. Responses were grouped by student, by PBL characteristic, or by keyword/topic. These various organization techniques allowed for a thorough analysis of my model. It allowed me to refine the model based on an iterative process of application and critique.

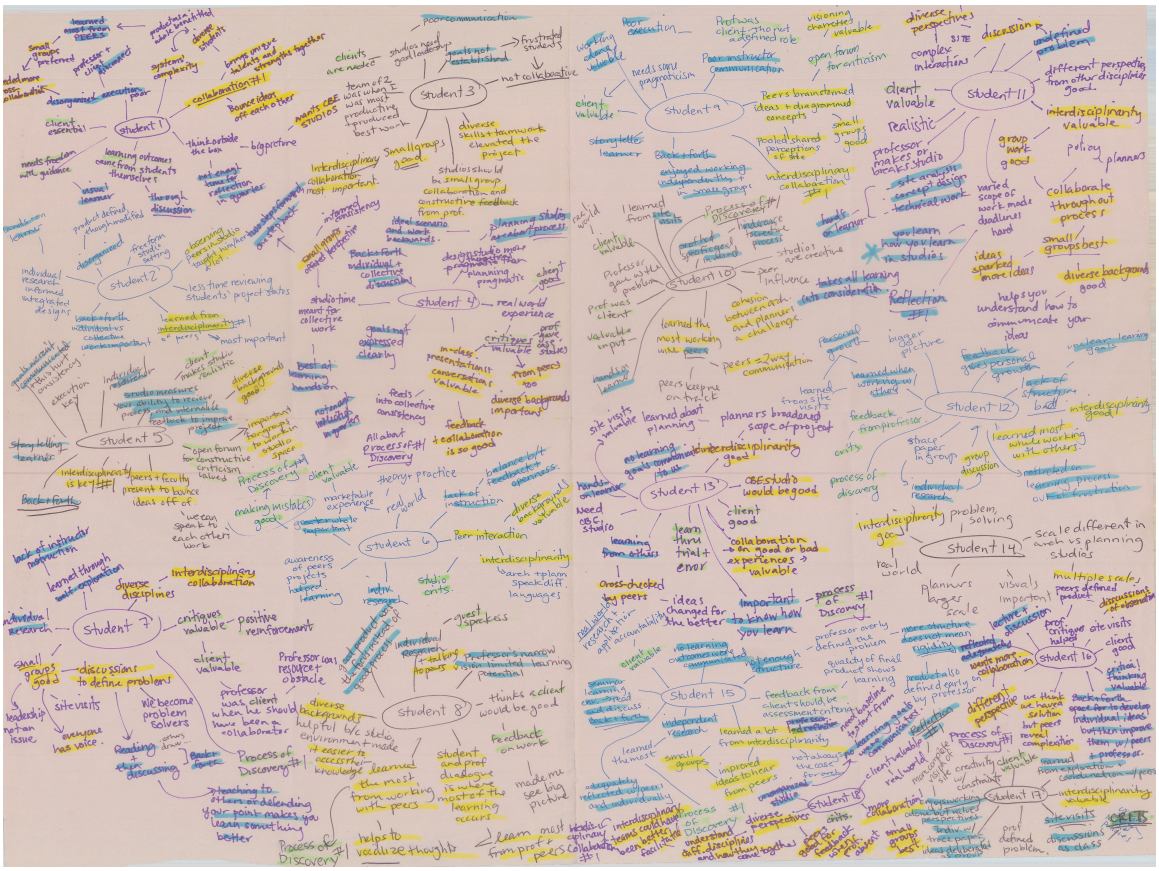


Figure 5. Web diagram used to find patterns in the interview responses. Colors represent different PBL elements (blue = process of discovery, yellow = interdisciplinary collaboration, green = metacognition). Source: author

Chapter 6: Illustrating the PBL Model

In this section I discuss the evidence of PBL I found in the two studio courses I observed and interviewed in for this research. It is my intention to present the voices and opinions of the students who participated in these studios in order to understand their individual and collective learning process. Based on these case studies, I will give examples of PBL as it exists in the studio learning process. Below is the Venn diagram that illustrates the interconnectivity of the three PBL elements and common pedagogical tools used in the observed studios to elicit them.

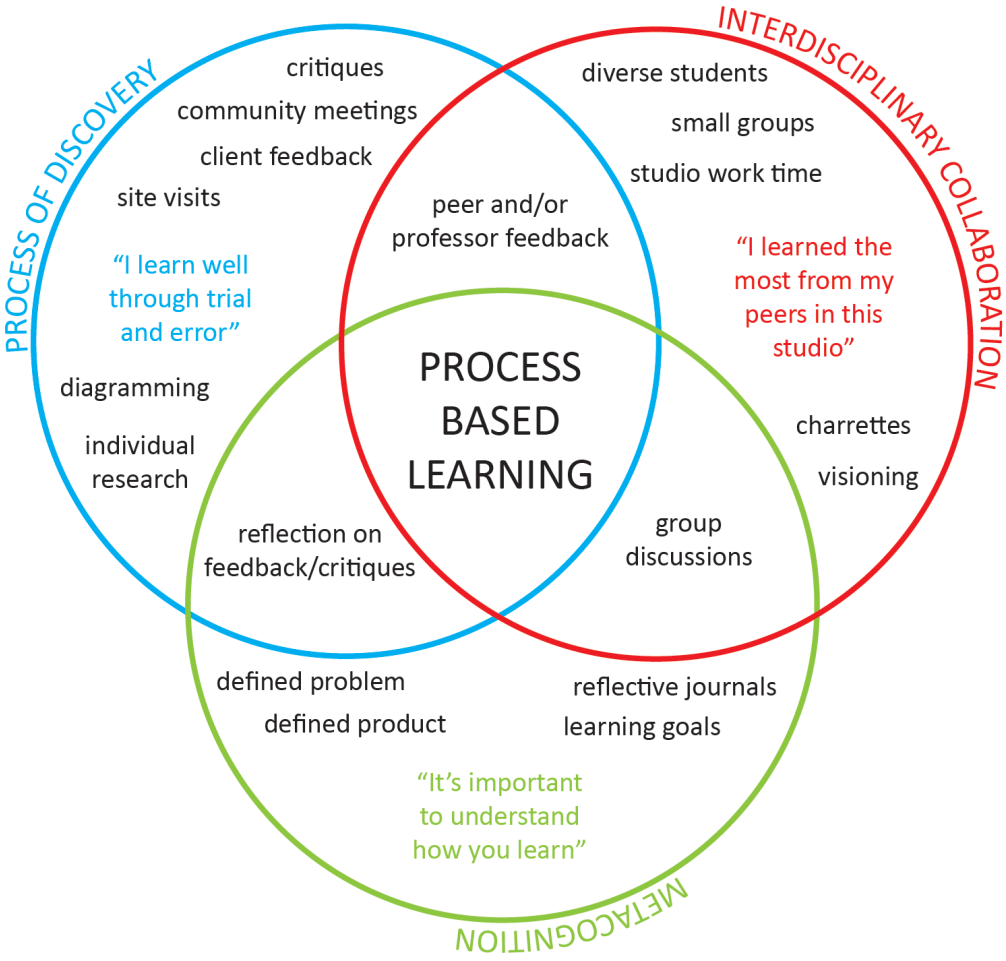


Figure 6. The key elements of process based learning (PBL). All quotes are from student interviews. Source: author

6.1 Process of Discovery

Upon reflecting on their studio experience, many students cited the process of discovery as one learning technique that set studios apart from other courses in the curriculum. The students valued this trial and error learning style because it forced them to repeatedly present and then revise a product after receiving critiques and feedback. Many students found that the most valuable part of their learning process in studios was the feedback from peers, professors, or clients. It was through these interactions that students were exposed to new strategies, ideas, techniques, and problem solving methods. It was then up to the student (sometimes in collaboration with their peers) to decide which tools to use in their design solution. This type of learning manifests in the process of discovery element of the PBL model because students were given fundamental knowledge and guidance, but were then left to themselves to discover the best strategy to reach their desired solution.

A. The Role of Feedback

Feedback manifests in the process of discovery because feedback launched and further fed the discovery process. Rather, good feedback asks the right questions of students by showing them different paths to take without telling them which is one is correct. Sometimes, students ignored feedback and blazed a new trail all on their own. No matter which road the student took, each student experienced valuable learning through the process of discovery.

Despite the benefits of feedback, it can also be frustrating. Typically, feedback comes when the student feels he/she is making strides towards a solution, but the feedback can cause

them to question their design and make modifications to it. Below is an example of a professor guiding a student but leaving it up to him/her to choose which path to take.

> His suggestions for case studies and precedents were the most helpful for me. In one specific conversation we were talking about how to handle an elevated-transit/heavily-traveled corridor/pedestrian trail interface. He brought up several different strategies, citing specific case studies that significantly informed my work. Design students need to remember that we're rarely reinventing the wheel – we're often using ideas that have already been used, but putting them together in a new way.
>
> - Student Interview, January 2014

As studios professors often do, this professor took on the role of facilitator, rather than instructor. He/she asked the right questions of the student and offered various directions for the student to choose from. This type of feedback ties in with all of the PBL elements, because it encourages the process of discovery through collaboration with the professor. Students reflect on the feedback and if they understand how they learn they will be able to quickly and successfully improve their product to incorporate this feedback.

B. Clients and Discovery Facilitators

When asked if working with a client was beneficial to the studio learning process, 100 percent of all student respondents said yes. According to the students, having a client made the studio more realistic and pragmatic, allowed the professor to take on a role of collaborator or coach rather than client, and provided criteria with which to assess the final product. Clients enhance all elements of PBL because they increase accountability in the process of discovery, interdisciplinary collaboration, and metacognition. Having a client puts pressure on the students and drives the process of discovery through client input, professional presentations,

and community meetings. These professional interactions also require attention to the interdisciplinary collaboration between the students and the client. A client's feedback is often times more than a suggestion, but rather a required change that the student must make to his/her project. In order to incorporate this feedback, the student is compelled to think metacognitively on his/her learning.

Working for a client provided students with a great deal of accountability because the product was for more than just a grade. Students said this inspired them to work harder and ultimately learn more. This improves metacognition because it forces students to think about one's definition of "quality" and his/her relationship to it. Additionally, one student recognized that a studio client “provided the opportunity for mutually beneficial learning and utility” (Student Survey, January 2014) because both parties, the students and the clients, had valuable insights to offer the other. Both the client and the students have goals for the studio, and it serves as an irreplaceable learning experience for students to work creatively within the constraints of a client. Having a client enhances PBL by introducing more checkpoints and feedback that the student is forced to incorporate into his/her model. There may not be a clear path to the solution the client requests, so students must think creatively to get to that solution. Clients rarely tell a consultant (in this case a student), *how* to solve a problem, but rather they tell them *what* they want the solution to look like. It is up to the student to discover the path to the solution, hopefully with the guidance of their instructor.

If there is no client for the studio and the professor intends to take on that role to some extent, then that role needs to be clearly defined at the beginning of the studio. In the CUL, there was no real client for the studio, and one professor decided to take on this role without

notifying his students. Many students confided that they became frustrated because this role was not clear and therefore "the professor was an obstacle rather than a resource" (Student Interview, March 2014). Therefore, when the professor is telling the students which path to take, it blocks the process of discovery and thus impedes a key element of PBL. Instead, professors need to offer guidance and tools, the client needs to clarify the desired product, and the students need to discover for themselves the best paths in which to navigate to their product.

C. Site Visits as Discovery

One pedagogical tool used by instructors to elicit the process of discovery in their students was a site visit. During site visits, students get to experience the project area for themselves and make personal observations. Without being told details about the site, they are able to discover them for themselves. Many students recognized the value of these site visits in their interviews. Without this on-site research, students would not have understood the existing social, environmental, and cultural conditions on their site. Without these explorations, students said they wouldn't have been able to offer valuable solutions that addressed the complexities of the site and its surrounding areas. Essentially, the site visit provided the fundamental knowledge students needed about their site in order to begin their meander to the best solution.

D. Personal Interviews as Discovery

An additional tool used to gather fundamental knowledge about a subject was personal interviews. Many students stressed the importance of conversations with community members, whether formal or informal; to better address the needs of the site. In these scenarios, the community member takes on the guiding role of a studio instructor, making suggestions and claims for what needs to be done on the site. It is up to the student to process these statements and decide which ones to address in their product. Community meetings can be used to formally gather feedback and conduct on-site information regarding the studio's project. In planning studios, this is a common pedagogical tool used to expose students to the various possible directions their studio process could take. Community meetings are also useful to spur reflection and collaborate with community members.

E. Discovery as an Individual and Collective Process

Various students cited the importance of individual research and design development as a means to gather and internalize ideas before presenting them to peers. They value this time alone to develop their ideas and think through their own solutions. This allows students to bring a well-researched and thought-out idea to their studio for critique and get input from both professors and peers. After receiving feedback, the process starts again as the individual works to incorporate the new ideas and improvements into their project.

6.2 Interdisciplinary Collaboration

Students recognize the value of interdisciplinarity. When students were asked if they benefitted from working with students with diverse educational backgrounds, all but one student responded yes (n=18). Students felt the diversity of their peers taught them new skills, broadened their perspective on a given problem, and improved their overall product. In addition to that, many students cited the real-world preparation they received from the interdisciplinary setting. Architects and planners will most likely be collaborating in the professional world so it is valuable to learn communication skills, work styles, and interdisciplinary teamwork first in an academic setting. While students cited the importance of full group visioning charrettes at the beginning of the course, they unanimously supported the learning environment when working closely in small groups. In general, interdisciplinary collaboration was seen as a valuable quality of the studio learning environment because peers became teachers, rather than just students.

One studio took the diverse student population one step further because it was an interdisciplinary studio that brought together architects, landscape architects, and urban planners. An architecture student said that when working with planners he found his “peers had a broader focus, so [he] became more aware of the larger context and the social and environmental impacts his project might have” (Student Interview, March 2014). Conversely, a planning student sited the value of architects because they " helped with my conceptual designs and drawings. Coming from a philosophy and liberal arts background, their expertise in translating thoughts and messages into design were very insightful and helpful throughout the course of the studio" (Student Interview, March 20140). Overall, students felt that they not only

improved their individual skill set through interdisciplinary collaboration, but they also understood diverse perspectives on a given problem and learned how to communicate with different disciplines. Many students recognized the different means through which architects and planners approached the same problem, as the quote below illustrates.

> Different perspectives always helps understands the problem better. Everyone comes from different specializations and backgrounds. Along this same line, everyone has different tool sets and skills that can enhance the project. Its also nice to have a person to bounce ideas off of and reign you in when you are off topic or being too 'precious.'
>
> - Student Interview, March 2014

Understanding one another's approach was imperative for successful communication and collaboration. In an academic context, students feel they now have a more holistic approach to problem solving, and in a professional context, students feel they now have marketable, real-world experience in collaboration.

A. Discussions as Interdisciplinary Collaboration

Vygotsky's ZPD theory describes how people learn through interaction and external conversation with a more knowledgeable other on any given subject. This theory is at the root of PBL's interdisciplinary collaboration. Because a studio facilitates interdisciplinary collaboration through its pedagogy, it is a learning environment that is ripe with interdisciplinary collaboration. Repeatedly, students said they felt voicing and defending their ideas improved them. This is similar to feedback, but focuses more on the collaboration and communication between two or more individuals. Feedback is often a cause of interdisciplinary collaboration and is closely related to the ZPD in PBL. Students were forced to articulate these

ideas with more clarity and support them with outside research. These conversations helped externalize internal thoughts and ideas, and made them stronger and clearer. Students felt that their peers positively impacted their ideas because they were in a two way communication flow, switching constantly between the role of teacher and student. Regardless of the role – teacher or student – both are learning and expanding their zone of proximal development to incorporate more skills and knowledge in the future.

> I think you learn more when you're teaching it to someone else. So working with a team, we have to teach people what we've learned or defend our point. That's when you yourself are actually going through the process of learning and not just being taught.
>
> - Student Interview, March 2014

The interdisciplinary CUL studio exposed the differences between architects and planners. Students in this studio claimed the two professions "speak different languages" (Student Interview, March 2014), and overcoming these communication barriers was a huge learning curve in the studio. This is a key step in interdisciplinary collaboration in the PBL model. Students must communicate, translate, and hybridize. If the studio is interdisciplinary, the communication challenge will exist in discipline and/or culture. This communication must then be translated and understood by the collaborators. Then there must be linguistic and cultural hybridization. In an ideal interdisciplinary studio, students will experience this interdisciplinary collaboration and be aware of it (metacognition).

These communication styles are different because architects and planners have very different problem solving approaches. Just as Van Herzele (2004) claimed, architects tend to focus on the immediate site without thinking about how it affects the surrounding region.

Planners, on the other hand, first look at the surrounding region and then think about how it affects the site. When working together on a common problem, these opposite problem solving strategies often cause difficulties for architects and planners. Communication and collaboration are tested as the two disciplines are forced to understand one another's perspective and approach. One such conversation that I observed illustrates these problem solving differences:

> Architecture Student: Is this process normal to you? Do you always look at the big picture first and try to get it all to work together in one vision?
> Planning Student: Well yes, you have to understand how it all works together before you can program a specific site.

The above quote is an example of the student translating the communication and realizing the cultural and linguistic differences present. Besides the different problem solving strategies, planners and architects often contributed different materials to the final product. In many of the CUL interdisciplinary small groups planners created guidelines and architects produced the visualizations. It was sometimes a challenge to get those two parts to mesh in a cohesive way, which represents the hybridization of interdisciplinary collaboration. This practice in interdisciplinary collaboration is valuable to the student's learning process because it is part of the necessary phases - communication, translation, and hybridization. Both disciplines had a great deal to teach one another – architects about the product, and planners about the process. Their influence on one another improved the quality of the studio as a whole.

Image 3. Architects and planners in a shared studio discuss their site's overall vision before sharing their individual research interests. Source: author

B. Space as Interdisciplinary Collaboration

A private group workspace is necessary to facilitate the interdisciplinary collaboration that takes place in studios. As one student put it, "the professor is not always around, so your peers become a great resource in studio" (Student Interview, March 2014). This shows the shift between teacher and student that occurs in the studio learning environment. Another student captures the studio environment as a space where, "peers are in the room though you are doing your own research and working through the project, but still you have peers and faculty present to talk through good ideas and explore options" (Student Interview, March 2014). If students are not all gathered and working in a common space, this collaboration is difficult and

therefore often bypassed. The quality of the studio's product and of the student's learning suffers from this. Peers offer diverse knowledge, various skill sets, unique ideas, and constant feedback. A group workspace allows students to bounce ideas off one another as they each take on the role of student and teacher throughout the course of the studio.

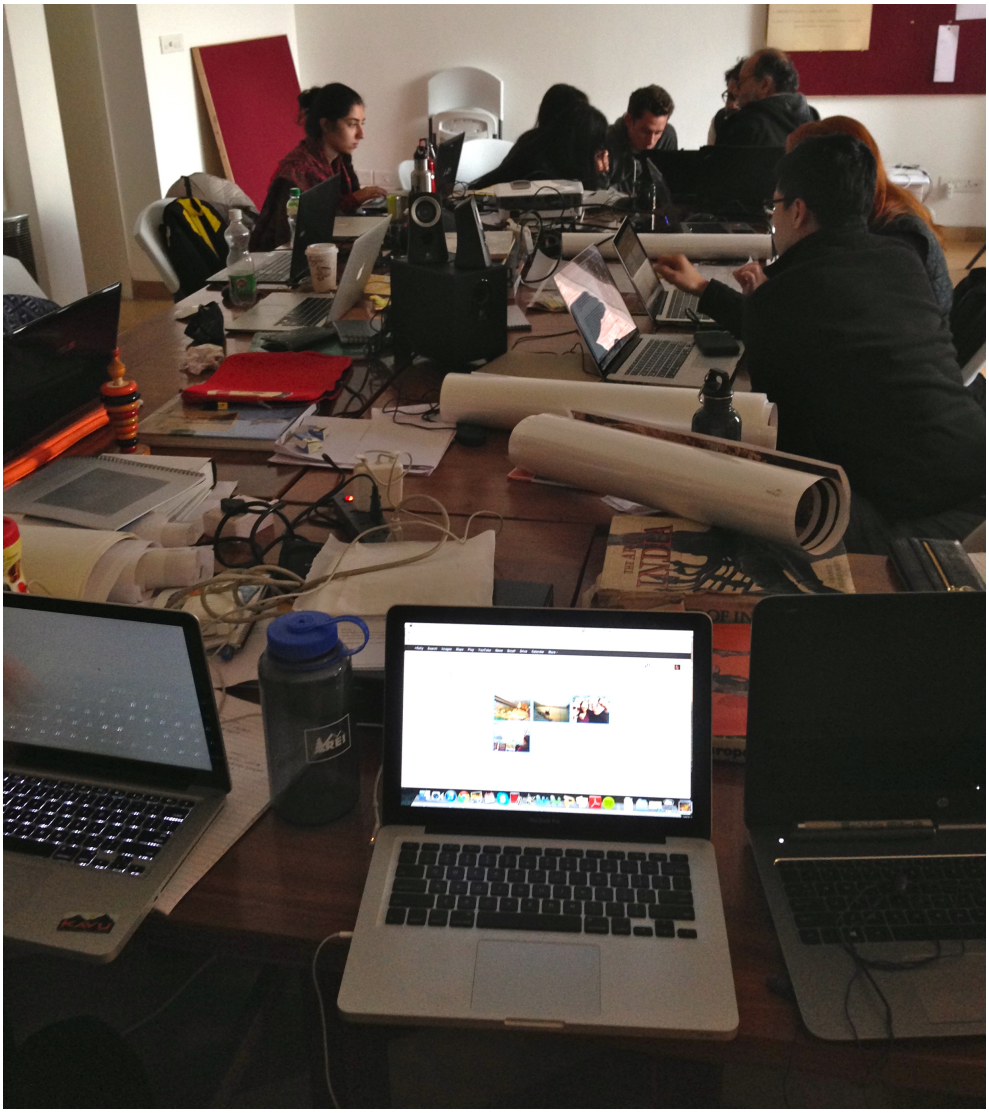


Image 4. The studio for the CUL provides space for interdisciplinary collaboration. Source: author

The studio space at the CUL (Image 4) was a large room with big tables meant for group work. There were different areas of the studio that were more conducive to collaboration or

individual work. For example, there was a loft that offered a reprieve from the bustle and noise of the main studio space for students needing time to think or do individual research. There were outdoor porches that provided quite areas for groups to collaborate and spread maps, diagrams, and drawings on the floor. The studio space is incredibly important because it's existence and design facilitate interdisciplinary collaboration, one of three important PBL elements.

C. Small Groups as Interdisciplinary Collaboration

Overwhelmingly, small groups were preferred over large groups by students in their studio course. Students said their voice was heard in small groups and their input felt valued. Others said they appreciated small groups because they "allowed each group to solve a specific problem in the greater spectrum" (Student Interview, March 2014). Leadership can be an issue of internal conflict in bigger groups, but if small groups are used, roles are usually more clearly and easily defined. When roles are more clearly defined, collaboration is more successful as individuals rotate between the role of teacher and student. This creates a positive environment for successful interdisciplinary collaboration in PBL. Small groups require accountability while still presenting diverse opinions. Small group work allows each group to solve a specific problem on a greater spectrum. Because the greater spectrum is all intertwined, cross-collaboration between groups and within the entire class should be facilitated by the professor to ensure consistency of the final product. Students felt that cross-collaboration between small groups would help the greater vision take on a more holistic response. Overall, facilitated by

the professor or not, interdisciplinary collaboration is a primary source of knowledge acquisition and application in studios.

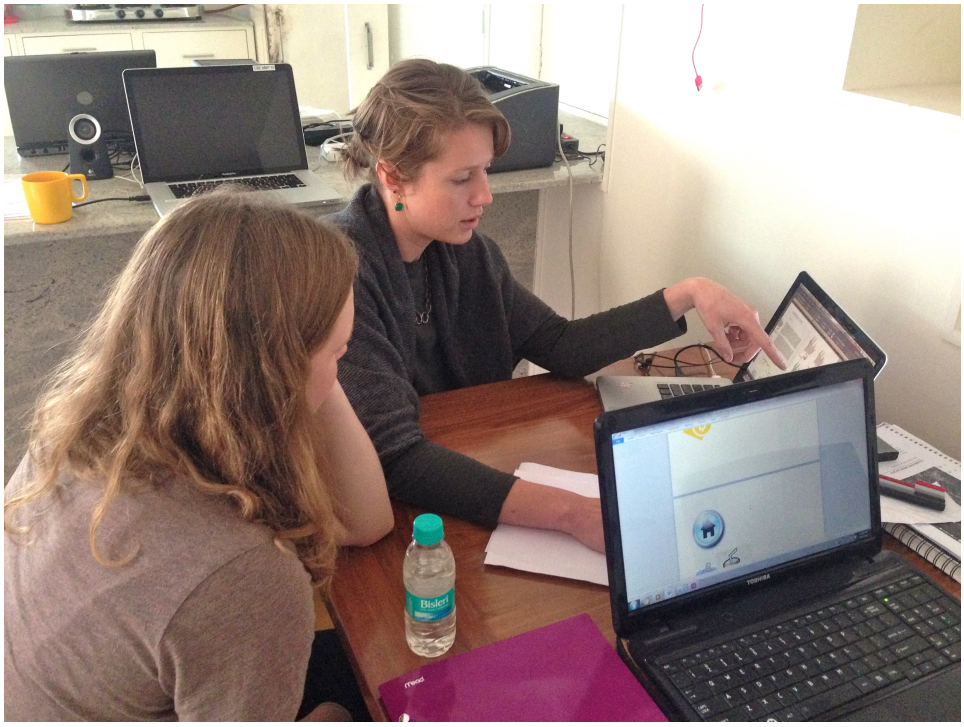


Image 5. Students collaborate in small groups to garner feedback and unite their individual projects into a greater whole. Source: author

6.3 Metacognition

"You learn how you learn in studios" and "it's important to understand how you learn" (Student Interviews, March 2014). These two students recognize the importance in understanding each individual's learning style in order to get the most out of a studio experience. One student elaborated, "[students] only reflected when frustration arose" (Student Interview, March 2014). If students recognize the importance of metacognition, but only take time to reflect when frustration arises; professors must build opportunities for reflection into their curriculum. Metacognition the most commonly overlooked element of the PBL model. Though the majority of students thought they adequately reflected on their learning

process during their studio course, none of this reflection was facilitated in the classroom. This type of structured reflection, especially early on in the course, could improve peer-client-professor communication and increase clarity of the studio's learning goals, site problems, and final deliverables. For these reasons, metacognition is an important element in the PBL model to round out and solidify the studio learning process.

Metacognition can take many shapes in the studio environment. Often, it seemed that frustration with how the professor ran the studio sparked reflection on the studio's purpose and what each individual hoped to get out of the studio. Other times, metacognition occurs after feedback or critique is received, and now the student needs to understand how to best incorporate this feedback and make the appropriate changes to their project. This is not to say that we should intentionally make our studios frustrating so students think metacognitively. There will always be frustration in any learning environment, no matter how organized it may be and frustration doesn't guarantee metacognition. Therefore, it is important that studios highlight the importance of metacognition throughout the meander, so that they understand how and when they learn, and so that they are able to apply what they have learned in future situations. Overall, one metacognitive strategy that appeared again and again in interviews was the need for the entire group to establish learning goals early on in the course and then revisit these throughout the quarter.

Very much related to the ZPD and interdisciplinary collaboration, students continually asserted how much they learned from their peers. Group discussions brought clarity, direction, and purpose to the studio. These discussions can seem both overwhelming and tedious at times, and are therefore tempting to brush over. Not all types of metacognition are this way,

but the problem and product definition in a studio is often tedious and can be frustrating. It is, however, a formative learning experience where short term and long term learning goals are agreed upon. However, it is clear from the student interviews and my own observations that these group discussions are necessary to ground the studio in agreed upon learning goals, to enhance personal growth, and to produce a quality final product. Students found that most of their learning occurred after a presentation, critique, guest lecturer, or outside research when they were able to discuss what they learned with their peers. These discussions allowed them to process and internalize what they had just learned.

6.4 Pedagogies for Full PBL

General observations of the studios revealed how the professor's role and the student's major could affect the outcome and process of the studio. Studios are learn-by-doing courses, which may cause some professors to neglect the quality of their design studio curriculum, especially with regards to student and faculty collaboration (Ochsner, 2000). Firstly, students said that their learning suffered when the professor was disorganized and gave too little guidance. Conversely, when the professor was too narrow minded and opinionated, he was also a hindrance to the learning process. The students interviewed in this thesis stress the importance of the professor's ability to balance guidance and freedom so that the students see the purpose but are allowed creativity to explore it. The professor must be seen as a resource and collaborator, not an obstacle or decision-maker. If the professor provides too much guidance, he negates the process of discovery. If the professor doesn't offer enough guidance, students will not have the tools necessary to discover for themselves. Skilled professors

empower their students with knowledge but allow them to experiment and apply it as the students see fit.

Chapter 7: An Ideal Studio Pedagogy

The following pedagogy is my own curriculum proposal for urban planning studios. By adding the element of time, I illustrate how the three elements of the PBL model would appear in a five part studio curriculum. It is based on my literature review, classroom observations, and student interviews. This pedagogy can also be used for interdisciplinary studios which include planners, and it assumes the presence of a client because students expect this professional experience and "without a real client the studio is only an academic exercise" (Student Interview, March 2014).

My proposed pedagogy is somewhat similar to the one proposed by Yocom et al. (2012) with some modifications influenced by my observations and interviews. Another major influence on my pedagogy comes from Senos et al. (2002) and their citation of four parts in the studio learning process. Those parts become parts of my proposed curriculum beginning with (1) problem identification, (2) analysis and synthesis, (3) communication and facilitation, and ending with (4) solutions and implementation. In my curriculum I emphasize one final part, (5) metacognition, as first described by Schon (1985) as reflection-in-action. My sub-headings below describe the part of the studio curriculum as well as the main PBL elements captured by that part.

7.1 Part 1: Problem identification | Interdisciplinary Collaboration and Metacognition

It is true that "real-world problems do not come well-formed" (Schon, 1985), so therefore a large part of the learning process in studios begins with problem identification. Defining the problem elicits cross disciplinary framing, methods of analysis, and requires full

group collaboration. According to Steinitz (1995), “design theory and research historically have directed a great deal of inquiry into the problem of how one defines problems.” Designers and planners must be able to define environmental problems clearly, accurately, and comprehensively to prescribe solutions that are compatible with the social and physical landscape. That entails "comprehending the economic, political, cultural, and ecological forces at work in any given landscape system prior to promoting specific change” (Senos et al., 2002).

When defining the problem it is equally important that the studio class defines the desired core competencies for both the individual and the group. Core competencies are the expected skills and/or learning outcomes for the client, professor, students, and the collective. They help us articulate what we have learned, what knowledge we have, and how we plan to use these skills. Identifying core competencies will give the studio ground from which to stand on, keep the students on track throughout the course, and provide a framework for assessment at the conclusion of the studio. The entire group will collectively decide on their core competencies and additionally each student will write down his/her individual core competencies. These can be reviewed in an exit interview with the professor towards the end of the studio course.

7.2 Part 2: Analysis and Synthesis | Process of Discovery and Interdisciplinary Collaboration

This phase of the curriculum represents the majority of the studio course. As more and more of our planning and design projects highlight the relationship between the built and natural environments, students are challenged to analyze and synthesize complex relationships. Architects and planners alike “do more than just collect information. We gather input from

many sources, distill the essentials, and critically make the synthesis spatially explicit" (Seños et al., 2002). We then have to communicate this multifaceted design to professors, community members, and professionals and incorporate their feedback. The analysis and synthesis part of a studio course demands interdisciplinary collaboration throughout the process of discovery, continuously moving forward only after first reflecting on lessons learned.

7.3 Part 3: Communication and Facilitation | Interdisciplinary Collaboration

Part 3 overlaps some with parts 2 and 4. Oral, written, and graphic communication skills are imperative for planners and are developed throughout the course of the studio. "Practitioners require good training in listening, facilitation, mediation, and conflict resolution to bridge communication and value differences across divergent stakeholder groups" (Seños et al., 2002). Students learn communication and facilitation skills through interaction with classmates, professors, clients, and community members. These skills can be learned in the studio classroom during presentations or critiques and/or at community meetings during public outreach.

A studio curriculum that elicits communication and facilitation opportunities can bring about other desired learning outcomes as well, such as learning about ethics, morals, and values. Planning studios desire an ethics learning outcome in their curriculum, but it is often hard to measure (Nemeth and Long, 2012). Ethics education can be built into a studio curriculum with clients who practice environmental or social advocacy. NGOs, environmental lawyers, tribal leaders, social workers, or government organizations as studio clients will offer critiques to build the ethics component that planning studios desire (Johnson et al., 2002).

7.4 Part 4: Solutions and Implementation | Interdisciplinary Collaboration

This part of the studio curriculum often lasts longer in design studios because of the focus on the product. On the other hand, planning studios are more focused on the process rather than the product. This part of studio is where the individual parts must be again brought together in one vision. The class must decide on the final product contents and how to communicate it to the professor, public, and client. In studios, "our work is oriented toward finding practical solutions, and doing so requires an ability to think 'out-of-the-box' and adapt to change through innovation, creativity, inspiration, and integration" (Seños et al., 2002). This part requires intense collaboration and reflection in order to bring all of the pieces together into a coherent final product.

7.5 Part 5: Metacognition

Schon (1985) says in studios, it is not about knowledge, but about procedure. I take this to mean learning is not about one's knowledge, but rather about the process and problem solving approach used. Learning is a dynamic knowing process rather than static knowledge that allows us to solve new problems even if they are different than any we've come up against in the past.

Similar to learning with understanding, in the process of discovery, it is important to take the time to understand how one solved the problem so that the same technique can be used again to solve a similar but different problem. This type of metacognition "converts tacit knowing-in-action to explicit knowledge for action" (Schon, 1985). This reflective learning

includes “restructuring function, reshaping strategies, understanding of phenomena, and ways of framing problems” (Schon, 1985). The entire process has a quality of a “reflective conversation with the situation” (Schon, 1985).

Chapter 8: Extending PBL to Non-Studio Courses

Now that we understand PBL theoretically and empirically we can ask if it is possible to extend it beyond the planning studio. Can PBL be incorporated into other forms of courses? To answer this, I experimented with my own undergraduate class, "Introduction to Community, Environment, and Planning (CEP) 200." CEP 200. CEP 200 class started with a lecture by the instructor (me), followed by a small group activity that got students interacting with and teaching one another, and concluded with a full group discussion that reflected on what was learned that day. Even lecture based classes can incorporate the process of discovery, interdisciplinary collaboration, and reflection.

As one student phrased it at the end of the course, "I realize how much more I learn from discussion based classes because I am able to explore ideas in conversation with my peers. This helped me understand the ideas better and really internalize the meaning because I had to figure out how to say them aloud. It also allowed me to expand my ideas on a topic because I could learn from the diverse opinions of my peers" (Student Interview, December 2013). As the student told me this, Vygotsky's name resounded in the classroom. Along with this famous educational psychologist, I also recognized the positive effects of the process of discovery, interdisciplinary collaboration, and metacognition. Below is a snapshot of a class session that captures these PBL elements.

8.1 CEP 200 Lesson

I agree that "education is perhaps the most important branch of scientific technology" (Skinner 1954, p. 93), and therefore it is important that we understand the psychology of

learning and its implications for curriculum design. Taking to heart Bransford's (1999) three types of learning and Bruner's (1994) models of the learners' minds, I constructed a lesson plan to teach my CEP 200 undergraduate students the skills and tools of facilitation as articulated in a handbook by Fran Rees (2005). My lesson plan was structured around Bransford's (1999) theory of learning with understanding, in that I presented student's with facts, then led two activities to apply the facts that had just been learned. The added discussion components check understanding and allow students to assess their own learning progress, and possibly introduce elements of metacognition. What arose were elements of PBL, most notably interdisciplinary collaboration and reflection, though there were bits of discovery as well.

This class session aimed to give the students a basic understanding of a facilitator's responsibilities in the group process and strategies to achieve the group's objective. The lesson plan began with an interactive presentation on the tools and techniques of a good facilitator. Details ranging from question asking to note taking were covered in the lecture. I grouped these tools and gave conditions in which they should be used. Though unknowingly at the time, this was a good teaching strategy because when we "chunk various elements of a configuration that are related by an underlying function or strategy" (Bransford, 1999, p. 32), we demonstrate superior recall abilities. This lecture was the first step in the process of discovery because I gave students fundamental knowledge of a subject before having them grapple with it to learn more.

Next, I split the class into six groups and gave them 15 minutes to decide with consensus on the ten most important items they would bring to a deserted island. This activity brought about the process of discovery through trial and error and interdisciplinary collaboration.

During this process some groups succeeded in coming up with ten items, while other groups forgot the facilitator's responsibility of time management. As a full class we dissected the group process and the various facilitation skills and tools employed. This activity allowed the students to an opportunity to discover tools of facilitation without further direction from the teacher. Through the process of discovery, students made some facilitation mistakes (like running out of time) that they were able to learn from before their next activity. They learned from these mistakes and from the mistakes of other groups when we reflected as a class on how the activity went.

For the last part of the class session, the students formed six small groups and were each given a scenario that represented a common obstacle in group meeting facilitation (i.e. a conflict between two housemates, a dominator in conversation, a quiet group member, a slacking group member, etc). Each group was asked to act out their scenario using the facilitation skills they had just learned in order to demonstrate their mediation of the obstacle at hand. After each group finished performing their skit, the rest of the students were asked to point out the specific skills that group used to quell their troublesome group member. This technique incorporated process of discovery, interdisciplinary collaboration, and metacognition because students learned basic facts and were then asked to work in teams to apply them to new scenarios. This activity was followed by a reflective discussion that made students aware of their learning process.

For this event, the student's learning was measured as a large group based on their analysis after the stranded island facilitation activity and with their application of said learned tools and strategies in their skits. When I watched the skits, there were various tools of

facilitation and question asking strategies exemplified by each group. Additionally, the rest of the class was able to pick out and discuss the application of these strategies by their peers. These skits were prepared under the assumption that PBL will elicit the strongest learning outcomes. It was my hope as the teacher that the scenarios I presented the students with would bring about different tools of facilitation, and that the creation and performance of the skits would give them a framework with which to remember the various tools. These skits prompted interdisciplinary collaboration and social learning because the creation and performance of a skit forced students to externalize their knowledge on facilitation shills and grapple with their use together. They had to collaborate quickly to create a skit in the allotted time. A great deal of learning occurs in conversation with others, and this lesson plan sought to elicit this learning.

A few steps were taken in order to check each student's learning and get him/her to reflect on their own acquisition of knowledge. Group discussions after activities two and three referenced back to the skills learned in the reading and presentation, identifying those applied by students. The approach was meant to elicit metacognition. I attempted to turn the "internal conversation" (Bransford, 1999) into a group discussion and get students to reflect on their own learning process because, "The ability to monitor one's approach to problem solving – to be metacognitive – is an important aspect of the expert's competence" (Bransford, 1999).

Overall, the PBL model accounted for much of my students' learning. They were given fundamental knowledge (process of discovery), and were then asked to apply those facts in two activities (interdisciplinary collaboration), and then they reflected on their application of this knowledge (metacognition). The second activity gave them even more opportunity to

demonstrate learning because they had control over all of the dialogue in their skits, and were therefore able to apply more of the techniques learned in the lecture. Hopefully, now that they have had practice applying these skills in class, they will be better equipped to apply them outside class. The act of performing, watching, and discussing skits on the learned knowledge helped organize many of the concepts and make them easier to retrieve. It was evident in my learning event that students grasped the concepts because they were able to apply them to mock real-life situations in the skits. The bridge between the facts and the application was perhaps the deserted island activity because it took them through the facilitation process as a participant and then had them reflect on it. For the skits, they became the collaborators and teachers for their peers. We concluded again with a metacognitive discussion on what and how we learned. Rather than pigeon-holing the PBL model as a learning process only present in studios, I would utilize it in lecture courses as well, as was done in CEP 200. If instructors understand the PBL model they will understand how and when their students learn, and instructors can structure courses to foster better learning.

Chapter 9: Learning Outcomes Assessment

The majority of PAB-accredited planning programs in the United States require a studio course, evidence of the value in this unique learning environment (Nemeth and Long, 2012). The content in the studios offered at planning programs across the US differ based on the surrounding community and its needs. Because of this content sensitivity, it is difficult to compare an outcome in one planning studio to that of the next. Yet, most of our assessments of learning outcomes respond to the *content* of studios at a very general level. This may be because content specific learning outcomes can be measured through objective testing such as exams, projects, presentations, assignments, or group work (Németh & Long, 2012, p. 479).

On that note, it is the PBL outcomes that should be measured – the process of discovery, interdisciplinary collaboration, and metacognition. These cannot be measured by exams, presentations, or assignments. For much of studio learning, evaluation should be "qualitative rather than quantitative, determining how the student structures and processes knowledge rather than how much is learned" (Mayer, 1992, p. 407). These three evolving elements of PBL need evolving assessments methods.

Student surveys and interviews could be conducted at the conclusion of each course in order to capture the learning that occurred through the process of discovery and interdisciplinary collaboration during the studio. Small group discussions could be held after the surveys and interviews to assess the collective learning that took place in the studio. Reflective journals completed throughout the studio can be revisited at the conclusion of the course to assess metacognition. These journals will help the instructor understand if his or her students are recognizing the elements of PBL as they go through it.

Urban planning instructors and graduate program directors should be aware of the PBL occurring in their studio courses, its value, and its assessment. According to Németh and Long (2012), studio learning assessment is commonly grouped in one of four ways: instructor, peers, self, or outside critic/client. Instead of choosing one of these methods, I suggest studio assessment should involve all four. Currently, no common rubric is established for any one of these assessment categories. Further research needs to be done to identify, test, and standardize (to some extent) possible PBL assessment methods.

Chapter 10: Conclusions

Instructors and students alike recognize the importance of the studio learning process. The unique type of learning it elicits, referred to as process based learning (PBL) in this thesis, is characterized by the process of discovery, interdisciplinary collaboration, and metacognition. Prominent learning theorists Bruner (1977, 1996), Vygotsky (1978), and Bransford (1999) acknowledge the learning value in these three elements. Likewise, much of planning literature highlights these same or similar characteristics as the value in the studio learning process. For this reason, it is important that we further investigate PBL so that we understand how we can enhance its learning potential in urban planning studio courses through pedagogical modifications. My proposed studio pedagogy is an attempt to do this. The student interviews and studio observations highlighted and further defined characteristics of the PBL model as it exists in the studio-learning process. This research grounded the PBL model in practice.

From here, planning academia must establish qualitative assessment methods that capture the key learning outcomes from PBL. It is important to understand PBL and its value because it can and should exist outside the studio course and outside of the urban planning education. PBL can add value to any classroom setting because it allows students to understand a complex process, and then apply that process knowledge to other domains. If we understand the existence and value of PBL, we can create best practices to elicit it in more of the curriculum.

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Appendix

These sample questions demonstrate the type of information I will be seeking in my interviews. Some of these questions are adapted from Németh and Long (2012).

Sample interview questions:

1. Did you like the studio? What did you like about it? What didn't you like about it? When did you decide to ask for help? What questions did you ask?
2. Where did your learning during this studio?
3. How do you view your studio experience as different from other courses in the curriculum?
4. What do you think are the most important learning outcomes in your studio course?
5. How were these learning outcomes communicated to you?
6. What do you think was the most important learning moment in your studio course?
7. How were learning goals expressed in your studio deliverables?

Process of discovery:

8. In studio courses, the problem is often undefined by the professors, how did you and your peers work together to define the problem at hand?
9. In studio courses the product is often undefined, how did you and your peers work together to define the final product in your course?
10. If you have a client for your studio, do you feel this relationship is beneficial to your studio's learning process?
11. In your opinion, are some learning processes more important than others? Why?
12. Do you feel that the program faculty understand and appreciate the role of studio courses in the planning curriculum?
13. If you have taken an architecture or landscape architecture studio before, how does a planning studio differ?

Interdisciplinary Collaboration:

14. What were the challenges of working with your peers in this studio? How did you handle conflict?
15. Did you feel that you learned the most in this studio course when you were working alone or when you were working with others (peers or professor)?
16. How did working in small groups help you understand the problem at hand?
17. How do you feel that your ideas were impacted through collaboration with your peers?
18. Was it beneficial for your learning to work with classmates from different educational backgrounds?
19. How did the professor's feedback help shape the studio's product?
20. How did the professor's feedback help shape your approach to identifying and solving the problem at hand? Can you point to specific conversations or learning moments where your problem solving strategy formed?

Metacognition:

21. How do you learn best?

22. Do you feel you adequately reflected on your learning process throughout the course?
23. What do you feel is the most important aspect of the studio learning process? Which one and why?
24. If you had to choose one element of the studio learning process as the most important, which would it be?
    a. Process of discovery
    b. Interdisciplinary collaboration
    c. Metacognition (Reflection)