

**Incorporating Problem-Based Learning Skills into Graduate and Professional Student Classes: The University of Michigan Law School's Problem Solving Initiative**

*Andrea Quinn \**

**ABSTRACT**

*This paper provides insights into an initiative that offers graduate and professional students from across the University of Michigan the opportunity to participate in multi-disciplinary, problem-based classes that foster creative thinking, teamwork, and development of transferrable skills. The paper describes how, in order to improve student learning outcomes and play to the strengths of instructors with, each, subject matter and problem solving expertise, we have modified the initiative's structure.*

**INTRODUCTION**

The University of Michigan Law School's Problem Solving Initiative (PSI) offers graduate and professional students the opportunity to learn creative problem solving and collaboration skills in a classroom setting. Under the guidance of the Associate Dean for Strategic Initiatives and the PSI Program Manager, this initiative incorporates instructional approaches and techniques from several sources, including problem-based learning and small group collaboration approaches.

The current structure of the PSI divides each PSI course into two distinct modules with two sets of instructors to cover, each, (1) substantive instruction on the specific class topic, and (2) the problem solving skills component. Students in each PSI course are required to take both the substantive module and the skills module as part of a single PSI course, where those two modules are taught concurrently.

Experiences with the University of Michigan Law School's Problem Solving Initiative offer insights into challenges and opportunities associated with creating and

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\* Andrea Quinn, University of Michigan Law School, United States of America  
Email: [amquinn@umich.edu](mailto:amquinn@umich.edu)

administering problem-based classes for graduate and professional students. I focus on one particular feature of these classes: the fact that they combine substantive instruction and skills instruction. I highlight pros and cons that this two-pronged approach creates, and I discuss how the PSI has been reconfigured to address some of those challenges. I first provide a brief overview of the Problem Solving Initiative's creation and the structure of PSI classes.

## BACKGROUND

The University of Michigan Law School launched the Problem Solving Initiative (PSI) in 2017 with two classes. Since then, the PSI has offered an additional sixteen classes, and it will offer another six to eight classes each academic year for the foreseeable future. Graduate and professional students from any unit (school or college) at the University of Michigan have the option to take a PSI class, where each PSI class is offered for a full semester for three academic credits.

With respect to offering students from several disciplines the chance to collaboratively tackle real-world problems, the PSI's structure parallels that of several programs at other colleges and universities, which provide opportunities for students and faculty from different units or departments on campus to work together. These include, for example, Yale University's Multidisciplinary Academic Programs, which offer undergraduates opportunities to examine "pressing social challenges from a variety of disciplinary perspectives among a community of students and faculty who have shared interests" and "Big Problems" courses offered at the University of Chicago, where each class focuses on a different, complex challenge using "interdisciplinary team teaching...cross[ing] disciplines and divisions" and "transcend[ing] familiar models of content, organization, and instruction." (Yale University Catalog, 2019; University of Chicago College Catalog, 2019).

The substantive component of PSI classes is taught by one faculty member from the Law School and a second faculty member from another (non-Law) University of Michigan unit. By contrast, the skills component of PSI classes is taught by instructors with expertise in team-based teaching, creative problem solving skills, design thinking, and community engagement. Faculty teams teaching the substantive modules typically change because new topics or challenges — ranging from identifying human trafficking victims in health care settings to tackling algorithmic discrimination by automated vehicles — are prepared and offered to a new set of students each term. Each PSI class is limited in size to approximately twenty students, and because each PSI class focuses on a different, real-world challenge or problem, students learn about that topic in depth while also absorbing and applying transferrable problem solving skills.

## **INSTRUCTOR EXPERTISE: THE CRITICAL COMPONENT TO PSI SUCCESS**

The first six semesters that PSI classes were offered provided us with key insights into the challenges associated with administering this initiative, the most important of which was that instructors who were responsible for introducing and teaching problem solving skills had to have a thorough understanding of the relevant pedagogical underpinnings and hands-on experience teaching those skills to students. Based on that information, we re-tooled the PSI accordingly.

As a result, for the past two semesters, instructors who teach problem solving skills modules have expertise in (1) small group facilitation, (2) community engagement, (3) iterative design processes that generate innovative ideas, (4) team conflict management, (5) creative problem solving, and (6) scoping solutions developed in the classroom to fit real world problems. The PSI selected and focused on this instructor skill set based on student and faculty feedback about PSI classes, discussions with teaching consultants and creative problem solving workshop designers, and extensive research on relevant scholarly literature and parallel programs offered at other academic institutions. Based on this foundational work and a clear understanding of our programmatic needs, we identified skills instructors who had been trained in creative problem solving and had experience teaching small groups and guiding student teams in cross-disciplinary and collaborative university initiatives.

## **APPROACHES AND IDEAS THAT INSPIRED THE PSI**

As noted, PSI classes allow students to learn about and engage with real-world problems. The nature of the challenges that students consider in each particular PSI class differ from class to class and from one semester to another. At the same time, all PSI classes foster acquisition and application of skills.

More specifically, skills taught in PSI classes incorporate underlying tools and techniques associated with creative problem solving. Throughout the term, and as part of the skills module, PSI students learn:

- how to work effectively as part of a team comprised of people from different disciplines
- how to innovate, develop prototypes, learn from failure, and scope potential solutions
- how to define real-world problems and engage in solving those problems
- how to apply creative problem solving strategies and tools throughout the term
- how to communicate ideas to stakeholders, faculty members, and fellow students

- how to view a problem through their own disciplinary lens and the lenses of other disciplines

As this list suggests, PSI classes are meant to benefit students in a number of ways. These classes provide students with skills that they will be able to continue to develop and apply in other classes and in settings where they will work as members of a team or group. In addition, students acquire skills in PSI classes that will be useful to them at a time when many future employers are likely to value “right-brain” aptitudes in their new hires (Pink, 2005). Law firms, corporations, government agencies, non-profit organizations, and other entities benefit from employees who can develop innovative solutions that reflect collaborative effort. PSI students also benefit from the experience of developing ties across campus and working with people from a range of backgrounds and disciplines.

Further, PSI classes offer a participatory learning opportunity that requires students to conduct research, assess what they know, prototype, work with stakeholders, and incorporate feedback and failures. Scholarly literature shows that problem-centered learning has several benefits, including improving active, self-directed learning, developing cross-disciplinary knowledge, and fostering student responsibility for their own learning, and students who learn and apply related techniques improve “process competencies” like project management, collaboration, conflict resolution, and communication skills (Biggs, 2003; De Graaff & Kolmos, 2003; Hmelo & Evensen, 2000; Kolmos, 1996; Savin-Baden, 2003). According to Servant et al. (2015), there may also be a link between problem based learning and “creative output.” (p. 48). For these reasons, PSI classes are meant to complement, and add another dimension to, existing opportunities at both the University of Michigan Law School and at the University of Michigan more broadly (Stanford University, Legal Design Lab, 2019).

Although the PSI does not represent an example of problem-based learning (PBL), the PSI’s format is partly inspired by approaches to PBL in academic environments. According to Yadav et al., (2011), PBL was developed in the 1950s in response to critiques that instruction based solely on lectures failed to prepare medical school students to solve problems in clinical settings (p. 255). Yadav et al. summarize PBL as a participatory, student-based approach to tackling problems (2011, p. 255). For their part, Stevens and Tieman (2017) write that PBL originated in the 1960s at McMaster University as an approach that allowed teachers to act as facilitators, where classes were limited in size, and students focused on particular challenges or problems even as they developed a distinct, problem-solving skillset that they would continue to refine.

PBL's origins are a topic in their own right; however, as Gijbels et al., (2005) note, disparate variants or offshoots of PBL emphasize tools and approaches that are distinct from PBL as it was initially developed (p. 29). In some cases, small group work and skill development are prioritized; in other settings, engagement with real-world problems and

knowledge acquisition — more than skill acquisition — are prioritized (Gijbels, et al., 2005, p. 29).

PSI classes are not an example of PBL; instead, PBL components offered a useful starting point and highlighted the need for us to clarify which goals we wanted to pursue as part of the Initiative. For example, we did not set out to replicate PBL as described by Barrows and Tamblyn, which was developed specifically with the needs of medical students in mind, nor did we use a model similar to the one described by Cowden and Santiago, where students learned to locate scholarly sources to support research with minimal instructor involvement. (Barrows and Tamblyn, 1980; Cowden and Santiago, 2016, p. 466). Rather, PBL provided one of the many precursors we considered in developing and modifying the PSI to suit the particular needs of our students and faculty. PSI students work in small groups and they work on developing solutions to problems. At the same time, PSI classes rely heavily on instructor experience and knowledge, and students receive guidance from faculty throughout the term when it comes to stakeholders they should interview, resources they may need to review, and understanding why different disciplines offer alternative insights into the problems they are interested in solving. In addition, PSI classes don't focus on hypothetical organization-level or workplace challenges; each class focuses on pressing and current challenges, such as firearm violence, toxic airborne emissions, or homelessness.

In this respect, PSI administrators focused extensively on the fact that PBL has been adapted, transformed, and applied in settings beyond medical education to include architecture, business administration, engineering, law, social work, and other disciplines (Gijbels et al., 2005, p. 28, Brescia, 2016). Cornell University's teaching resources define PBL as “a student-centered approach in which students learn about a subject by working in groups to solve an open-ended problem.” (Cornell University Center for Teaching Innovation, n.d.) At UC Berkeley, the School of Public Health covers foundational sciences classes using PBL through a combination of patient case studies, information gathering, concept maps, and group participation and collaboration. At the University of Delaware, a number of courses have been taught using a PBL format, including Introductory Biology, Introduction to Biochemistry, and Honors Introductory Physics (PBL@UD, n.d.). PBL has also been adapted to Law Schools, with instructors using a variety of different PBL components, such as small-group work, to address a specific, well-defined problem (Flagg, 2002; Grimes, 2015; Wijnen et al., 2017). Based on a host of examples, we modified and repurposed components of team-based student learning approaches for the Problem Solving Initiative.

## PSI CLASSES: SUBSTANCE, STRUCTURE AND SKILLS

PSI classes incorporate a number of features: PSI classes focus on pressing real-world problems, and instructors provide essential information, guidance, and resources to further student learning. PSI classes also cover a broad range of topics that warrant input from people from a range of different disciplines. Past PSI classes have focused on disparate topics, including concussions in youth football, heritage preservation, and “fake news.” Faculty members who teach PSI substantive modules are subject matter experts who guide student learning. At the same time, PSI students play a central role in directing their own learning, as they engage in small-group work, report out to fellow classmates, and apply the problem solving skills that they are learning to their class challenges.

Even though the substantive material that PSI students learn in each PSI course is unique to that class, since each class focuses on a different challenge, the skills that students absorb and develop throughout the term as part of the skills module are part of the fabric of the entire PSI program and of *all* PSI classes. These problem solving skills, broadly defined, allow students to gather and assess information, work well as part of a team, collaborate with people from academic disciplines outside their home units, incorporate human-centered design thinking, learn how to identify and scope a problem, and develop one or more potential solutions to that problem. PSI students learn that they can master tools applicable to an indefinite number of challenges, large and small. Students in PSI classes grasp and apply a set of transferable skills throughout the course of a semester, but one goal of the PSI is for students to continue to develop and hone those skills and apply them to other classes, jobs, group work, and challenges that they will tackle in the future, long after they have completed a particular PSI class.

Unlike in some flipped classrooms, where students "are required to engage in or complete some form of preliminary learning online" to prepare for a coordinated learning activity that subsequently takes place on campus with fellow students and faculty, in-person work is prioritized in PSI classes. (Reidsema et al., 2017, p. 6). For example, it is the case that PSI students complete group tasks during their skills sessions — during a typical skills module session, a student team might complete a group exercise, discuss alternative plans to address their class challenge, or present information about findings from their research. In addition, although PSI students play a role in directing their own learning, instructors in both the skills and the substance modules are critically important. Instructor guidance is essential, not only given the range of material covered in each PSI class, but also because the format is unfamiliar to students. Instructors present information, they observe student teams and offer feedback, they oversee in-class exercises, and they demonstrate and discuss how tools learned in the skills module are applicable to the class challenge. As such, PSI faculty members play several different roles in PSI classes throughout the

semester, and students spend most of their class time engaging in person with fellow students and instructors.

As noted, students are taught PSI skills by one set of instructors, and they learn substantive information about their class challenge from another set of instructors. Instructors who teach the substantive module use a variety of methods to assess student work, including a final capstone project. Instructors who teach the skills module use several methods to assess student progress and mastery of materials. First, skills instructors observe student participation, answer student questions, and review student work in class. Next, the quality of student work and student learning in the skills modules are assessed in other ways, including:

- written reflections on how to address the class challenge and approaches to problem solving
- ecosystem maps identifying components of the class challenge, designated stakeholders, impacted groups, and other relevant parties
- visualization, prototyping, and community engagement exercises
- lists of potential, alternative solutions to the class challenge
- written plans of action that demonstrate understanding and application of concepts discussed and applied throughout the term

### **FLAWS WITH EARLY APPROACHES TO TEACHING THE SKILLS COMPONENT**

Over the course of six semesters of PSI classes, it became clear to PSI administrators that teaching problem solving skills to students in PSI classes presented several challenges. Before we developed the new structure that split the skills module and the substantive module into two parts, the three primary challenges that we faced in the PSI specifically linked to skills instruction were:

1) Most faculty members who taught in the PSI did not have formal problem solving expertise that they could seamlessly integrate and apply to their PSI class. Only a few units on campus are likely to have faculty members familiar with relevant teaching skills, such as those in Information Schools, Design Schools, Libraries, Business, and certain other fields that regularly and consistently incorporate problem solving in their classes.

2) Most instructors do not teach PSI classes repeatedly; rather, they usually teach only one PSI class, so there was little incentive for them to invest in the training or preparation to teach the skills portion of the class. Further, the skills component of PSI classes essentially required preparation for what amounted to a second class, since faculty had to select readings, develop class assignments, prepare lectures, and develop in-class

exercises on problem solving, in addition to the work that they committed to the substantive component of their PSI class.

3) Even when a faculty member who taught in the PSI did have experience teaching creative problem solving or had a comparable set of skills, it was still the case that the framework that the faculty member presented, the assignments and exercises he or she used, and the skills that the faculty member prioritized differed from those that the PSI had adapted or that other faculty members in the PSI used. Having myriad approaches to teaching problem solving skills ran counter to a key PSI goal; namely, offering a uniform problem solving approach that all PSI students could learn over the course of a semester.

With respect to the first challenge described above, faculty members are usually experts on key issues, research, and scholarship in a particular field or fields, and they are used to training graduate and professional students to approach writing, research, class assignments, and in-class discussions in a way that reflects their own training, scholarly interests, experiences in the field or professional life, and intellectual priorities. Faculty members training graduate students and professional students are, in general, preparing those students to pursue a career in a specific discipline – environmental studies, law, business, engineering, etc. – so it is reasonable for faculty members to help their students hone skills that will be useful to them as subject matter experts. Part of what appeals to faculty members who teach in the PSI is the opportunity to tackle a pressing, contemporary problem with which they are deeply familiar. At the same time, however, the PSI is a program rather than a single class, and its programmatic goals are broader and more complex than the goals pursued by an individual faculty member. The PSI enrolls between 160-180 students each academic year, and a central objective of the PSI is for students to learn about, adapt, and apply a set of problem solving skills, in addition to ensuring that students learn about and engage in advancing solutions to important problems.

With respect to the fact that PSI instructors typically only teach one PSI class, even when faculty members were comfortable incorporating small group work, self-assessment assignments, student-directed learning, and other similar exercises and tools into their classrooms, their priority was still to help students learn the substantive material presented over the course of the term rather than for students to acquire problem-solving, design thinking, or teamwork skills for their own sake.

The PSI does not have its own cohort of instructors. Instead, PSI instructors are drawn from all over the University of Michigan campus to teach a PSI class for one term based on their research interests. Some instructors have taught more than one PSI class; however, even in those cases, each class topic was new, requiring class preparation. In contrast to the goals of individual PSI faculty, the aim of PSI classes is to ensure that students acquire a range of skills that are broadly applicable, where those skills or tools

have a distinct value of their own. Faculty members who teach PSI classes bring their expertise to bear as students learn about and weigh solutions to complicated problems, but expecting these same faculty members to also be experts in teaching problem solving techniques was unrealistic.

Along similar lines, because each PSI course is taught only once and because the faculty teams are different each time, individual faculty members had no incentive to invest the time to learn how to teach creative problem solving, human-centered design thinking, stakeholder engagement, or collaboration skills to students from a range of different disciplines. PSI instructors were already tasked with prepping a new class, navigating the complexities of working with a co-instructor, and providing students with guidance on a capstone project. Requiring faculty members to also familiarize themselves with another set of skills, to the point where they could comfortably teach those skills to students, was not an effective use of their time.

Some faculty members are familiar with and do have an interest in applying problem solving methods in their PSI classes. In addition, some faculty members come to PSI classes with past experience teaching problem-based classes, engaging with stakeholders, and incorporating a number of skills into classroom work. Nevertheless, faculty members' backgrounds, priorities, and methods vary from one person to another. In addition, the faculty members who have adapted relevant techniques to their classes have often worked only with students from their home unit, and they have incorporated exercises and assignments that harness problem solving tools for use in a particular discipline. To ensure that all PSI students gain the same set of tools over the course of semester, relying on individual instructors was not viable.

In combination, the fact that faculty members who teach in the PSI lack formal problem solving expertise, PSI faculty members only teach one PSI class, and a key PSI goal is ensuring that students in PSI classes all learn the same set of skills, meant that the PSI had to separate the substantive module and the skills module into two distinct components. As noted, this means that two sets of instructors now work with each PSI class — a set of skills instructors and a second set of instructors, who cover substantive material. This allows instructors to focus on their areas of expertise, which simplifies things for the instructors and improves the classroom experience for students.

## **STUDENT FEEDBACK**

As part of our assessment of the PSI, PSI classes, and features of the PSI program, we collected and reviewed anonymous student feedback about the skills component of PSI classes for each term that PSI classes have been offered using Qualtrics, which stores completed (anonymized) survey responses for each term and offers a number of analysis

and reporting tools. Sample PSI survey questions are provided in Appendix A. Survey questions were developed with the input of, each, teaching and research consultants on campus, research faculty, and PSI administrators. The PSI surveyed students from four PSI classes offered in the first term of 2019 from eleven different graduate and professional programs at the University of Michigan: Law, Social Work, Public Health, Architecture and Urban Planning, Business, Environment and Sustainability, Public Policy, Engineering, Information, Literature, Science and the Arts, Music, Theater, and Dance, with at least one student from each of those units responding to the PSI's Qualtrics survey. Using Qualtrics, we determined that of the combined sixty-four students who took the four PSI classes, forty of them (62.5%) responded to the survey that the PSI administered at the end of the term. Along with what we had learned from faculty members and observed during class sessions, student comments lent further support to the idea that restructuring the PSI to develop a distinct skills component would be beneficial.

Students from all four (first term) 2019 PSI classes were given the opportunity to respond anonymously to an open-ended Qualtrics question about how to improve their class. One subset of those student responses focused on learning and skill acquisition. Specifically, students made it clear that they wanted to learn how to work as part of a team, how to navigate conflicts within a team, how to make the most of working with people from different disciplines, and how to incorporate different perspectives to understand the class challenge and define the ultimate goal for the class capstone. Another set of student responses focused on a desire to practice working through the problem solving process and understand the value of distinct stages of problem solving, including how to generate ideas and how to withhold judgment. Students also requested more instructor assistance connecting the skills component of the class to the substantive components of the class.

In short, students in all four 2019 PSI classes expressed a desire to learn from instructors who were deeply familiar with structured problem solving techniques, human-centered design thinking, and tools to foster innovation, collaboration, and assessment. Students made it clear that they wanted to learn relevant problem solving skills and methods throughout the term with the aid of instructors who were well-versed in teaching those skills and navigating challenges to learning and applying problem solving skills. For example, before we created distinct skills and substance modules in the PSI, one PSI student noted that “[t]here was very little content in this class on collaboration strategies, how to effective[ly] frame a problem, or interdisciplinary work.” Another student recommended that the PSI incorporate experts who could “...speak about problem-solving and working on interdisciplinary teams...” Another student noted “ I would have appreciated the introduction of a tool/process for interdisciplinary collaboration; [little] was presented to advance our interdisciplinary work.”

Prior to the new format that separated the skills module and the substantive module, PSI students also noted that PSI instructors had subject matter expertise, but that they did not have had the expertise to help students address the class challenge with an eye to the more abstract, step-by-step process of solving problems, leading them to request that PSI classes “[d]evelop a more thorough...informed perspective [about how to scope the challenge].” Another student wrote: “[The faculty members are content area experts, but] PSI course instructors need to receive advanced training in facilitation.” Similarly, another student wrote, “I would love for there to be training for faculty to obtain facilitation skills. While they are content area experts, they did not have the tools to facilitate the course in an efficient fashion.” In addition, some students commented on needing guidance in order to collaborate effectively with people from other schools and colleges, as PSI faculty members did not provide sufficient help to students when they faced challenges specific to working as part of a multi-disciplinary team.

Based on this feedback, students in all four PSI classes made it clear that they wanted to learn how to work in teams, scope problems, interact effectively with people from other disciplines, and develop a skillset that they could develop throughout the term and use well after their PSI class ended. This input supported what students in other PSI classes in prior terms had communicated about their experiences, and it was part of the impetus for making program-wide changes to the PSI, whereby skills and substance modules were offered as distinct components taught by different sets of instructors.

### **SUMMARY: INCORPORATING FEEDBACK AND ASSESSMENTS TO IMPROVE SKILLS ACQUISITION**

Student feedback echoed what we had heard from PSI instructors and observed as part of our own assessments administering the PSI. We also benefitted from assessments offered by a number of partners and consultants who had experience teaching problem-based approaches to university students. Based on those assessments, discussions with PSI faculty, student feedback, and evaluations from eighteen different PSI classes over the course of two years, we restructured PSI classes.

As noted above, key features of the restructured framework are: 1) a distinct, program-wide PSI skills component, 2) skills instruction by individuals who are trained in creative problem solving and separate instruction on the class challenge by subject matter experts, and 3) an extended timeline to teach, and ensure absorption of, PSI skills over the course of the entire term. By modifying the way that skills are taught, we aim to improve the learning experience for students, clarify our expectations for faculty, and refine our goals as a program.

Beginning with the second 2019 term, the skills portion of PSI classes will be taught as a separate, semester-long module in tandem with the substantive module on the class challenge. Instructors of the skills module will focus only on problem solving skills, rather than the class challenge. Skills instructors will identify, explain, and apply the components of a creative problem solving approach, as they facilitate the learning process and handle challenges that arise within student teams, cover solution assessments and feedback, and incorporate exercises that develop students' problem solving skills (De Graaff, 2016, p. 398). As a result, PSI students will cover topics like working in teams, communicating across disciplines, scoping a problem, learning about alternative problem solving styles, incorporating stakeholder needs, and more, throughout the term.

According to Salinitri et al. (2015), although "numerous facets" are associated with the use of PBL, "skilled facilitators are central" to the success of PBL pedagogy given its many moving parts (p. 73). Drawing on that logic, and for the purposes of the PSI, in order to ensure that students can develop problem solving skills in a step-by-step manner and build on those skills all semester long, the PSI's new skills module is taught by experienced instructors, who focus only on teaching problem solving skills. Two other faculty members separately cover substantive material for each class challenge. As noted, instructors who run the skills module have participated in training programs to facilitate small group work and develop problem solving skills and multi-disciplinary collaboration, and they have studied general principles of creative problem solving, incorporating classroom shadowing and feedback from more experienced instructors. (Kukkamalla and Lakshminarayana, 2011, p. 1152). Our expectation is that students will benefit from this new arrangement much in the same way that McLoone et al. (2016) found that facilitators with problem solving experience were better at teaching students relevant skills and addressing challenges than instructors without those qualifications (pp. 72-79).

The new, updated PSI configuration will allow students to both learn problem solving skills and focus on the substance of their class throughout the term. This two-pronged approach will ideally ensure that students absorb information, and it will provide a longer timeline for them to practice problem solving skills and apply them to the class challenges. In addition, by enlisting experienced instructors and teaching problem solving skills as a distinct module, we hope students will be equipped to continue applying problem solving tools in other settings.

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