TEACHING WOULD-BE IP LAWYERS TO 'SPEAK ENGINEER': AN INTERDISCIPLINARY MODULE TO TEACH NEW INTELLECTUAL PROPERTY ATTORNEYS TO WORK ACROSS DISCIPLINES

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INTRODUCTION

When I designed my course—the Detkin IP and Technology Legal Clinic—in 2012, I had come straight from private practice at a technology company. In thinking about the most important lessons I wanted to teach new practitioners, the one at the top of the list had taken me a decade of practice to learn. Lawyers communicate differently than many of the clients we serve. If we want to be effective counselors, we have to study those differences and learn to accommodate. In an in-house setting, we also have to appreciate and leverage the strengths of different sorts of professionals, including engineers.

I am now familiar with a growing movement toward increased interdisciplinary learning in the graduate school context. The literature acknowledges that different professional schools approach teaching according to wildly different philosophies,[1] and that in addition, the students of these different schools may have predominantly different learning styles.[2] Yet these students later work side by side at the same companies, or they hire each other as service providers, to achieve common goals.

If we expect new lawyers to succeed, we must give them tools and experience to bring about that success. This includes team building and

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[1] *See, e.g.*, Richard A. Kaplan, *Toward Better Communications Between Executives and Lawyers*, UTAH B.J., July–Aug. 2011, at 18, 19–20; Celeste M. Hammond, *Borrowing From the B Schools: The Legal Case Study as Course Materials for Transaction Oriented Elective Courses: A Response to the Challenges of the MacCrate Report and the Carnegie Foundation for Advancement of Teaching Report on Legal Education*, 11 TRANSACTIONS: TENN. J. BUS. L. 9 (2009); Lee S. Shulman, *Signature Pedagogies in the Professions*, DAEDALUS, Summer 2005, at 52.

[2] *See, e.g.*, David A. Kolb, *Learning Styles and Disciplinary Differences*, *in* THE MODERN AMERICAN COLLEGE: RESPONDING TO THE NEW REALITIES OF DIVERSE STUDENTS AND A CHANGING SOCIETY 232, 233–35 (Arthur W. Chickering & Assoc. ed., 1981) (setting out the theory behind the experiential learning model, which Kolb continued to develop and update for over twenty years); ISABEL BRIGGS MYERS WITH PETER B. MYERS, GIFTS DIFFERING: UNDERSTANDING PERSONALITY TYPE 139–64 (1995) (discussing in chapters 13 and 14 different learning styles and occupational and academic groups that correlate with different Myers-Briggs personality types).

good communication skills across disciplines.[3] Law students do not even team with each *other* in the typical law school class. Yet to prepare the transactional lawyer of tomorrow, we need to offer practice in collaborating, especially with the other professionals they will join in the workforce. And to do that well, we need to employ methods of truly interdisciplinary study.[4]

This Essay discusses an interdisciplinary module I have designed to use within my clinic to bring students from the law school and engineering school together. In summary, it challenges pairs of students over a three-week period to understand a new invention, draft patent claims over it, and then compare their efforts to the real-life patent. Substantively, it introduces engineers to the legal patent process. It also encourages law students to place patents into context, to see them as a business tool rather than a legal exercise. However, the module is primarily designed to nurture cooperation and communication between students from different disciplines in order to train them to better collaborate when it counts. Although this particular module pairs lawyers with engineers, its underlying purpose is consistent with efforts to bring together lawyers with business professionals, psychologists, accountants, or any other professionals with whom they need to work.

In Section I of the Essay, I will explore some of the literature emphasizing the importance of interdisciplinary education for lawyers, exploring the benefits to the profession as well as to clients. I also discuss a number of great interdisciplinary programs and place my module in context. In Section II of the Essay, I will discuss my module specifically together with changes I have implemented or am considering. In Section III, I will discuss the unexpected lessons that emerged from the module, both for the students and for me. Finally, in Section IV, I will summarize and analyze data from survey responses gathered from the last three semesters of my former students to give a quantitative analysis on whether this module meets its original teaching goals.

I. IMPORTANCE OF INTERDISCIPLINARY EDUCATION

Law is a service profession, where lawyers can only further a client's goal by really understanding the client's business. Particularly in the intellectual property (IP) realm, this can mean embracing science and

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[3] Anthony J. Luppino, *Minding More Than Our Own Business: Educating Entrepreneurial Lawyers Through Law School–Business School Collaborations*, 30 W. NEW ENG. L. REV. 151, 159–62 (2007).

[4] *See* Eric J. Gouvin et al., *Interdisciplinary Transactional Courses*, 12 TRANSACTIONS: TENN. J. BUS. L. (Special Report) 101, 102 (2011); Luppino, *supra* note 3, at 157 ("A rich body of literature strongly supports the conclusion that modern legal education must, for contextual and other practical reasons, involve interdisciplinary elements.") (citing more than a dozen other sources).

technology.[5] Servicing clients engaged in the commercialization of any sort of technology requires a lawyer to understand the interplay between engineering, law, and business strategies.

Of course it is not just the IP lawyers that need to be comfortable in the scientific and technological realms. For example, practitioners that counsel entrepreneurs often brush up against new technologies and science. Similarly, lawyers on the forefront of health law—for examples those that deal with reproductive technologies—must be knowledgeable about science and technology issues.[6] And many litigation cases require understanding of scientific principles.[7] Increasingly, a lawyer who is not conversant in science and technology is at a disadvantage during many modern debates about privacy, patentable subject matter, or Fourth Amendment rights.

Similarly, engineers must be comfortable in the legal and business realms. Many trained engineers join industry after school, where they are promoted into business and management roles. However, they may be unprepared for the challenges they face because of a dearth of training in management, communication, and team-based problem solving.[8] Others go into government or nonprofit roles,[9] where understanding regulations and market considerations would be helpful. Even engineers who pursue academic careers might benefit from legal and business acumen in order to better understand when their research has commercial poten-

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[5] For the purposes of this Essay, I will conflate the fields of science, engineering, and technology. Although the clients in each field are distinct and have distinct needs, these three sets of clients may nonetheless present similar communication challenges for a lawyer. I will also refer to the law students in my class throughout as the "lawyers" and the engineering students as the "engineers," even though they have not yet entered the profession, for brevity and simplicity.

[6] Susan B. Apel, Column, *Teaching Health Law: Teaching Law and Medicine on the Interdisciplinary Cutting Edge: Assisted Reproductive Technologies*, 38 J.L. MED. & ETHICS 420 (2010) ("Especially with the law in its infancy, how were we to understand, critique, and formulate legal solutions to problems surrounding this new form of family establishment if we did not understand its scientific underpinnings?").

[7] *See, e.g.*, Stephen Breyer, *The Interdependence of Science and Law*, 82 JUDICATURE 24 (1998).

[8] COMM. ON SCI., ENG'G, & PUB. POLICY, NAT'L ACAD. SCI., RESHAPING THE GRADUATE EDUCATION OF SCIENTISTS AND ENGINEERS 78 (1995) [hereinafter COSEPUP] ("More students should, for example, have off-campus experiences to acquire the skills desired by an increasing number of employers, especially the ability to communicate complex ideas to nonspecialists and the ability to work in teams of interdependent workers."); INDUS. RESEARCH INST., INDUSTRIAL PERSPECTIVES ON INNOVATION AND INTERACTIONS WITH UNIVERSITIES 5 (Feb. 1991) ("[T]here is room for improvement in certain areas, however, including management skills, communication skills, quality assurance, and a team approach to problem solving."); Steve H. Barr et al., *Bridging the Valley of Death: Lessons Learned From 14 Years of Commercialization of Technology Education*, 8 ACAD. MGMT. LEARNING & EDUC. 370, 372 (2009); Raymond G. Greene et al., *Graduate Education: Adapting to Current Realities*, ISSUES SCI. & TECH., Winter 1995–96, at 65–66.

[9] COSEPUP, *supra* note 8, at 30.

tial, particularly in the life sciences.[10] Universities find that they lose the opportunity to file many possible patents because the scientists and engineers behind the inventions did not recognize their invention's commercial application, or as an alternative, did not understand how the pure science could be used for an alternative, industrial use.[11] By providing an introduction to business or legal considerations that is integrated with their research, even academic engineers could gain perspective without sacrificing their focus on technical training.[12]

Interdisciplinary knowledge for lawyers does not have to come via additional degrees. With the exception of patent prosecutors, most IP lawyers do not in fact have additional graduate technical degrees. The reality is that in practice, IP practitioners rely on technical professionals, either clients or colleagues, to guide them. Even dual-degree lawyers cannot know everything about the invention or the product at stake. Professionals must translate across disciplines, with engineers decoding technical speak and lawyers unraveling legalese in order to meet business goals. In short, professionals must ably communicate across disciplines in order to meet client objectives. Innovation success depends on the contributions of a variety of professional perspectives.[13]

In addition, companies increasingly rely on models of integrated product development, which in turn depend on the successful collaboration of cross-disciplinary teams.[14] When the teams work well, the collaboration can translate into lower costs and better results for companies.[15] So

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[10] Marie C. Thursby, *Introducing Technology Entrepreneurship to Graduate Education: An Integrative Approach*, *in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 211, 213–14 (Gary D. Libecap ed., 2005).

[11] Marie C. Thursby et al., *An Integrated Approach to Educating Professionals for Careers in Innovation*, 8 ACAD. MGMT. LEARNING & EDUC. 389, 391 (2009).

[12] *See id.*

[13] *Id.* at 389–90 ("[I]nnovation is implicitly a team activity, which relies on participants understanding at least some aspects of each others' expertise as well as effective communication across areas.").

[14] Donald Gerwin & Nicholas J. Barrowman, *An Evaluation of Research on Integrated Product Development*, 48 MGMT. SCI. 938, 938 (2002); Sarah Holland et al., *Critical Success Factors for Cross-functional Teamwork in New Product Development*, 2 INT'L J. MGMT. REVS. 231, 231 (2000) ("Reviewing 11 surveys of best practice in new product development, Griffin (1997) found consensus that effective implementation of cross-functional teams 'is crucial to success' False") (citing Abbie Griffin, *PDMA Research on New Product Development Practices: Updating Trends and Benchmarking Best Practices*, 14 J. PRODUCT INNOVATION MGMT. 429, 435 (1997)).

[15] Holland et al., *supra* note 14, at 232 ("A large bench-marking study of 103 new product projects in 21 divisions of major chemical companies found 'true' cross-functional teams to be the top driver of project timeliness, and an important driver of profitability. In another bench-marking study of the 244 firms responsible for 80% of R&D spending in Western Europe, Japan and North America, 'multifunctional teams' had the greatest statistical impact on time to market for new products.") (citations omitted) (citing Robert G. Cooper, *Developing New Products on Time, in Time*, RES.

companies have a vested interest in hiring professionals that already communicate well across disciplines.

Similarly, law firms look for associates with good communication skills because of the benefit to law-firm clients and therefore to law-firm bottom lines.[16] The much publicized 1992 MacCrate Report, distributed by the American Bar Association, described a set of skills that lawyers needed for successful practice and then specifically called upon law schools to help students develop those skills within their curriculum.[17] Communication skills were one of the ten "fundamental lawyering skills" they identified.[18] Communication skills were also listed as part of the second of three "domains" of professional competency and identity in the follow-up Carnegie Report.[19] Similarly, law firms are increasingly evaluating potential new hires on their ability to communicate, in particular across disciplines. One focus group of Georgia health law attorneys put it succinctly: "We want to hire attorneys who can talk effectively to different kinds of people."[20]

So if lawyers will need to be able to communicate across disciplines once they reach the workplace, then there is an opportunity—even a need—to enrich programming in law schools to improve communication and subject matter competency, particularly across the legal-technical divide. What form could it take? Recent studies in technology entrepreneurship recommend (1) collaboration among disciplines to enrich perspective and purpose; and (2) engaging the students in an active project to accelerate and cement learning.[21] With these goals in mind, how are law schools executing on bringing interdisciplinary study into their curriculums? There are a wide variety of models, but in general the truly interactive models that bring lawyers and technical students together are few.

On one end of the spectrum, it easy and popular for law students to learn new subject matter by enrolling in courses at other schools in their

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TECH. MGMT, Sept.–Oct. 1995, at 49; Edward B. Roberts, *Benchmarking the Strategic Management of Technology*, RES. TECH. MGMT, Mar.–Apr. 1995, at 18).

[16] Neil W. Hamilton, *Changing Markets Create Opportunities: Emphasizing the Competencies Legal Employers Use in Hiring New Lawyers (Including Professional Formation/Professionalism)*, 65 S.C. L. REV. 547, 551–53 (2014) (communication ranked second in the relative importance of different competencies for large firms in Minnesota and fifth for smaller firms).

[17] ABA SECTION OF LEGAL EDUC. & ADMISSIONS TO THE BAR, LEGAL EDUCATION AND PROFESSIONAL DEVELOPMENT—AN EDUCATIONAL CONTINUUM 127–29 (July 1992).

[18] *Id.* at 138–39.

[19] Charity Scott, *Collaborating with the Real World: Opportunities for Developing Skills and Values in Law Teaching*, 9 IND. HEALTH L. REV. 409, 414 (2012) (citing WILLIAM M. SULLIVAN ET AL., EDUCATING LAWYERS: PREPARATION FOR THE PROFESSION OF LAW 27–28, 145–47 (2007)).

[20] *Id.* at 418 (internal quotation marks omitted).

[21] *See, e.g.*, Barr et al., *supra* note 8, at 372–75; Thursby et al., *supra* note 11, at 390.

university. Not only can students create their own opportunities on an ad hoc basis, but also sometimes, as at the University of Pennsylvania, the law school actively encourages cross-disciplinary programming through certificate programs, joint degrees, or other formally structured coursework.[22] But in some certificate programs, law students still work mostly alongside other law students. Even when the classes include students from various disciplines, the students are learning in parallel and communication is not a pedagogical goal of the class. Although the students are developing subject matter expertise, and to some extent sensitivity to other professionals' points of view by listening to their colleagues speak in class, because for the most part classes are not project-based, students are not practicing interdisciplinary communication skills. These classes also generally do not encourage self-reflection, which is critical to developing better communication habits.[23]

Other models consciously maximize interdisciplinary interaction by teaming students from different disciplines in small class size settings. Such interdisciplinary collaborations are already common in the realm of health law,[24] child advocacy[25] and even entrepreneurship (including community development clinics),[26] where law students team with medical school students, social work students, or business students. Many of these classes are co-taught by professors from the different schools. Other

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[22] *Joint Degree Programs*, PENN L., https://www.law.upenn.edu/crossdisciplinary/joint-degrees.php. Penn Law currently partners with its sister institutions at the University of Pennsylvania to offer a multitude of cross-disciplinary programs. These programs have proved to be widely popular with students, and more than 67% of the class of 2014 took part in at least one of over 30 Certificate of Study and/or Joint Degree programs. *Id.*; *Certificates of Study*, PENN L., https://www.law.upenn.edu/crossdisciplinary/certificates.php.

[23] For discussion of the importance of self-reflection and self-regulated learning, *see* ROY STUCKEY & OTHERS, BEST PRACTICES FOR LEGAL EDUCATION 65–67 (2007); Michael Hunter Schwartz, *Teaching Law Students to Be Self-Regulated Learners*, 2003 LAW REV. MICH. ST. U. DETROIT C.L. 447, 452, 480.

[24] Apel, *supra* note 6, at 421–22; Scott, *supra* note 19, at 423 ("More than forty law schools have set up interdisciplinary clinics, courses, and externships that engage legal and health professionals in educational and service collaborations.").

[25] Sara R. Benson, *Beyond Protective Orders: Interdisciplinary Domestic Violence Clinics Facilitate Social Change*, 14 CARDOZO J.L. & GENDER 1, 7 (2007); Kathleen Coulborn Faller & Frank E. Vandervort, Presentation, *Interdisciplinary Clinical Teaching of Child Welfare Practice to Law and Social Work Students: When World Views Collide*, 41 U. MICH. J.L. REFORM 121, 164–66 (2007); Christina A. Zawisza & Adela Beckerman, Therapeutic Jurisprudence Review, *Two Heads are Better than One: The Case-Based Rationale for Dual Disciplinary Teaching in Child Advocacy Clinics*, 7 FLA. COASTAL L. REV. 631, 631–32 (2006).

[26] For a great summary of law school–business school collaborations as of 2008, *see* ANTHONY J. LUPPINO, CAN DO: TRAINING LAWYERS TO BE EFFECTIVE COUNSELORS TO ENTREPRENEURS apps. 5 & 6 (Jan. 30, 2008), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1157065. *See also* Susan R. Jones & Jacqueline Lainez, *Enriching the Law School Curriculum: The Rise of Transactional Legal Clinics in U.S. Law Schools*, 43 WASH. U. J.L. & POL'Y 85 (2013).

models even add the aspect of live client work. However, most of these models do not pair legal and technical students.

Only a very few programs incorporate law students into teams with a technical member. Standouts include the Technology Entrepreneurship Program at the University of Oregon; the Technology Innovation: Generating Economic Results (TI:GER) program at Georgia Institute of Technology and Emory University; the Entrepreneurship & New Venture Creation course at the University of Missouri-Kansas City; the Business Law Clinic at the University of Tennessee; and the Innovation Advancement Program at Arizona State University.[27] All of these programs use interdisciplinary teams of lawyers, business students and engineering students (and sometimes liberal arts students) to analyze a technology and prepare a path to commercialization. Sometimes the technology at issue belongs to the technical team member, sometimes to the university tech transfer office, and sometimes to local labs or other universities with which the program has a relationship. What all these programs have in common, however, is a semester-long or longer working relationship between teammates from different disciplines to accomplish a business result over a technical topic. The interdisciplinary collaborations teach both substantive topics valuable to the team members and the communication skills necessary to achieve the business goal.

However, not every school can build such a comprehensive interdisciplinary program. The more ambitious the program, the more extreme the challenges. Logistically, it is necessary to line up student schedules, both for regular class times and across divergent quarter/trimester/semester systems. Deciding where the class will meet, as well as whether students will get credit for the course at their home school, and which school gets the tuition dollars, can all be concerns. There may be requirements imposed from outside—as from the American Bar Association—on whether certain classes can "count" toward the professional degree. Pedagogically, the schools may have different opinions about what should be on the syllabus and how information should be taught, and there may be suspicion of the value of a new kind of course in the first instance. It may be hard to teach students with differing levels of understanding on various topics. It may be difficult to both spend enough time to explain new concepts in depth to students without prior exposure and still engage students with a prior understanding. Philosophically, there are also challenges. For example, in an interdisciplinary module using live client work, programs have to resolve ethics and professionalism hurdles around maintaining confidentiality and attorney–client privilege. There may also be conflicting opinions about the most deserving clients to serve.[28]

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[27] My sincere apologies if I fail to mention a relevant program.

[28] For a great discussion of his experience facing and addressing challenges in developing his interdisciplinary program, *see* Luppino, *supra* note 3, at 162–77.

The module I describe solves or sidesteps most of these problems. It pursues some of the same goals as these more robust interdisciplinary experiences, yet because of its limited duration and targeted scope, it can avoid addressing some of the challenges. Only a few weeks in length, scheduling is doable. There are no accreditation or funding issues, since the content is incorporated into a preexisting law school course, not free-standing. In addition, since it is a module instead of a separate course, I have not had to present the new content or the approach to anyone other than the engineering professors that advertise the opportunity to their students. These professors are very supportive of the module's philosophy as well as its execution. And finally, since the students do not service live clients, we avoid ethics issues. By focusing on a specific task that is at first intimidating to both sets of students, it challenges each to assume leadership and define the role they must play to ensure the project's success. Yet, the task is also limited enough that it gives the students a chance to absorb the lessons of communication and collaboration that are at the core of the assignment.

II. THE INTERDISCIPLINARY MODULE, IN DETAIL

A. *Pedagogical Goals*

I designed the module with at least six specific pedagogical lessons in mind. Four are patent industry specific, so I will save an in-depth discussion of how I address those lessons for a separate paper.[29] However, the final two lessons are designed to help the students become better at interdisciplinary interactions.[30] Although I do assign one reading that obliquely addresses interdisciplinary interactions between lawyers and engineers,[31] I have opted to mostly have the students learn through experiencing first, and then later discussing the lessons in class discussions. A final written reflection is also a great pedagogical tool to allow the students to summarize the whole experience and rethink successes and challenges.

My interdisciplinary lessons are that:

i) Professionals from different disciplines may absorb, process, and transmit information differently. Methods of communication that are comfortable for one colleague might be ineffective and even uncomfortable to another. In general, engineers excel at absorbing concepts through pictures or demonstra-

[29] The lessons are to show that: (1) IP is a means to a business end; (2) patents can be powerful tools, but they must be used to be effective; (3) the scope of a patent post-prosecution will likely be narrower than the coverage originally sought; and (4) patent prosecution is an art, not a science.

[30] Section IV, *infra*, provides empirical evidence from the student participants on potentially how successfully I conveyed these lessons.

[31] D.C. Toedt, *Reengineering the Inventor Interview*, 78 J. PAT. & TRADEMARK OFF. SOC'Y 19 (1996).

tions and lawyers gravitate toward verbal learning.[32] When the two groups interact, it can be frustrating to both. A lawyer may ask how something works, expecting a verbal answer addressing functionality, but the engineer might instead explain the design of the object and start by drawing the lawyer a picture. Engineers also tend to answer questions literally and like certainty, while lawyers are more comfortable with inferences.[33] And even the same words may have different meanings to the different groups; for example, "research" to a scientist or engineer may mean experiments, yet to a lawyer, it means finding precedent.[34] Yet these different approaches can enrich the end product of an interdisciplinary team because the different perspectives foster more nuanced results.

ii) A professional on an interdisciplinary team may need to effectively translate and facilitate field-specific issues for her colleagues. Engineers therefore have to learn how to describe technology in simple terms; lawyers need to learn how to describe and apply the law. Each has to do it clearly and respectfully. This means students need to consider that the other side has much less understanding, and likely much less interest, in the subject matter than they do. It means having the judgment to only introduce critical information, not all information, through a method that is comfortable to the *partner*, not to them. Once information flows easily from partner to partner, they can leverage the contributions of all members of the interdisciplinary team.

B. Summary and a Schedule

With these goals as a backdrop, I will next explain the process I employ. In summary, the module teaches lessons at the intersection of law, business, and technology by engaging pairs of law and engineering students in a patent drafting simulation. Students first use background information to perform a prior art search over a given real-life invention. They then perform a technical interview of the actual inventor of the product to confirm the problem the invention addresses and to understand how the invention works. The students then draft and redraft pa-

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[32] Richard M. Felder & Linda K. Silverman, *Learning and Teaching Styles in Engineering Education*, 78 ENGINEERING EDUC. 674, 680 (1988) ("Many or most engineering students are visual, sensing, inductive, and active . . . ."); *see generally* Eric A. DeGroff & Kathleen A. McKee, *Learning Like Lawyers: Addressing the Differences in Law Student Learning Styles*, 2006 BYU EDUC. & L.J. 499.

[33] BRIGGS MYERS WITH MYERS, *supra* note 2, at 139–66; DeGroff & McKee, *supra* note 32, at 515, 525 ("For Assimilators, emphasis is on abstract conceptualization, reflective observation, and the development of theories and ideas. . . . A substantial majority of the law faculty (81%)—and 45% of the law student respondents in this study—preferred an Assimilating learning style.").

[34] Telephone Interview with Marie Thursby, Executive Director, TI:GER program, Hal and John Smith Chair in Entrepreneurship, Regents' Professor, Georgia Tech Scheller College of Business.

tent claims. The final session allows students to compare their drafting to the claims from the actual issued patent, which not only gives them a reference for whether they captured the inventive concept adequately, but prompts a discussion about patenting process, style, and purpose. The scheduling works as in the chart pictured below:

	Monday	Wednesday
Week 1	Class 1: Prior Art Lecture (Prior art assignment due)	Class 2: Inventor Interview
Week 2	Off: Lawyers meet separately without engineers (Patent claims first drafts due)	Class 3: Patent Claims drafting lecture (Patent claims redrafts due on Friday)
Week 3	Class 4: Sum up lecture	

C. The Students and the Subject Matter:

Choosing the students and the subject matter is critical to the module's success. As to students, I accept an equal number of engineers as enrolled law students so that the partnering is equal. The lawyers are all enrolled in my IP clinic. They are all IP interested, but only some have taken patent law, and most do not have a science or technology background. A very few have patent drafting experience. They are mostly 3Ls, but there are sometimes a few 2Ls or an LLM.

The engineers are co-enrolled in either the first or second semester of an Engineering Entrepreneurship class, which is a great fit because these students, more than many of their colleagues, aspire to industry jobs. They connect this module to their career path, so they are motivated to learn the subject matter and also to learn to work with lawyers. They also bring a business interest to the module, which may be lacking in the law students.[35] The engineers complete a written application. I choose candidates based on language mastery, field of study, maturity, and background. The engineers receive extra credit within their class for their efforts but not a separate letter grade. The law students' work is graded as part of the clinic.

I originally chose the subject matter of the module carefully, and I continue to use the same technology now several semesters later. Because the engineers have varied backgrounds, and because most of the lawyers do not have technical training, I use a technology that is straightforward and familiar to most students (cell phone location). I purposefully used an actual invention with a recently issued patent to make the exercise as

[35] Increasingly, students in my clinic have completed or are co-enrolled in Penn Law's Certificate in Business Management program offered at the Wharton School (University of Pennsylvania's business school). This certificate program is one of the many interdisciplinary opportunities at Penn Law.

"real" as possible, and also so that I can offer them an actual set of claims in the last session for comparison. I chose an invention where the inventor was willing to appear live, and was also a good cross-disciplinary communicator, so that I could remove some of the communication challenges from the experience. Of course it helped that the patent had only twenty claims, including system, method, and apparatus options. There were other things that were fortuitous about the choice that I did not appreciate until later.

D. Running the Module, with Reflections:

1. Background Materials

I first distribute background information specific to the simulation. The law students play the role of the General Counsel and the engineering students the Chief Technical Officer. The information describes the state of the technology in the field and introduces the company's product line and market. It then presents a technical problem the company is facing in detail and shows why prior solutions have not worked (because of regulatory issues, cost, and technological limitations). I also assign readings on how to run a prior art search.

2. Class 1—Prior Art Search and Lecture

I then assign the first exercise, which the engineers and lawyers complete individually before the first class session. Given what they know about the invention, they run a brief prior art search. This exercise: (1) introduces them to a task that is common to research and development personnel, inventors, and practitioners operating in the realm of patents; (2) familiarizes them with patents in general (even many of the IP-interested lawyers have never read a patent), and the special law-technology hybrid language of this realm; (3) reveals the products and the players in this specific market; and (4) forces them to start to understand the technology.

Specifically I ask the students to use an online tool called "Google Patents" to search for patents through keywords and identify four patents that they think might be prior art to our invention. They send me the links to the patents, list their searches, and describe their process, ending in why they chose those particular four patents. I give them strict instructions to avoid reading any patents by the inventor. I then provide individual feedback on both their process and their results.

I want to force the students to generate and test relevant key words. I hope that this exercise familiarizes them with common terms in the industry, and because they will likely have to narrow down the search by choosing additional keywords, I hope they begin to distinguish the invention from prior art. Navigating through many hits also reveals that they are operating in a crowded field, what the technology is that has come before, who the competitors are, and the realization that this patent will necessarily need to be drafted narrowly. This exercise is designed to force

the students to really consider the "inventive step"[36] over previous inventions, and how the product should be protected to best meet the business needs of their simulated company.

After having tried a prior art search once themselves, for our first class session together, the students are ready to more ably discuss when a prior art search might be warranted, and how to do one. I have in the past invited a guest speaker to lead this discussion, since he is a patent-searching star. As counsel for a patent licensing company, his job depends on his ability to run thorough searches to conclusively evaluate patent strength. As a result, he has mastered the art of searching for prior art. For his talk, he sets the stage by discussing when searches might be relevant to an entrepreneur, and he then explains the sources and strategies he uses. He ends by running the assigned search again in front of the students, and then reflects on the student efforts.

This "do and then learn how to do it" method of teaching is helpful. The students ask questions based in experience rather than in the abstract, since they have already made some common mistakes. The format also allows the speaker to run the search as a demonstration, thus teaching through doing, rather than only a lecture-style verbal presentation. I hope this engages some of the engineers and other "converging style" learners.[37] Using a guest speaker for the first session, however, does not allow me to develop a bond with the engineers, so I am thinking about how to improve that aspect of the module. I may ask the speaker to reserve time at the end of the session for a more general discussion that I lead. One idea for the topic of such a discussion is below.

In addition, I found early on that the students that learn the most from this exercise are the ones that have tried multiple searches and looked through twenty to thirty patents. In contrast, most students complete the assignment too quickly. By only focusing on finding the four patents, they do not absorb the information that would provide the big picture. For example, most of them neglect to notice the companies behind the most problematic patents, so they miss identifying potential licensing partners or competitors. Some of them—particularly the lawyers that do not yet understand the technology—stop at a very high level, claiming very old, very general patents as prior art. They miss the chance to refine their keywords to find much more troubling patents (and many of those patents do exist). Finally, because some students do not review the patents they uncover in enough detail, they end up focusing too closely on only one aspect of the invention, and do not realize they need to refine their strategies and are searching too narrowly. As a result, they end up

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[36] *See* 35 U.S.C. § 108 (2012). This concept is analogous to the requirement of non-obviousness. *Id.*

[37] *See* Alice Y. Kolb & David A. Kolb, *Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education*, 4 ACAD. MGMT. LEARNING & EDUC. 193, 197 (2005) ("In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications.").

missing many of the relevant prior art hits and have no idea how crowded the field really is.

I addressed some of these problems in later semesters by changing what I asked the students to do. I now ask the students to describe their process, which forces them to not only search more completely, but to notice and adjust when a search is unproductive. In future semesters, I would also like to devote some time to a group discussion. I would like students to help each other discuss the technology, analyzing which parts of the field seem most crowded, who the competitors are, and what keywords led to the most productive results. Because our time is short, in future semesters, I will ask our speaker to truncate his remarks and let this guided discussion fill the last third of the class.

3. Class 2—The Inventor Interview

Armed with their knowledge of the market, industry, and potential prior art, for the next session I ask the students to pair off and plan and run a technical interview of the inventor. To prepare for the session, I assign readings on how to run a technical interview and encourage the pairs to meet at least once beforehand to plan their strategy. I also ask them to at least skim the upcoming reading on claims drafting so that they can set goals for the interview.

Because the inventor's time is limited, the class interviews him as a group, which has benefits and disadvantages. However, although they do it as a group, the pairs sit together in the room so that they can confer. We cycle around the room with each pair asking two questions before we rotate to the next pair. I strongly recommend to them that they use some portion of the interview session to ask for the inventors' help to draft Claim 1 of the patent.

I like the group effort because students gain the benefit of others' questions, which is especially helpful for the least experienced, technical, or prepared. A group interview also showcases more examples of how different people attempt to gather and process complicated information. The students learn much by watching their peers struggle to understand new concepts, and the more peers they watch, the more lessons they learn. Of course, a group interview would never happen in real life. In addition, I worry that a group setting might intimidate some students who would then resist asking basic questions or following up a line of thought exhaustively for fear of seeming ignorant in front of their peers. The format might in fact quash some questions, although I have been lucky enough in past semesters to have had at least one student in each class who was not afraid to admit that he did not understand and asked questions until he did. My fear that one team would monopolize the session and we would run out of time before every team had had a chance to ask their questions proved to be unfounded. Although we always fill the entire session, by the end, we have typically gone through the entire room of pairs at least twice, and we have seemingly exhausted the questions. So on balance, I think the group effort satisfies the pedagogical

purposes of this module even if it does not mimic exactly what would happen in real life.

The students often emerge from the interview with a shallower understanding of the technology than they think. This is an important communication lesson for both the lawyers and the engineers, which they do not appreciate until they start to try to draft. Knowing that you cannot understand what you do not understand until you try to put it into words, I have recommended to the students that they use part of their interview time to ask the inventor to help draft Claim 1 of the patent. No student group has ever followed my recommendation. However, many teams then leave out the most critical parts of the invention in their first drafts. Mandating that the students draft Claim 1 before they leave the room would streamline the process and I think result in better claims. However, provided I can help them draw the connection between neglecting to use the inventor in the drafting stage and a poor draft, I think the stronger lesson might come from failing the first time. Then students can reflect back on why it was that they left the interview before they fully understood the information. Regardless of whether the problem stemmed from how the inventor explained the information, or from the students' inability to compensate for the imperfect communication, reflecting on what happened teaches the students important interdisciplinary communication lessons.

4. Class 3—Claims Drafting I and II:

After finishing the interview, the teams have five days to jointly draft a set of claims, aided by their extensive reading on the subject. I do not mandate when or how they collaborate. I return written feedback on their first drafts, and then they have a lecture on patent claims drafting techniques. They use the feedback and the lecture to create a redraft.

Similar to what happens with the prior art search, I schedule the lecture on drafting after the students have had a chance to first try writing claims on purpose. First, patent prosecution can be a dry subject, and without context, many of the valuable lessons might not get absorbed. Once students have struggled and failed to put the invention into suitable words fitting an acceptable format, they can truly appreciate advice on how to do it better. Besides benefitting more from the advice after drafting, they also can ask much more relevant questions. And finally, the lecture gives them a chance to ask questions about the written feedback on their claims, which would not happen if the feedback came after the live interaction.

After they submit their redraft, I send them the real claims from the actual patent application as they were submitted to the United States Patent and Trademark Office (USPTO). I ask the students to review the real claims against their attempt with their partner and come ready to discuss them in class together.

5. Class 4—Final Discussion:

The last class gives the students a chance to contrast the actual submitted claims to their efforts. We discuss why the prosecutor drafted the way he did, which they can evaluate much better after having done the prior art search, met the inventor, and tried to draft themselves. I ask them to comment on why they drafted the claims differently, if they did, and then to comment on whether they thought the prosecutor's version was stronger or weaker and why. I initially thought that the students would all find fault in their own versions as compared to the professional's, but I was delighted to see that in some cases, they had great explanations for why they drafted the way they did and could make a good case why their version was stronger. I wanted them to see that within the bounds of form, there are many good ways to draft a patent.

Next, I distribute the claims from the patent as issued by the USPTO, and we discuss how the office actions forced the company to respond by greatly narrowing its patent claims. With information about the lifetime cost of a patent, this leads inevitably to a discussion about the worth of this patent specifically, patents in general, and when and why to patent.

Finally, we discuss the module and the process through which the students worked together. I offer the students a chance to comment about how they were able to leverage each other's perspectives and strengths, hoping that such a discussion might give them strategies for the next time. The teams generally discover that the engineers' detailed technical perspective is helpful to draft with enough specificity to avoid prior art and to add additional embodiments and address possible infringers that might not have occurred to the lawyers. The teams then rely on the broader perspective of the lawyers to save the claims from becoming too narrow, such that would-be infringers could easily design around them. The lawyers also keep the project on track when the engineer gets caught up in postulating invention improvements, and the lawyers make sure the claims are clearly written in the proper form.

I ask every student to draft a reflection after the last class. This gives them the chance to really think about to what extent their interaction succeeded or failed and why. For that reflection, I offer them a set of questions to consider, including which student in the team emerged as a leader and when, whether the leadership changed depending on the stage of the project, how they collaborated, what skills seemed to come more easily to either member, and what aided or challenged their effective communication. The quotes in Section III of this Essay below come from these reflections.

Finally, we have used this sum up class to discuss the inventor interview and what the students might do differently after having had the chance to draft the claims. We also use this class to explicitly discuss differences in communication styles and the role that each student played during the module in translating her field of expertise to her partner.

III. UNEXPECTED LESSONS

While running this module, I learned several unexpected lessons, which I pass on here.

A. *Patent Claims Will Be Markedly Different Depending on Who Explains the Invention to the Drafter.*

A misstep actually became one of the greatest teaching moments of the module. The first two times I ran the simulation, the class interviewed the actual inventor. However, the inventor moved to Washington DC in semester three. So I asked the Chief Technical Officer (CTO) of the company—the inventor's boss—to pinch hit. It was a disaster.

I had drafted the background information with the inventor's help and with the real patent claims as an end goal. I carefully laid out all the problems the invention solves. The students were primed to ask questions based on the inventor's conception of what the invention needed to do. However, the CTO had a completely different orientation. He explained the system of which the invention was a part. His explanation was so general, in fact, that halfway through the CTO's explanation I thought he was describing the wrong patent. I held a sidebar. We confirmed we were on the same exercise. He resumed the interview, but the students never got an answer to their primary question, which was in effect, "What is so special about this invention?"

At first I was embarrassed and dismayed that my module had been torpedoed. I spent the next several days reorienting the students. As they came into my office one after the other, I would explain that I was putting a "gloss" on the CTO's explanation, and I would explain the invention from scratch, emphasizing the inventor's high points and highlighting the problem and the solution that had made the invention patentable. In effect, I could not see the lesson that was staring me right in the face. I had been speaking all semester about perspective and communication skills. Yet, I had not capitalized on the vivid example of how different a result can be if even the same message originates from a different source.

Our next session became a great discussion about interdisciplinary communication. The CTO had done nothing wrong; he had just been acting like a CTO. He saw the invention as a part of a greater whole, wrapped up in the company's product line. He used the interview to justify the invention's business purpose instead of to describe its specific details. As a result, at the end of the interview the students understood how highly the company valued the invention yet could not draft strong patent claims.

What could the students have done differently? They might have refocused his orientation by asking more detailed questions that focused only on the problem and its solution. They might have used confirmatory statements to show the CTO they heard his message and understood the

value of the invention and then directly asked what technically made the invention distinguishable. They could have used the patents they discovered in the prior art search as a counterpoint, again focusing the CTO on the technical differences that made this invention unique. And of course, in a real scenario, the students could have also interviewed someone else closer to the invention, if they realized they were not getting the information they needed in a useful format.

But lest the students complain too much about the CTO, we also discussed the downsides of asking the actual inventor to describe the invention. Besides a bias against noticing the invention's weaknesses, sometimes the inventor may only imagine one embodiment, thus limiting the specification. Similarly, the inventor may not be senior enough to see how an invention fits into the greater business whole, and as a result the drafting may end up being too narrow or may not fill in the gaps between this patent and rest of the company's portfolio. Finally, the inventor may not have knowledge about competitors that might lead to drafting additional defensive claims.

The conclusion was that a patent can only reflect the orientation of the person that describes the invention and is only as complete as the communication between the drafter (usually a lawyer) and the company representative (usually an engineer or scientist). The fate of the company might depend on this communication if the patent is critical to the company's success. So it is crucial to consider whether the information being conveyed is complete, correct, and in line with company needs. All parties need to consider how to maximize the chances for success. This unexpected experience more than anything else drove home to the students why we were doing the module.

I would like to have this important discussion in future semesters, although logistically it may be hard to replicate the lesson that brought it about. I saw the contrast because I was privy to both interviews. Therefore, I may have to present the two interviewees back to back and have students reflect on whether the information they received from either was complete and whether the answers between the two interviewees were consistent. Regardless, discussing how the information is conveyed from inventor to drafter, and how to enhance that process, is a really important part of the module that I will surely incorporate in ongoing semesters.

B. Pick an Invention That Shows the Nuance of a Complicated, Real-World Problem.

The second unexpected lesson involved the choice of the subject matter. I learned that it was important to choose a technology that solved a complicated real-world problem for at least two reasons.

First, it makes it easier to search for prior art and to draft claims. When the invention solves a problem, students can easily identify the important part of the invention, can distinguish the invention from prior

art, and can focus their claims drafting. It helps them to avoid getting lost in a crowded field of patents. It also drives home the lesson that a company does not have to patent everything it invents but should definitely patent the inventions that are necessary (for the company and for its competitors) to practice in order to produce and sell their products.

Second, it is pedagogically useful. Inventing to solve a real-world problem reveals an important difference in approach between engineers and lawyers and drives home the critical lesson that patents must be a means to a business end. It is not unusual for a company or a lab to be limited by cost, regulations, a competitor's patent, or another force that impacts what they may invent. The most efficient answer may not necessarily be the best one for the company. For example, the problem inspiring this module's technology revolves around how to get additional information to a new party through existing technology. The most efficient way to solve the problem, however, would run afoul of Federal Communication Commission (FCC) regulations and therefore could never be productized. The invention in the simulation, on the other hand, is inelegant, yet it complies with FCC regulations. It is not the best technical solution, but it is the only solution for the company if it wants to make money.

The engineering students are taught to solve problems efficiently. This invention makes them bristle. They argue with first the law students and then the inventor about whether this invention deserves a patent at all. Yet this challenge to the integrity of the invention annoys especially the nontechnical lawyers, who do not question the invention. They prefer to spend the limited time they have together as a team trying to figure out how to protect it. This lesson in different approaches becomes obvious only because the invention in the simulation must solve both a technical and a regulatory problem. Like most real-world problems, this problem is multi-faceted. The second best solution from a technical standpoint becomes the only solution simply because efficiency is not the only challenge the invention must meet.

Recognizing these diverging views of a patent's purpose, as well as the forces that can make an otherwise good invention unmarketable, creates a heated final discussion. The issues are especially relevant in this case, since the patent emerges from prosecution with such narrow claims. Students can explore when it is valuable to apply for a patent, and whether the company made the right decision regarding this invention. At this point in the semester, the pairs are comfortable enough with each other that they can openly explore their frustration with each other's approach, with the technology, and with the process.

C. *It Helps to Be Transparent and Obvious About Varying the Teaching Methods in Order to Drive Home the Lesson About Different Learning Styles of People and Disciplines.*

The engineers do not enjoy creating the written reflection and do not expect or appreciate long readings. The lawyers are used to long readings and written assignments but are mostly uncomfortable working with such technical subject matter.

I believe the students appreciate my acknowledgment that they are operating out of their comfort zone. I also try to explain how different activities during the module will come more easily to some than to others, but the greater goal was to find a way to work together to produce a quality product. Although the explanations did not make certain tasks any easier, the students reflected on how they learned best and potentially why.

D. *Almost Every Team Experiences the Same Predictable Tension During the Drafting Process.*

The students' perspectives play out in two ways: how narrowly they draft, and how carefully they follow the correct drafting format. I can tell almost immediately when I review the draft claims if a certain team member took control of the process.

The engineers draft extremely narrowly because they believe the goal is to describe the invention completely. They focus on putting all the information into one independent claim. And they resist coining terms; they like to draft exactly. The lawyers draft too broadly because they may not understand the distinguishing characteristics of the invention as opposed to prior art. They may miss certain embodiments because they cannot envision other uses for the technology.

As to the strict drafting format rules, the engineers almost universally thought they were needlessly complicated. I found this comment especially ironic coming from computer software engineers. The lawyers accepted the formatting as the rules of the game. Perhaps because lawyers are used to strict formatting rules when it comes to statutes, case citations, and especially footnote citation for law review articles, the law students were very comfortable with the idea of a new set of formatting rules as concerns patent claims drafting.

E. *It Helps to Keep External Indications of Power or Emphasis in Balance to Encourage Equal Participation and Control in the Teams.*

The lawyers have told me that at the beginning of the module, the engineers assume this module is a "legal" exercise, and they expect the lawyers to take the lead, even though almost universally the lawyers have no experience with patent drafting, and many have never even taken patent law. I am sure I helped to reinforce this assumption by running the entire module at the law school. During the first semester that I ran the

module, we held half the sessions in each school, and I think the engineers felt more ownership from the beginning. I will look for more ways to signal equal buy-in from the engineering school, whether that be as simple as holding half the sessions there or whether an engineering professor should co-teach the discussions with me.

I have also come to realize that it is important to ensure the students are equally incentivized. This is important both to signal that we have similar expectations for each student and to encourage equal participation. Since many goals of the module are dependent on practicing working together, if one partner is less engaged, the whole module is less valuable for everyone. Since the work in the module is difficult and time consuming, I have learned that, with busy schedules, students have to have a reason to devote enough time to the module. Specifically, students need to feel a grade is hanging in the balance in order to prioritize the work at or above the work they do for other graded classes. Giving them "extra credit" and the opportunity to put it on their resume does not appear to be enough. Although many of the students were self-motivated and realized the uniqueness of the learning they could do with the module, the engineers were less incentivized than the lawyers to put in the extra time that it took to do the project well.

I do set clear expectations for the engineers to indicate how much time the module will take before they apply and again before they start the module. However, I am trying to work with the engineering professors to add a downside for the engineers if they do not do well in the module.

F. Teams That Collaborate in Real-Time Achieve a Better Product and Learn More About Effective Interdisciplinary Interaction.

I suspected that teams that met in person several times would achieve the best results, both for the written product and for learning about communication styles, but in the beginning I did not mandate that teams meet in person. Because I was asking students to work outside of class on this project, I initially left it up to them to decide how their schedules would accommodate the work. Students designed several different methods of collaboration, ranging from doing all the work side by side, to working simultaneously but remotely, collaborating online through a tool such as Google Docs, to meeting once and then trading drafts.

My suspicions were borne out for the most part, although my analysis is incomplete and largely subjective and anecdotal, based on student evaluations.[38] In general, teams that met in person for every aspect of the

[38] I also have records to quantitatively compare how long teams take to draft their claims because the law clinic students submit timesheets for every week in the semester.

project produced good work and ended up bonding the best.[39] Their process may not have been as efficient, however, because these teams spent more time on the project than other teams.[40]

Teams that employed a hybrid process, where they met in person sometimes but also worked off of a Google Doc (although also real-time) also had some good outcomes, largely perhaps because the team members were cognizant enough about each other's strengths to design a situation that allowed the members of the team to contribute in the way they felt most comfortable. These teams also seemed to be more efficient than the teams that solely met in person[41]

The few teams that worked only by exchanging drafts (either by design or through circumstance) had the least satisfying experience and provided the least finished work product. Almost uniformly in these cases, the lawyer received very little input from the engineer, and at the end neither team member could contribute much to the discussion about collaboration.[42]

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[39] Some student teams that operated this way gave the following feedback: (i) "I am glad we decided to meet in person instead of dividing the work, because we had a chance to contribute equally and to discuss our project at length. Both of us realized that we worked best together and for this reason we decided to meet before every step of the assignment"; (ii) "We also did all the work together as opposed to assigning ourselves tasks to do on our own time. Working on the same computer certainly kept us focused and honest. . . . If we had clashed in the beginning we would probably have gone our ways but the relationship was smooth from the beginning and communicating was easy so we kept going."

[40] It is hard to determine if teams met for longer because they started to bond, or teams started to bond because they met for longer. As one team reported, "I think that overall, our final product was more thorough than it would have been had we not been as patient. Being patient, however, did have its frustrating points."

[41] Some of those teams reported as follows: (i) "One difference I noticed was that our work together was much more productive when we met over Skype and wrote our claims in a shared Google Document. I think this benefited each of us in different ways. For me, it became much easier [to] share examples with [my teammate] of the types of wording and phrasings that would make our claims stronger, meaning that I was doing much less verbal explaining. It was possible to just copy and paste examples into a chat window. I also think that because we were not physically in the same room, we felt more free to just work on the document, and edit one another's writing, and speaking verbally as needed"; (ii)"We communicated every day and often after the [inventor] interview, which was key to our successful composition of 20 fairly good claims. Typically, I would receive a text from [my teammate], e.g., that he was about to start drafting, then I would think for a minute how to respond, e.g., by texting him back an idea for Method Claim 1 using gerunds, then he would edit the Google Document he had created for the draft, and finally I would look at his work, make changes and add to it. This iterative process of sharing ideas allowed us to get creative and feel that we had contributed equally and together, even when we were not working in the same room. And it was fun!"

[42] Representative comments included the following: (i) "I felt that I did not get as much help as I would like when we were actually putting the invention into claims. Ideally, I would like to have him more involved in the drafting process"; (ii) "His contribution to the actual claims [was] limited to the suggestions he made after reviewing my completed draft of the claims. Even then, there were not too many

What I summarize from these results is that real-time communication—in either electronic or physical form—was instrumental both to the quality of the finished product and to the quality of the experience for all partners. Although I cannot draw a conclusion about whether an in-person meeting was superior to real-time electronic meetings, since groups that used both seemed to succeed, what these groups had in common was that the partners found a way to get both members of the team to contribute.[43]

Given these results, I am considering whether I would like to set requirements about methods of collaboration. Of course my decision to allow the students to choose their collaboration plan was based on more than just considerations of convenience for them. I also allowed them to make their own decisions here because they will get to decide how to collaborate in the workplace. They will likely be equally busy during their workdays and will need to decide whether it is worth sacrificing some efficiency in order to meet in real-time in some way. It is also an important part of learning to collaborate to grapple with dealing with a partner that does not do her share of the work. If the promise to exchange documents encourages freeloading, students could learn from this experience and try a different method next time.

The benefit of allowing students to choose a method they ultimately find lacking is that the next time they might choose a different method. In addition, these collaboration failures could be fodder for a great reflective discussion about teamwork. However, this would be an awkward discussion to have with the "freeloading" members of the teams present. In addition, by allowing students to try a method that does not work, they tend to blame the partner or the program rather than their choice of method. And not having experienced a good result from a different method, they do not realize that their results could have been better, plus they miss out on all the learning resulting from a good collaboration.

On balance, next time I run the simulation, besides trying to even out the incentive structure, I will add two collaboration requirements. The first will be that each teammate must prepare his own set of draft

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changes to the claims. Ultimately, I think the final end product of the simulation was heavily influenced by me, so my partner did not significantly affect the simulation."

[43] As another team stated: "[My teammate] and I were also very good about using each other's strengths during the drafting process. Neither of us completely took the lead during the simulation. [My teammate] took the lead on writing the initial claims, since he had a better grasp of the proper technical language. I orally told him in laymen's terms what I wanted the claims to say, and he would simultaneously translate my words into 'engineering' language. Once that was done, I then edited the claims to ensure that we were using the proper legal patent lingo (comprising of v. consisting of, etc.), proper formatting (independent v. dependent claims), broad language, etc. Sharing the work and playing off each other's strength[s] helped us create a better final product and gave us both a sense that our contributions mattered."

claims and then that the teams must meet real-time in some way to combine them into the draft they submit to me. I will leave unstated how they are to combine the drafts, how they go about submitting their redraft the following week, and how they will prepare for the inventor interview. This will still allow students significant autonomy over the collaboration process, yet will force each teammate to contribute significantly to the first draft. Second, I will have a discussion with the lawyers separately (during the "off" class session in the middle of the module) about their collaboration choices and how they are playing out.

G. *Students May Need More Time and Discussion to Digest the Lessons That They Are Learning, Particularly About Interdisciplinary Communication.*

This module sets out to teach both substantive skills and skills of interpersonal relations. Because the sessions are few and the substantive skills are complicated and new, much of the class time is devoted to introducing the substantive skills. I already discussed my desire to build in some additional time for discussion around the prior art search results and the inventor interview. But I currently rely on the written reflection assignment to drive home the interpersonal skills lessons.

I do not think relying only on student reflection at the end of the module is enough, especially given how much emphasis I would like to place on learning these skills. Small lessons may go unnoticed or may be forgotten if there is no chance to capture and discuss them close to when they occur. I would like to ensure that developing good communication between technical and nontechnical professionals becomes an obvious goal of the module.

I aspire to accomplish this in a few ways. First, I will publicize the goals of the module to the students ahead of time, and alert them to the subject matter of the final reflection, so that they are thinking about interpersonal relations from the first session. I also may expand my use of the Myers-Briggs Type Indicator test.[44] I already start my clinic semester by giving the law students a related version of the Myers-Briggs to introduce them to the concept that people process information differently and to get them thinking about their own style. I will ask the engineers to take the same test. This would signal my intended focus on interdisciplinary communication skills early on, and also give the students a common language to reference when they are later discussing differences. It would also give the students a chance to test the hypotheses that certain professionals cluster around different types. And provided they are comfortable sharing their type with their partner, it may also give them a head start toward working together successfully.

Finally, I would potentially like to build in a discussion session devoted specifically to concepts of collaboration and interdisciplinary commu-

[44] For a discussion of the MBTI, see generally *MBTI Basics*, MYERS & BRIGGS FOUND. (2015), http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/.

nication. There are three challenges I see. First, enough collaboration has to have taken place for the students to have thoughts and experiences to share. Second, I would like to support such a session with readings, and the students—especially the engineers—are already overwhelmed with the reading already assigned. Lastly, it could be potentially embarrassing for the students to talk about the challenges of their collaborations with their partners present.

My potential solution would be to use part of the "session off" in the middle of the module to have a discussion on collaboration, but only with the lawyers. The advantage is that in that session students could discuss their collaborations plans and execution so far (whether done jointly and all in person, partly in person, or remotely through Google Docs) and weigh the pros and cons of each, with time left in the module to make changes if desired. In that way, students could both benefit from experiencing the autonomy of planning their own collaboration method and learn to appreciate that certain methods may lead to better results than others. It would also free up the law students to speak freely without their partners present. I could also assign a few short readings to the law students, since there are no readings currently assigned for that session.

The disadvantage of course is that, although my teaching allegiance is strongest to the law students in my class, the engineers would not have the benefit of the discussion. We could make up for this in part by devoting a bit of the final discussion session to a wrap-up of these teaming issues, which could start all the students thinking about the discussion in their final reflection paper. With the Myers-Briggs results to pull from, and the benefit of their colleagues' comments, the reflection papers should be all the richer for the additional information.

IV. STUDENT REACTIONS TO THE MODULE MEASURED THROUGH A SURVEY

I was curious as to whether this module, as designed, was helpful to the students. I had made assumptions that the lessons I'd hoped to teach were important ones, which would later help the students to succeed in the workplace. But I needed to see if I was correct in order to make adjustments to improve the experience for future students.

I sent a survey out via email to all former participants. Out of 46 students, 32 answered, about a 70% answer rate. Although the sample size is small, I still found the results illustrative and actionable. Overall, they indicated that some lessons I hoped to teach through the module came through clearly, and some less so, but that the interdisciplinary nature of the experience did indeed have value to the students as they entered the workforce.

I will divide the analysis of the results into four short sections. First, I will discuss the data addressing whether presenting an interdisciplinary experience to law and engineering students is relevant to them and why. Second, I will discuss the data showing how effectively this module taught

the students about interdisciplinary interactions. Third, I will discuss whether interdisciplinary skills are contributing to student success in the workplace. And finally, I will present the students' impressions of the experience overall, hopefully to inspire others to use some sort of interdisciplinary module in their programs.

A. *Testing the Hypothesis: Is Offering an Interdisciplinary Experience Between Law and Engineering Students Relevant, and if so, Why?*

An interdisciplinary experience may be most relevant to students who will later need to engage in interdisciplinary interactions in their workplaces. So, to gauge the impact of such an experience, I first tested the assumption that law and engineering students interfaced with people from other disciplines after they graduated and entered the workforce.

To answer this question, I targeted questions to identify and focus on the students who already had permanent jobs. For the analysis, I considered both students working full time at the time of surveying (12 of 32, hereafter called "full-time") and the students that had worked after the module at their place of future employment, even if they still had more schooling to complete (an additional 7, hereafter called "part-time"). This methodology likely underestimated the measure of interdisciplinary interaction. It notably excluded many recent law graduates, since they had already completed their summer clerkships at their permanent employer before taking the module, yet at the time of the survey were studying for the Bar and had not yet started their permanent employment. In addition, all the students it did include had had very little time in the workforce after the module (at the most, for students that graduated in 2013, one year, and for the returning students, only a summer). I expect that resurveying the students in a few years' time, after they have developed their careers and taken on additional responsibility, might elicit different answers. Even so, I was struck with the impressive amount of interdisciplinary interaction the young professionals had already experienced, almost across the board.

After gathering information about their employer and department, I specifically asked the students if their jobs "provided . . . professional opportunities to interact with people from other disciplines," and then if so, to describe them. Of the 12 full-time professionals, every one of them relayed that interdisciplinary interaction either already was or would be a part of their career. Five out of 12 (2 law and 3 engineering) students already engaged in interdisciplinary interactions "regularly"; 5 others (2 law and 3 engineering) engaged "sometimes," and the remaining 2 described that they did not engage yet, but expect that they will. Not one checked the available option of "no, and I don't expect it will."

One observation I had while reviewing the data was that interdisciplinary experiences might start earlier for the new engineers than for the lawyers, as the part-time professionals had a different distribution. These lawyers and engineers had only worked for a very short period of time.

Out of the 7 part-time students polled, 5 of them engaged in interdisciplinary interactions either regularly (3) or sometimes (2), but most of those were engineers (4 out of 5). Further, the sole law student in that group only engaged sometimes. The remaining 2 part-time students, one who had not engaged in interdisciplinary interactions at work yet but remained hopeful that he would (1), and one who did not engage and did not expect he ever would (1), were both lawyers. This anomaly could be due to reality or perhaps to perception. Besides a very real later onset of interdisciplinary interactions, the lawyers also may not at first realize that they will engage in interdisciplinary interactions when they start out their career. As the experience of slightly more experienced lawyers seems to show, such interdisciplinary interactions may become a larger part of practice than new lawyers initially expect. In contrast, interdisciplinary experiences seem to play either a regular or occasional role in even fledgling engineering careers.

What kinds of interdisciplinary interactions do the lawyers and engineers have? Although it varied by job and employer, students reported interdisciplinary interactions when servicing outside clients, when working to achieve goals across a larger organization, when dealing with administrative functions, when negotiating contracts, and during business and client development. Lawyers, engineers, entrepreneurs, artists, and regulators all worked together on common goals.

Some examples included:

> "At my position, I often times have to communicate with transit agencies . . . and other companies regarding business development. . . . I do work with people from a lot of disciplines."
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> "In my position, I engage both researchers and lawyers on a daily basis in order to support . . . commercialization efforts."
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> "Since I'm a product manager, I have to talk to sales and business people when trying to sell our product and work with engineering people in order to prioritize features."
>
> "I regularly work with business owners that own intellectual property or are developing IP that requires interdisciplinary knowledge in areas such as technology, science, business, environmental, and others."
>
> "I, on behalf of the Legal Department, work closely with the TV Production department, the finance department, and the administration department with my company, or of any other relevant party before finalizing the IP contracts."
>
> "I often participate in telephone conversations with clients and other parties (opposing counsel, in-house counsel, CEOs, scientists, R&D, Quality Assurance employees) and have gone on several pitch lunches to interact with startup company employees."
>
> "I have regular interactions with people from a wide variety of different backgrounds, from lighting designers to graphic artists, to electrical engineers, to sculptors and roboticists."

> "We all cross-collaborate because resources are so limited. As a result, a lot of the design is IP driven and we try very hard to fit anything we make into the scope of previous patents or at least close enough to file a continuation in part. Our design meetings often have our legal department sit in."

The next question I asked was whether students believed that their interdisciplinary interactions proceeded more easily once they had learned to recognize and adjust for differences between professionals of varied disciplines. If the answer was yes, given that such opportunities present themselves to both law students and engineers even early on in their careers, then I thought that attempting to develop and hone such skills during their schooling, through opportunities for interaction like the module described, would have value.

The students I polled in fact did believe strongly that an ability to identify and adjust for professional differences is helpful to navigate interdisciplinary interactions. I first asked to what extent the students believed that "professionals from different disciplines absorb, process, and transmit information differently." I asked the students to rank the strength of their belief on a scale of 0 to 100 (100 being the strongest belief). Out of 32 students, 13 (6 out of 17 engineers and 7 out of 15 lawyers) ranked this statement at a belief level of 100. Overall, the average belief level was 86.8; if broken out separately, the engineers averaged a score of 86.7 and the lawyers a score of 86.9.

Since most of them believed that professionals had different approaches, I then asked the students whether members of interdisciplinary teams had to adjust in some important ways in order to help the team. I asked the students to rank how strongly they believed the statement that "a professional on an interdisciplinary team may need to effectively translate and facilitate field-specific issues for her colleagues." The results were equally as compelling. Out of 32 students, again 13 ranked their belief at 100 (some, but not all of the same people as had ranked the prior statement at 100; again 6 out of 17 engineers and 7 out of 15 lawyers). Overall the average belief was 90.1; broken out separately, it was 89.2 for the engineers and 91.1 for the lawyers.

Stories from actual experience included:

> "It's been useful to recognize how lawyers and scientists can understand and communicate what they think the key concepts are, and how those don't always align. I've been on negotiation calls where the lawyers from each side are arguing about one concept, and the scientists from each side are arguing about something different, so the negotiation doesn't go anywhere until everyone can get on the same page."

> "I have to cooperate with . . . people in different departments with no legal background and with a different and unrelated way of thinking regarding the channel's deals, and so I have to explain to non-lawyers many legal points that I usually take for granted. . . . Many times each department's point of view has 'to be translated'

> to the other departments in order for all the departments of the company to be on the same page . . . before the company makes the decision."
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> "It is important for the lawyer to facilitate issues by avoiding legalese and asking questions about concepts in the client's discipline . . . that the lawyer may not understand."
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> "When you can see/appreciate where the other side is coming from, it helps to reach common ground faster."
>
> "As a scientific expert, I find myself explaining basic concepts to lawyers so that they can assist me in doing my job better (the same is of course true in reverse)."
>
> "My job requires communicating complex ideas to individuals who work in very diverse fields and have varying levels of education. This is not an easy task . . . ."

In summary, both the law and the engineering students do interface with professionals of other disciplines when they reach the workplace. When they do, they believe that these other professionals they meet might deal with information differently than they do. And when working with a team that includes a variety of different kinds of professionals, they may be called upon to translate and facilitate information for their colleagues in order for the team to succeed. So it just remains to discuss how they develop these skills of translation and facilitation. Can an interdisciplinary module like the one I describe in this article help?

B. Is This Module Effective at Teaching Students Some Skills They Need to Succeed in an Interdisciplinary Setting?

In order to analyze what the students might have learned through this module about skills or perspectives helpful to interdisciplinary interaction, I returned to the same statements. This time, instead of asking the lawyers and engineers to describe the extent to which they agreed with the statements, I asked them to what extent their agreement stemmed from their exposure to the interdisciplinary module.

Specifically I first asked to what extent the module introduced them to or deepened their understanding of the concept that "professionals from different disciplines may absorb, process and transmit information differently." Having confirmed that the vast majority of the students agreed with the statement to a great extent (overall average rating of 86.8; 86.7 for engineers and 86.9 for lawyers), I hoped this question would isolate whether specifically this module had introduced or built on knowledge.

The results were encouraging. For the most part, the students were willing to attribute their learning of this concept specifically to the module. The average overall rating was 82.2. For engineers the average was 81.6, and for lawyers it was 82.9. In fact, there were 11 ratings of 100; seven from engineers and four from lawyers. These students connected their learning to an extremely strong degree to the module.

Sprinkled among the 26 high marks were 6 sub-70 marks: 3 from engineers, and 3 from lawyers (65, 63, 62, 56, 30 and 20). Two of these 6 also ranked belief in the basic statement low, so their score does not reflect what happened during the module.[45] In thinking about why the remaining 4 students could believe in the concept, yet not highly ascribe the learning to the module, it is possible that they learned this lesson at other times in other ways. But in order to improve learning in any event, by implementing the changes I have outlined above, I hope to deepen and improve the experience for all the students. Being more obvious upfront about the goal of improving interdisciplinary interaction, allotting more time to discussion between the engineers and lawyers, and including a few more readings (at least for the lawyers) specifically on the subject may help to strengthen the message. And in allotting more time for discussion, I can also discern which parts of the module resonate best with the students, and which parts to further improve.

Finally, I also asked a second question to test learning from the module, and the results were even more encouraging. When asked to what extent the module introduced them to or deepened their understanding of the concept that "a professional on an interdisciplinary team may need to effectively translate and facilitate field-specific issues for her colleagues," the scores were higher, even for the six students who had scored the learning low for the idea that professionals process information differently. Specifically, the average overall was 85.4; separately, for engineers the average was 83.0 and for lawyers it was 88.1. There were 11 measurements of 100; 6 from engineers and 5 from lawyers. And there were only 4 as opposed to 6 sub-70 marks (61, 60, 56, and 50), from 4 of the same 6 students who had ranked learning low on the prior question.

Curiously, the final 2 students who had ranked learning as a sub-70 experience over the prior question now ranked learning at 80 and 95. Perhaps the more basic concept of professional differences was an old concept for them, but this module helped them to newly put it into practice.

I did not specifically ask the professionals to explain *how* this module had introduced or deepened their understanding of these concepts. However, a few comments did specifically connect the module to developing skills helpful in an interdisciplinary setting.

> "During the course, I had to work with a law student in our attempt to draft patent claims. We literally had to bridge a gap between the technical language of the patent (which I was more comfortable with) and the legal language, which was less familiar to me. This is something I do today as well."
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> "The experience I gained from the lectures increased my confidence in explaining technology and communicating from outside

[45] The student who assigned a score of 65 to what he had learned from the module ranked his belief in the basic statement at 70, and the student who assigned a score of 56 to the module also ranked the statement at 56.

the field of engineering."

"Cooperating with non-lawyers is a very interesting experience for a lawyer and a necessary opportunity to gain valuable knowledge in the field."

Students began to appreciate their role as members of an interdisciplinary team. They realized they needed to both convey and receive knowledge, and needed to rely on each other to translate critical information they all needed to know. But would this practice prove helpful at a time when it was more than a classroom exercise?

C. *Do Skills and Perspectives that Strengthen Interdisciplinary Interaction, as Introduced or Developed in this Module, Help the Professionals to Succeed in Their Workplaces?*

Having determined whether such interdisciplinary opportunities exist for these students (yes), that they believe the skills are important to develop (yes), and that the module helps to develop those skills (yes), the final question is whether the students are using the skills in the workplace to help them succeed.

Again focusing on only the full-time and part-time students, which excludes recent law school graduates, the answers are exciting. Even given their early stage in the workplace, already most of the students are using interdisciplinary skills in practice, across many workplace environments, and using these interdisciplinary skills is helping them to succeed.

I again returned to the same questions, but this time asked the students to measure to what extent UNDERSTANDING the concepts listed helped them to succeed in their profession. The first concept was that "professionals from different disciplines may absorb, process, and transmit information differently." The second concept was that "a professional on an interdisciplinary team may need to effectively translate and facilitate field-specific issues for her colleagues."

Of the 19 full-time and part-time students, 16 stated that knowing that "professionals from different disciplines may absorb, process, and transmit information differently" was relevant to their success. A full 12 out of 19 ranked the extent to which this specific knowledge helped them to succeed in their profession at 70 or more; 7 even ranked it at 95 or more. As to the follow-up concept, that "a professional on an interdisciplinary team may need to effectively translate and facilitate field-specific issues for her colleagues," even more students agree that having this knowledge was relevant to their success. A full 13 out of 19 rank that concept as helping them to succeed in their profession at a measurement of 80 or more; 9 rank it at 90 or more.

This shows that students not only believe these concepts, but believe they should use them in practice, and that having such knowledge helps them to succeed. The students that share this sentiment are from different law and engineering careers and work in a wide variety of places, including university tech transfer; the engineering department of an enter-

tainment conglomerate; the corporate practice of a medium sized law firm; other practices of medium and larger law firms; an academic research center of a medical school; in-house legal departments of a television channel and a global corporation; the USPTO; several small start-up companies; an oil and gas financial services company; the research and development department of a biological device company; and an international auto manufacturing company. The few students who thought these concepts were barely or not at all relevant to their success worked in places with a large population of people from the same profession: departments at large law firms (2) or in the network engineering team of a large company (1). However, surprisingly, even other students similarly situated to these three did not report a similarly cloistered experience: other students at large law firms and international companies reported having interdisciplinary experiences and using the concepts to achieve success. So in other words, across every workplace environment represented in our sample, students interacted with professionals from different disciplines, and their ability to do so well impacted their workplace success. A few students described their experiences as follows:

> "As a lawyer, it helps to be able to engage (even at a rudimentary level) with the client about their IP needs in light of the type of product they are working with. I have helped business owners think through strategic ways to protect their IP in light of the type of product and their budget. Sometimes I have been able to advise them towards a patent (medical devices) and other times away from patents (code-based technology). I advise that IP protection is both a legal and business decision."
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> "[T]he Patent Prosecution Module helped prepare me [to] understand how to communicate and understand people from different fields in order to integrate ideas and present them in comprehensive ways."
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> "I think it's very important for lawyers, even at the youngest level (such as a law student[s]) to start getting exposure to other disciplines, especially as the world becomes increasingly global and interdisciplinary."

D. *In Sum, Is Planning and Running Such an Interdisciplinary Experience Worthwhile?*

Planning and running this module takes work, even now long after I have already set the curriculum and run the module several times. Besides the teaching, it requires quick turnaround on several assignments, logistical organization, and effort to quickly integrate eight new students into the class. But in a short period of time, the students are exposed to unique lessons that they would not otherwise get a chance to learn. They study patenting techniques, but they also explore the importance of fitting IP into larger business goals, why certain inventions may have more value than others, and most importantly, how to improve their own work product by incorporating the input of colleagues from other disciplines.

Overwhelmingly, student reviews were positive. Most expressed that the exercise was challenging: "The patent drafting simulation exercise was the most difficult assignment I have encountered as yet in law school"; but also thought it was worth the effort: "The patent drafting simulation was a very rewarding experience." For purposes of this paper, I questioned the students specifically about whether they appreciated the chance to develop interdisciplinary skills. Almost universally, they did. When questioned whether "the interdisciplinary team experience of the module [was] useful," 31 out of 32 professionals characterized the experience as either "very useful" (16) or "moderately useful" (15), as opposed to "somewhat useful" (1) or "not useful at all" (0). The lawyers as a group valued the experience higher than the engineers, but the difference is slight. Eight law students and eight engineering students characterized the experience as "very useful," while six lawyers as opposed to nine engineers called it "moderately useful," however, the only person to say it was only "somewhat useful" was a law student.

What I glean from these results is that running this module is in fact worth the effort. In fact, when asked how to improve the module, a number of students asked that it be expanded to include several more sessions if not a full semester. Although this is not feasible for my clinic, which seeks to cover all areas of IP in one semester, this module could be the core of a patent prosecution class open to engineers, entrepreneurs, and lawyers alike.

In the last question of the survey, I asked students to optionally add anything else they would like to say. Many of the students did in fact add a comment, and all were positive. Several said that they appreciated being exposed to important lessons in cross-disciplinary education and communication.[46] They also pointed out the relevance of learning substantive patent law.[47] They also expressed that the skills they learned would not only benefit the individuals involved, but the companies, firms, or entities that employed them.[48] Overall, the students were positive, calling the module among other things a "great introduction to the world of IP," a "great resource [that] gave me insight," "an excellent learning experience," and "a great idea and great learning opportunity."

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[46] One student commented, "Engineering students that aspire to leave academia must be familiar with [the] IP space and not regard it as a nuisance. Law students on the other hand must learn to comfortably talk with engineers and not be afraid of the technical language that usually accompanies these interactions."

[47] Comments included: "Makes filing a patent a lot less intimidating. Great resource on learning how to evaluate existing patents."; "This was a novel experience, I thought it was a great way to expose [e]ngineering students to something relevant but [outside of] their core curriculum."; "The module helped me learn the lexicon that is important in the litigation realm."; "I think the course is a great, hands on experience that has a lot of great takeaways [that] will be useful regardless of the field you go into."

[48] One student aptly noted: "The ability to communicate leads to innovation, efficient processes, and a healthier work environment."

However, my favorite comment of all came out of the reflection of one of the engineers and will be the inspiration for my continuing to pursue this module and others interdisciplinary opportunities like it going forward:

> "I do not know if I will ever need to seek out a lawyer to help me draft a patent of my own, but I am certain that I will encounter legal-minded people in my work. And the ability to empathize with their concerns and understand how they approach situations is just as necessary as it is enriching, especially in today's day and age where the boundaries between these disciplines are slowly evaporating. It is no longer clear where the line between 'tech' territory and 'legal' land sits. Witness the evolution of software over the past decade, along with the current dialogue on incorporating patentability into cyber-driven systems. As far as I am concerned, this field is wide open, and the more I understand about varying perspectives, the more I fully comprehend the problems at hand in my quest to make a significant difference."

How exciting to play a part in helping him to get there.