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The Patent Bar Gender Gap: Expanding the Eligibility Requirements to Foster Inclusion and Innovation in the U.S. Patent System

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THE PATENT BAR GENDER GAP: EXPANDING THE ELIGIBILITY REQUIREMENTS TO FOSTER INCLUSION AND INNOVATION IN THE U.S. PATENT SYSTEM

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Qualified women are unnecessarily excluded from membership in the "patent bar" as a result of the perpetuation of an institutionally biased and archaic set of scientific and technical requirements by the United States Patent & Trademark Office (USPTO). While the USPTO has not failed to recognize the lack of equal gender representation among innovators (i.e., inventors) in the United States, it has remained silent on the lack of gender diversity within its own patent bar. Still further, even when the gender gap within the patent bar has been acknowledged, there have been few, if any, attempts to abolish the systemic obstacles that seem to exclude women from participation. This paper explores and criticizes these obstacles prohibiting women from equal representation in the patent bar and proposes possible solutions to reach greater gender inclusion therein. Specifically, the USPTO can foster greater inclusion and innovation in the U.S. patent system by (1) expanding the enumerated technical degrees that automatically satisfy the scientific and technical requirements for patent bar eligibility; (2) removing the undue requirements regarding program accreditation (for computer science degrees) and coursework; and/or (3) implementing an apprentice model as an alternative path to patent bar eligibility.

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INTRODUCTION

Qualified women are unnecessarily excluded from membership in the "patent bar" as a result of the perpetuation of an institutionally biased and outdated set of scientific and technical requirements by the United States Patent & Trademark Office (USPTO).[1] While the USPTO has not failed to recognize the lack of equal gender representation among *innovators* in the United States, it has remained silent on the lack of gender diversity within its own patent bar.[2] Still further, even when the gender gap within the patent bar has been acknowledged, there have been few, if any, attempts to abolish the systemic obstacles that seem to exclude women from participation.

As will be appreciated by any patent practitioner, and as will be addressed in more detail herein, to be patent bar eligible in the United States, an individual must establish she has the requisite "scientific and technical" knowledge.[3] While the reasons women are underrepresented in the patent bar are not due exclusively to these scientific and technical requirements, these eligibility requirements are unnecessarily exclusionary of women and are responsible, in large part, for the lack of female patent practitioners in the United States. This exclusion of women, as well as the pervasive silence and lack of acknowledgement thereof, is particularly troubling in a time in which there is a growing recognition of the lack of gender equality within the patent system as a whole.[4]

This paper will explore and criticize the various obstacles prohibiting women from equal representation in the patent bar, and will propose three possible solutions to reach greater gender inclusion within the patent bar.[5] Part I will provide a brief, yet comprehensive, background of the current scientific and technical requirements to become a registered patent practitioner in the United States, and introduce the available statistics regarding the current level of representation of women in the patent bar. Armed with this knowledge, Part II will identify and criticize the systemic limitations preventing women from equal representation in the patent bar. Part III will propose three modifications to the current patent bar eligibility requirements that would promote the inclusion of more women. In particular, Part III will argue for: (1) the expansion of the enumerated technical degrees that automatically satisfy the scientific and technical requirements for patent bar eligibility; (2) the removal of the undue requirements regarding program accreditation (*e.g.*, for computer science degrees) and coursework; and/or (3) the implementation of an apprenticeship model as an alternative path to patent bar eligibility. Finally, Part IV of this paper will consider the impact of these proposed modifications on patent quality, as well as the tangential benefits of including more women within the practice of patent prosecution.

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[1] The "patent bar" refers to the collective group of individuals who are recognized to represent inventors before the USPTO. *See infra*, notes 6-14 for an explanation of the patent bar and how an individual becomes recognized.

[2] *See* ANDREI IANCU & LAURA A. PETER, U.S. PATENT & TRADEMARK OFFICE, STUDY OF UNDERREPRESENTED CLASSES CHASING ENGINEERING AND SCIENCE SUCCESS: SUCCESS ACT OF 2018 (2019); *see also* U.S. Patent & Trademark Office, PROGRESS AND POTENTIAL: 2020 UPDATE ON U.S. WOMEN INVENTOR-PATENTEES (2020).

[3] U.S. PATENT & TRADEMARK OFFICE, GENERAL REQUIREMENTS BULLETIN FOR ADMISSION TO THE EXAMINATION FOR REGISTRATION TO PRACTICE IN PATENT CASES BEFORE THE UNITED STATES PATENT AND TRADEMARK OFFICE (2020) [hereinafter, "GRB 2020"], https://www.uspto.gov/sites/default/files/documents/OED_GRB.pdf.

[4] For example, in 2018, Congress passed the Study of Underrepresented Classes Chasing Engineering and Science Success (SUCCESS) Act in recognition of the lack of patents awarded to women. The report prepared by the USPTO in accordance with the SUCCESS Act was silent with respect to the gender gap within the patent bar. *See* SUCCESS Act, Pub. L. No. 115-273, 132 Stat. 4158 (2018); *see also* Iancu & Peter, *supra* note 2.

[5] *See, e.g.*, Clara Guibourg & Nassos Stylianou, *Why are so few women inventors named on patents?*, BBC (Oct. 2, 2019), https://bbc.com/news/technology-49843990. While the focus of this paper is limited to gender, it is expected that many of the solutions would also benefit minorities and other diverse groups.

I. PATENT BAR ELIGIBILITY & THE PATENT BAR GENDER GAP

Patent prosecution is the practice of drafting, filing, and negotiating patent applications with the United States Patent & Trademark Office (USPTO) in order to obtain patent protection for an invention.[6] Unlike every other specialized field of law, patent prosecution is unique in that it allows non-lawyers to practice, provided that they are a member of the patent bar.[7] These non-lawyer members are referred to as "patent agents," while licensed attorney members are referred to as "patent attorneys." Currently, entry into the patent bar is conditioned on the passage of a six-hour, 100-question, open book, written examination.[8] The pass rate of the exam is notoriously low, and has been less than 50% every year since 2013.[9] In 2019, the pass rate was 45.3%.[10]

The requirement to pass the written examination has been an essential feature for registry into the patent bar since 1934.[11] Although the exam has taken many forms over the years, the purpose of this examination requirement has remained consistent; to ensure that all patent practitioners "possess[] the legal, scientific, and technical qualifications necessary for him or her to render [patent] applicants valuable service."[12] The written examination—colloquially referred to as the patent bar exam—however, only assesses whether the practitioner has the "legal" qualifications, whereas (typically) the practitioner's undergraduate education assesses whether she possesses the "scientific" and "technical" qualifications.[13] Accordingly, in order to even qualify to take the written examination, an individual interested in entry into the patent bar must first demonstrate to the USPTO that she has the sufficient scientific knowledge to make a reliable and valuable contribution to the practice of patent prosecution.[14]

A. What Are the "Necessary Scientific and Technical Qualifications"?

The USPTO sets forth three categories by which a potential patent practitioner (hereinafter, an "applicant") can demonstrate she has the qualifications for entry to the patent bar. The first, Category A, enumerates a number of subjects in which evidence of a bachelor's degree leads to automatic eligibility.[15] The second, Category B, provides that an applicant with a bachelor's degree in an unenumerated subject (*i.e.*, a subject not listed in Category A) is eligible, provided she can demonstrate sufficient coursework in subjects such as chemistry, physics, engineering, biology, and the like.[16] The final category, Category C, allows "practical engineering or scientific experience" to substitute the educational requirements of Category A and Category B.[17]

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[6] Christi J. Guerrini, *The Decline of the Patent Registration Exam*, 91 Neb. L. Rev. 325, 328 (2012).
[7] *Id.*
[8] *Id.*
[9] *Registration Exam Results and Statistics*, USPTO.GOV, https://www.uspto.gov/learning-and-resources/patent-and-trademark-practitioners/registration-exam-results-and-statistics.
[10] *Id.*
[11] Kenneth L. Port, Lucas M. Hjelle & Molly Littman, *In Pursuit of Patent Quality (and Reflections of Reification)*, 20 MARQIPLR 79, 86 (2016) (citing Comm'r of Patents, Order No. 3,206, printed in 440 Off. Gaz. Pat. Office 781 (Mar. 27, 1934)).
[12] *See* GRB 2020, *supra* note 3, at 1.
[13] *Becoming a Patent Practitioner*, USPTO.GOV, https://www.uspto.gov/learning-and-resources/patent-and-trademark-practitioners/becoming-patent-practitioner.
[14] *See id.*; GRB 2020, *supra* note 3, at 3-9; 37 C.F.R. § 11.7(b)(1)(i)(C).
[15] *See* GRB 2020, *supra* note 3, at 3.
[16] *Id.* at 4-7.
[17] *Id.* at 7.

1. Category A: Automatic Eligibility

Under Category A, an applicant can establish she has the necessary scientific and technical qualifications by showing via an official transcript that she has been awarded a bachelor's degree in one of the following subjects:[18]

Biology	Pharmacology	Electrochemical Engineering
Biochemistry	Physics	Engineering Physics
Botany	Textile Technology	General Engineering
Computer Science*	Aeronautical Engineering	Geological Engineering
Electronics Technology	Agricultural Engineering	Industrial Engineering
Food Technology	Biomedical Engineering	Mechanical Engineering
General Chemistry	Ceramic Engineering	Metallurgical Engineering
Marine Technology	Chemical Engineering	Mining Engineering
Microbiology	Civil Engineering	Nuclear Engineering
Molecular Biology	Computer Engineering	Petroleum Engineering
Organic Chemistry	Electrical Engineering	

If the applicant has a degree in Computer Science, she must demonstrate that the degree is accredited by the Computer Science Accreditation Commission (CSAC) of the Computing Science Accreditation Board (CSAB), or by the Computing Accreditation Commission (CAC) of the Accreditation for Engineering and Technology (ABET).[19]

Significantly, the USPTO's Office of Enrollment and Discipline (OED), which oversees the administration of the examination and the regulation of the eligibility requirements, states that if the degree "is not listed EXACTLY as shown in the Category A list," or if the applicant has a master's degree or higher in one of the enumerated subjects, but not a bachelor's degree, the applicant must qualify under either one of Category B or Category C.[20] Therefore, any degree in, for example, Biological Sciences, Biomechanical Engineering, Materials Engineering, Pharmacy, Agricultural Sciences, Mathematics, and Statistics would *not* qualify for automatic eligibility.

2. Category B: Sufficient Scientific Education

Any applicant who has a bachelor's degree in an unenumerated subject (of Category A) must establish her scientific and technical qualifications by providing evidence she has completed enough training to satisfy at least one of the following four options:

Option 1: 24 semester hours in physics;
Option 2: 32 semester hours in a combination of:
    8 semester hours in chemistry or 8 semester hours in physics; and
    24 semester hours in biology, botany, microbiology, or molecular biology;
Option 3: 30 semester hours in chemistry; or

[18] *Id.* at 3.
[19] *Id.*
[20] *OED Frequently Asked Questions (FAQs)*, USPTO.GOV, https://www.uspto.gov/learning-and-resources/patent-and-trademark-practitioners/oed-frequently-asked-questions-faqs (emphasis in original).

Option 4: 40 semester hours in a combination of:
8 semester hours in chemistry or 8 semester hours in physics; and
32 semester hours in chemistry, physics, biology, botany, microbiology, molecular biology, or engineering.[21]

In addition to these requirements, the USPTO requires, in part, that "only courses for science or engineering majors will be accepted," and that for Options 2 and 4, the eight semester hours in chemistry or physics "must be obtained in two sequential courses, each course including a lab" and "must be for science or engineering majors."[22] Even further, only grades of C- or higher are accepted for any of these courses.[23]

3. Category C: Practical Scientific Experience

If an applicant does not or cannot satisfy either Category A or Category B, she can establish her eligibility by providing evidence of her passage of the Fundamentals of Engineering (FE) test, which is administered by a State Board of Engineering Examiners in each state or comparable jurisdiction.[24] As discussed below, the USPTO publishes extremely limited data on the patent bar registry, let alone data regarding the manner in which patent practitioners demonstrate their technical and scientific qualifications.[25] Anecdotally, however, the vast majority of patent practitioners demonstrated their eligibility through Category A or B. The number of practitioners who qualified via Category C is likely very low.

B. Evidence of the Patent Bar Gender Gap

The gender inequality in patent systems around the world is not new to criticism. A 2019 report by the USPTO found that only 12% of all inventor-patentees on U.S. patents were women.[26] These numbers are consistent across the globe, with women inventors accounting for just under 13% of all patent applications.[27] However, when it comes to the demographics of patent practitioners, data are scarce. Currently, the USPTO does not collect or provide substantial or meaningful demographic data on registered practitioners. At most, it maintains a roster, updated nightly, of all registered practitioners, which includes standard identifying information, such as name, employer, address, and status (*i.e.* patent agent or patent attorney).[28]

Despite the lack of regulated and verified data, a few studies have developed independent methodologies to gender-identify this roster of patent practitioners. These studies generally employ a methodology that uses available census data to determine a practitioner's gender based on his or her first name.[29] A 2011 publication gender-identified approximately 95% of the roster of registered patent practitioners through the end of 2008 and found that only about 18% of registered practitioners were women.[30] Building upon these data, a subsequent study found that these numbers remained constant

[21] *See* GRB 2020, *supra* note 3, at 4.
[22] *Id.* at 4-5.
[23] *Id.* at 5.
[24] *Id.* at 7.
[25] *See infra* text accompanying note 28.
[26] Iancu & Peter, *supra* note 2, at 2.
[27] Guibourg & Stylianou, *supra* note 5.
[28] *Download Practitioner Roster*, USPTO.GOV, https://oedci.uspto.gov/OEDCI/practitionerRoster.
[29] Saurabh Vishnubhakat, *Gender Diversity in the Patent Bar*, 14 J. Marshall Rev. Intell. Prop. L. 67, 72 (2014).
[30] Annette I. Kahler, *Examining Exclusion in Woman-Inventor Patenting: A Comparison of Educational Trends and Patent Data in the Era of Computer Engineering Barbie*, 19 AM. U. J. GENDER SOC. POL'Y & L. 773, 791–92 (2011).

through the end of 2012.[31] In particular, Saurabh Vishnubhakat found that, of the 77.50% percent of the roster that could be gender-identified using his methodology, only 18.12% were women.[32]

These statistics are reflective of not only the exclusionary scientific and technical requirements, but also the overall lack of women who pursue careers in science and engineering, as well as the lack of women who pursue careers in law. It is at the intersection of these career paths – science and law – where we will find the women who pursue careers in IP law, or more specifically, patent prosecution. Absent significant efforts to make science and technology and/or law more gender inclusive, it is unlikely the proportion of female patent practitioners will change within the foreseeable future. Nonetheless, the USPTO is in a unique position to blaze the trail to minimize this gender disparity. Specifically, the USPTO holds the discretion and authority to rework its scientific and technical requirements to bring more women into the fold as registered patent practitioners.

II. Identifying Obstacles for Female Applicants to the Patent Bar

The reasons for the lack of female patent practitioners run much deeper than just the eligibility requirements described herein. These reasons run even deeper than the gender imbalance within law more generally.[33] In order to fully appreciate the institutional bias perpetuated by the USPTO's current scientific and technical requirements, we must first acknowledge and understand the inherent limitations on reaching gender equality within the patent bar by exploring the pipeline problems of women in STEM and women in law, as well as where these pipelines converge – women in IP law. It is also worth exploring, albeit briefly, the objective differences between the curriculum of the degrees enumerated in Category A of the USPTO's requirements and that of various degrees in unenumerated STEM and STEM-adjacent technologies. Examples of these STEM-adjacent technologies can include nursing, pharmacy, and psychology. Understanding where these curricula overlap, as well as where they diverge, can provide useful context for revealing why, and how, the USPTO's current eligibility requirements exclude qualified women, and why these requirements might be changed.

A. Acknowledging the Pipeline Problems

1. <u>Underrepresentation of Women in STEM</u>

In order to critically evaluate the gender gap within the patent bar itself, it is imperative to acknowledge the gender gap within STEM education, as it is from these programs where the patent bar pipeline – and its corresponding problems – initiates. Specifically, we must acknowledge the clear gender gap within the population of individuals who pursue degrees and/or careers in science, technology, engineering and mathematics (*i.e.*, STEM).

Data show that, in 2016, women earned approximately half of all STEM bachelor's degrees.[34] However, the proportion of women earning these degrees varied significantly across the fields of study.[35] While women earned 75% of the bachelor's degrees awarded in psychology, 55% of the bachelor's degrees awarded in biological sciences, and 55% of the bachelor's degrees awarded in social sciences, they earned only 19% of the bachelor's degrees awarded in computer science, only 21% of the bachelor's degrees awarded in engineering, and only 19% of the bachelor's degrees awarded in physical sciences (*e.g.*, chemistry, physics, etc.).[36]

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[31] *See* Vishnubhakat, *supra* note 29, at 80.
[32] *Id.*
[33] *See, e.g.*, DESTINY PEERY, NAT'L ASS'N OF WOMEN LAWYERS, *2019 SURVEY REPORT ON THE PROMOTION AND RETENTION OF WOMEN IN LAW FIRMS* (2019), https://www.nawl.org/page/nawl-survey.
[34] *Field of Degree: Women*, NAT'L CTR. FOR SCI. & ENGINEERING STATS. (Mar. 8, 2019), https://ncses.nsf.gov/pubs/nsf19304/digest/field-of-degree-women.
[35] *Id.*
[36] *Id.*

The data further show that more of these women, regardless of field, pursue master's degrees. For example, while women only accounted for about 19% of the bachelor's degrees awarded for computer science in 2016, they accounted for nearly 31% of the master's degrees awarded in the same field.[37] These trends are generally consistent across each subject-area, and suggest that women in technical fields are obtaining master's degrees at higher rates than their male peers.[38] However, when it comes to doctorate degrees, the trend generally reverses, with percentages of women earning Ph.Ds. more closely mirroring those of women obtaining bachelor's degrees in those fields.[39] In sum, although women are outnumbered by men in nearly all subjects at the graduate levels – except for psychology, biological sciences, and social sciences – women appear to obtain master's level graduate degrees at higher rates than their male counterparts.

Unsurprisingly, these trends of being outnumbered by men continue beyond the classroom. Of all individuals employed in STEM professions in 2017, only about 31% were women.[40] In fact, only about 15% of the women who had obtained a STEM degree were employed in a STEM career, as opposed to 33% of men, indicating that across all fields, women leave STEM at higher rates than men.[41] Notably, however, similar to undergraduate and graduate programs, these workplace trends are highly dependent on technology area. Where women tend to have the most parity with men in the STEM workplace is in the life sciences – *i.e.*, biotechnology, pharmaceuticals, organic fine chemistry, macromolecular chemistry, and analysis of biological materials.[42] Additionally, in 2017, among the scientists and engineers employed in STEM-adjacent professions, such as nursing and other health and healthcare occupations, about 58% were women.[43]

Considering the current scientific and technical requirements, these data illuminate a serious pipeline problem for ever obtaining gender parity in the patent bar. The requirements heavily favor degrees and coursework in hard sciences, such as chemistry, physics, and engineering, which are the sciences in which women are statistically less likely to participate.[44] However, by broadening the scope of the analysis from only those STEM fields enumerated in Category A of the USPTO's eligibility requirements to encompass those additional STEM and STEM-adjacent fields, there is a noticeable increase of female participation – both at the undergraduate level and in the workplace. In fact, women tend to dominate the proportions of undergraduates obtaining degrees and pursuing careers in many of these STEM-adjacent disciplines, such as psychology, biological sciences,[45] and social sciences.

Evaluating and criticizing the underlying reasons for the significant disparity between male and female representation in STEM educational programs and careers is beyond the scope of this Article. These issues are societal, cultural, economic, and familial.[46] However, by compounding the low number of women pursuing STEM degrees and careers with the number of women who pursue careers in law, it is possible to shed light on how the USPTO's current scientific and technical requirements further perpetuates the exclusion of women from the patent bar.

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[37] *Id.*
[38] *Id.*
[39] *Id.*
[40] *Occupation*, NAT'L CTR. FOR SCI. & ENGINEERING STATS. (Mar. 8, 2019), https://ncses.nsf.gov/pubs/nsf19304/digest/occupation.
[41] *Id.*
[42] Kate Gaudry & Leron Vandsburger, *Across Industries, the Female Inventor Rate is Half the Female Employment*, IP WATCHDOG (Apr. 20, 2020), https://www.ipwatchdog.com/2020/04/20/ across -industries-female-inventor-rate-half-female-employment-rate/id=120717.
[43] *See supra* note 40.
[44] *See supra* notes 18, 21, 34-36, and accompanying text.
[45] *See supra* note 20 and accompanying text, including "Biology" and excluding "Biological Sciences" as enumerated subjects for Category A eligibility. Therefore, for consistency with the current USPTO requirements, "biological sciences" is referred to as "STEM-adjacent" herein.
[46] For at least one study exploring the underlying reasons for the gender gap in undergraduate majors, *see* Jamin D. Speer, *The Gender Gap in College Major: Revisiting the Role of Pre-College Factors*, 44 LAB. ECON. 69-88 (2017).

2. Underrepresentation of Women in Law

The pipeline for women in STEM is not unlike that for women pursuing and maintaining professions in law. Both suffer from a number of "leaks,"[47] further limiting the number of women who may ultimately end up practicing IP law, let alone patent law or patent prosecution, particularly once the current scientific and technical requirements of the USPTO are considered.

Ever since 2016, the number of women that have matriculated into law school in the United States has consistently outweighed the number of men. For example, 54% of the total enrollment of first-year law students in 2019 was female.[48] However, reaching this level of gender parity in legal professions has yet to be realized. While women enter law school at higher rates than men, entering associate classes of private law firms have been comprised of only about 45% women for several decades.[49] A 2016 study found that female law students tended to be clustered at lower-ranked law schools, impacting job opportunities and placement.[50] In particular, the authors of the report found that, using *US News*'s 2015 law school rankings, the bottom "unranked" quarter of law schools had an average enrollment of 53% women, whereas that of the top 50 ranked law schools was just 46%.[51] The authors further concluded that this gender gap had continuously widened in the twenty-first century, as prior to 2001, no significant correlation between a law school's gender composition and its *US News* rank was identified.[52]

As further evidence of the leaky pipeline of women in law, as of 2019, only 38% of the legal profession was comprised of women.[53] These issues are not only prevalent among law schools and entry-level positions, but pervade into the highest echelons of the legal profession, where women make up only about 23% of private practice partnership, and only about 19% of private practice equity partnership.[54]

Frequently, there are three reasons cited for the reason women both leave legal professions at higher rates, and, as noted above, enter legal professions at lower rates than men: (1) work-life balance; (2) unconscious bias; and (3) the pay gap.[55] The first reason, work-life balance, reflects the societal pressures successful businesswomen face when it comes to managing and balancing each of their familial and work commitments. While a 2019 survey found that 82% of managing partners believed their firms were "active advocates of gender diversity," only 62% of their female colleagues agreed.[56] These statistics expose the stark unconscious bias against women in law, which is the second reason cited for women leaving the profession. Finally, the pay between men and women in law has never reached parity. Between 2006 and 2016, women lawyers earned between 70.5% and 89.7% of that of their male

[47] *See, e.g.*, Patricia Fara, *'Leaky Pipelines': Plug The Holes Or Change the System?*, NPR (Feb. 2, 2018), https://www.npr.org/sections/13.7/2018/02/02/581849526/leaky-pipelines-plug-the-holes-or-change-the-system, for a discussion of the metaphorical "leaky pipeline," and a call for retirement of the term, insofar as it refers to women with STEM degrees who leave the field to pursue alternate passions. An argument could be made that a woman leaving a STEM career to become a patent practitioner (such as myself) would contribute to this "leaky pipeline."
[48] *2019 1L Enrollment by Gender & Race/Ethnicity*, AM. BAR ASS'N, https://www.americanbar.org/groups/legal_education/resources/statistics/.
[49] *A Current Glance at Women in the Law*, AM. BAR ASS'N, (April 2019) https://www.americanbar.org/content/dam/aba/administrative/women/current_glance_2019.pdf.
[50] Elizabeth Olson, *More Law Degrees for Women, but Fewer Good Jobs*, N.Y. TIMES (Nov. 30, 2016), https://www.nytimes.com/2016/11/30/business/dealbook/more-law-degrees-for-women-but-fewer-good-jobs.html.
[51] Deborah Jones Merritt & Kyle McEntee, *The Leaky Pipeline for Women Entering the Legal Profession* (Nov. 2016), https://www.lstradio.com/women/documents/MerrittAnd McEnteeResearchSummary_Nov-2016.pdf.
[52] *Id.*
[53] *See supra* note 49.
[54] *Id.*
[55] *See, e.g., Why Women Leave the Profession*, AM. BAR ASS'N (Dec. 2017), https://www.americanbar.org/news/abanews/publications/youraba/2017/8ecember-2017/aba-summit-searches-for-solutions-to-ensure-career-longevity-for/.
[56] *Why senior women leave the law – and how to stem the tide*, AM. BAR ASS'N (Dec. 2019), https://www.americanbar.org/ news/abanews/publications/youraba/2019/8ecember-2019/new-report-details-how-law-firms-can-keep-experienced-women-from/. The study also found that 91% of the women attorneys' experienced male counterparts agreed with the managing partners.

colleagues.[57] In 2016 specifically, the median earnings of women lawyers were merely 77.6% of the salary of their male peers.[58]

Thus, the pipeline of women patent practitioners is leaking at both ends. With fewer women pursuing degrees in subjects recognized by the USPTO's eligibility requirements, and greater amounts of experienced women leaving the legal profession, there is little chance that gender parity can ever be achieved in the patent bar without reworking the USPTO's current scientific and technical requirements. And even with reworking, it is unlikely true gender parity will ever be achieved without addressing the greater pipeline issues (*i.e.*, women in STEM, women in law, etc.) described herein. Nevertheless, there remain opportunities to narrow the gender gap within the patent bar.

3. Underrepresentation of Women in IP Law

The demographic composition of intellectual property law does not significantly differ from the general practice of law. Rather, if anything, it exposes an even wider gender gap within this specialized field of law. For example, a 2019 report by the American Intellectual Property Law Association (AIPLA) unsurprisingly found that IP law (inclusive of patents, trademarks, copyright, licensing, litigation, prosecution, etc.) is overwhelmingly white and male.[59] In particular, it found that about 80% of IP attorneys were male, and about 86.5% of IP attorneys were white.[60] Despite IP law being among one of the fastest growing legal practice areas in the United States, of the 1.3 million licensed attorneys, there are only approximately 48,000 registered patent practitioners with the USPTO.[61] Of course, as described above, this number of patent practitioners includes not only licensed attorneys, but also registered patent agents who do not have a law degree.[62] Thus, even *fewer* of the approximately 18% of female patent practitioners are patent attorneys.

It flows from the foregoing, that by compounding the number of women in STEM with the number of women in law, that the number of women who pursue careers in intellectual property – and particularly patent prosecution – is inherently limited, especially in view of the current patent bar eligibility requirements. Rather than relying on the work of others to plug the leaks in these pipelines, the USPTO must adopt new guidelines that can capture more of these qualified women that may, or may not, meet the rigorous requirements of Categories A, B, and/or C. That is, the USPTO must shift perspectives and look at these issues as not at *pipeline*, but as a *funnel*, where broadening the scope of eligibility – or the brim of the funnel – will fundamentally capture more women, thereby leading to an increase in participation by women in the patent bar.

B. Exploring the Differences in Curricula of Category A and STEM-Adjacent Degrees

Buried within the USPTO's Frequently Asked Questions (FAQs) appears the question: "If my degree is similar to the degrees listed in Category A, may I assume my application will be processed as a Category A application?"[63]

The USPTO answers the FAQ in the negative, stating, "No. If your degree is not EXACTLY as shown in the Category A list, you must qualify under one of the Category B options or Category C and submit the required documentation."[64] The USPTO provides for only thirty-two degrees in Category A,

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[57] *See supra* note 49 at 6.
[58] *Id.*
[59] *2019 Report of the Economic Survey*, AIPLA, https://www.aipla.org/home/news-publications/economic-survey.
[60] *Id.*
[61] *ABA National Lawyer Population Survey*, AM. BAR ASS'N, https://www.americanbar.org/content/dam/aba/administrative/market_research/national-lawyer-population-by-state-2010-2020.pdf; *Practitioner Roster*, USPTO.GOV, https://oedci.uspto.gov/OEDCI/ practitionerRoster.
[62] *See supra* notes 6-8 and accompanying text.
[63] *See supra* note 20.
[64] *Id.*

thereby failing to acknowledge the growing diversity and increased specialization of many undergraduate STEM programs, as well as the substantial overlap in science curricula across the country.

While there are very few, if any, regulated standards for the curriculum of a particular bachelor's degree across all undergraduate universities in the United States, there are commonalities that a typical degree generally shares, regardless of the university from which it is obtained. For example, a degree in chemistry from Harvard requires courses in general chemistry, inorganic chemistry, organic chemistry, physical chemistry, mathematics and physics.[65] A degree in chemistry from a state school, such as the University of Illinois, similarly requires a combination of general chemistry, organic chemistry, and physical chemistry, as well as courses in mathematics and physics.[66]

Although the requirements for degrees in fundamental subjects, such as chemistry, remain relatively consistent across universities, many schools offer STEM degrees that carry different names than those listed in Category A, yet consist of a curriculum that is substantively equivalent to one or more of the enumerated degrees. For example, the University of Illinois does not offer an undergraduate degree that reads "exactly" as "Biology," "Microbiology," or "Molecular Biology," *i.e.*, the three biology-related degrees enumerated in Category A.[67] Rather, the University of Illinois offers specialized degrees in each of "Integrative Biology" and "Molecular & Cellular Biology," between which undergraduate biology students choose in their second year of study.[68] These programs include substantially the same curriculum, requiring courses in biology, chemistry, mathematics, and physics.[69] Nevertheless, it would appear that, based on the USPTO's own interpretation and explanation of their requirements, such degrees would not qualify for automatic eligibility under Category A, and would instead require the submission of additional evidence under Category B.[70] While submission of such evidence for many women may never actually threaten their eligibility, and may merely be a cumbersome exercise in data gathering, there remain many instances in which submission of this additional evidence may be insufficient and preclude eligibility.

Significantly, the USPTO requires applicants to have obtained a grade of at least a C- in all courses relied upon under Category B. Therefore, it is entirely conceivable that a student with a degree in Integrative Biology or Molecular & Cellular Biology may not be eligible for admission into the patent bar if they were to achieve anything less than a C- in a course, notwithstanding the fact that they earned the degree. In contrast, no such grade requirement is necessary for eligibility under Category A. Moreover, Category B also requires that any coursework in physics and chemistry must be for science and engineering majors and must "be obtained in two sequential courses, each course including a lab." Thus, it may be possible that even more students, who took the required coursework, but not in sequence or at the appropriate level, would further be excluded from eligibility.

The USPTO additionally and explicitly excludes certain STEM-adjacent degrees, such as "Biological Sciences," from Category A eligibility. Applicants with such a degree must satisfy the

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[65] *Harvard College Handbook for Students 2019-2020*, HARVARD UNIV. https://handbook.fas.harvard.edu/book/chemistry.
[66] *2020-2021 Academic Catalog, Chemistry, BSLAS*, UNIV. OF ILL., http://catalog.illinois.edu/ undergraduate/las/chemistry-bslas/#degreerequirementstext.
[67] *2020-2021 Academic Catalog, Undergraduate Majors & Concentrations*, UNIV. OF ILL., http://catalog.illinois.edu/undergraduate/#B.
[68] *2020-2021 Academic Catalog, Biology*, UNIV. OF ILL., http://catalog.illinois.edu/ schools/las/biology/#text.
[69] *2020-2021 Academic Catalog, Molecular & Cellular Biology*, UNIV. OF ILL., http://catalog.illinois.edu/undergraduate/las/molecular-cellular-biology-bslas/#degreerequirementstext; *2020-2021 Academic Catalog, Integrative Biology*, UNIV. OF ILL., http://catalog.illinois.edu/undergraduate/las/integrative-biology-bslas/#degreerequirementstext.
[70] It is worth noting here that "[t]he *General Requirements* themselves . . . are not dispositive in determining whether an applicant may sit for the PTO examination. The Commissioner may, at his discretion, determine if an applicant possesses sufficient technical skills to take the examination." *Premysler v. Lehman*, 71 F.3d 387, 390 (Fed. Cir. 1995) (emphasis in original). Therefore, it is not outside the realm of possibility that an applicant having an "Integrative Biology" degree would be accepted via Category A. Nevertheless, the cost and effort involved in applying to sit for the examination, let alone the cost and effort involved in preparing for the examination itself, are likely to lead applicants to err on the side of caution when applying to minimize any cause for denial. Therefore, applicants with "Integrative Biology" degrees, for example, should always assume that their application will not be accepted through Category A, alone.

requirements of either Category B or Category C.[71] The rationale behind excluding a degree in "Biological Sciences," yet recognizing a degree in "Biology" is unclear, particularly in view of many undergraduate degree programs tending to equate the two degrees. For example, DePaul University (Chicago, IL) and the University of California–Santa Barbara each offer degrees in Biological Sciences, which require courses in general biology, general chemistry, organic chemistry, physics, and mathematics, but no such degree in "Biology."[72] Similarly, Marquette University offers a degree in "Biological Sciences (Biology)" requiring the same coursework, and appears to use the two names interchangeably.[73] Therefore, as noted above, it is conceivable that one student, having a degree in "Biology" from a lower tier science program may be automatically accepted via Category A, while a student from an upper tier science program with a degree in "Biological Sciences" cannot even be admitted via Category B, due to, for example, a poor grade in a difficult upper level physics course.

Meanwhile, the USPTO recognizes esoteric degrees, such as Textile Technology and Marine Technology (as opposed to Marine Biology) within Category A, which in some cases require significantly less, if any, coursework in chemistry and/or physics.[74] Table 1, below, provides the required coursework for each of these two esoteric degrees from two exemplary accredited universities or colleges that would render an applicant automatically eligible via Category A.[75]

TABLE 1. EXEMPLARY REQUIRED COURSEWORK FOR TEXTILE TECHNOLOGY & MARINE TECHNOLOGY, CATEGORY A DEGREES

Textile Technology **NC State University**	Natural Science (7 credits, at least one with a lab; can be fulfilled by physics or chemistry; grade of C- or higher **not** required for physics)
	Chemistry – Molecular Science (4 credits, with lab)
	Intro to Textile Technology (3 credits)
	Intro to Fiber Science (3 credits)
	Business of Textiles (3 credits)
	Yarn Production & Properties (4 credits)
	Woven Fabric Technology (3 credits)
	Knitted Fabric Technology (3 credits)
	Intro to Nonwoven Products & Processes (3 credits)
	Design Technology of Technical Textiles (3 credits)
	Technology of Textile Wet Processing (4 credits)
	Biotextile Product Development (3 credits)
Marine Technology **Northwestern Michigan College**	General Physics I & II (8 credits total, each with lab)
	CADD/Computer Modeling (4 credits)
	Intro to Engineering Tech (2 credits)
	Electrical Studies I & II (6 credits, total)
	System Engineering in Practice (3 credits)
	Marine Electronics (3 credits)
	Meteorology & Climatology (4 credits)
	Oceanography (4 credits)

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71 *See* GRB 2020, *supra* note 3 at 3–4.
72 *Major Requirements: Biological Sciences Core*, DEPAUL UNIV., https://csh.depaul.edu/ academics/biological-sciences/undergraduate/biological-sciences-bs/Pages/major-requirements.aspx; *Biological Sciences BA and BS*, U.C. SANTA BARBARA, https://undergrad.biology.ucsb.edu/majors/biological-sciences.
73 *Biological Sciences (Biology) Major*, MARQ. UNIV., https://www.marquette.edu/explore/major-biological-sciences.php.
74 *See Textile Technology (BS)*, N.C. ST. UNIV., https://oucc.dasa.ncsu.edu/tex-18txtechbs-nosubplan-2198/; *see also Marine Technology, Bachelor of Science*, NW. MICH. COLL., https://catalog.nmc.edu/programs-az/technical/marine-technology/?_ga=2.43697954.604130414.1596385226-1560573607.1596385226#requirementstext.
75 General education coursework required of all degrees are excluded from this table, except for the physics/chemistry courses required for any Bachelor of Science degree (*e.g.*, required English and/or foreign language courses are not included).

	Fluid Power (3 credits)
	Marine Hydraulics (3 credits)
	Microcontroller Programming (3 credits)
	Microcontroller Systems (3 credits)
	GL Research Technologies (3 credits)
	Underwater Acoustics & Sonar (3 credits)
	Marine GIS & Data Processing (3 credits)
	ROV Systems & Operations (3 credits)
	Remote Sensing & Sensors (3 credits)
	Sonar Systems & Operations (4 credits)
	Advanced Marine Survey & Data (3 credits)
	Marine Tech Internship (3 credits)
	Marine Technology Capstone (4 credits)
	Marine Industry (3 credits)
	Marine Project Management (3 credits)
	Advanced Marine Platforms (3 credits)

As can be seen by these curricula, the course requirements for some of the Category A degrees may not even satisfy the requirements for eligibility via Category B (*e.g.*, where the above-referenced Marine Technology degree does not include the various combination of biology, engineering, etc. courses to satisfy Options 2 or 4 of Category B, and where the above-referenced Textile Technology degree does not require a grade of C- or higher in physics for degree conferral).

When it comes to Computer Science, not all applicants with such a degree will be accepted through Category A, despite being an enumerated science. The USPTO qualifies eligibility for computer science, requiring that, to be acceptable under Category A, the degree program must be accredited by the CSAB or the ABET. While many schools have such an accreditation, it cannot go unstated that the computer science programs at each of Carnegie Mellon University, Stanford University, the University of California-Berkeley, California Institute of Technology, and all of the Ivy League schools (other than the University of Pennsylvania) are *not* accredited by these agencies.[76] Significantly, each of Carnegie Mellon, Stanford, and UC-Berkeley tie for the number one ranked computer science program in the country, yet graduates of these programs are not deemed patent bar eligible via Category A.[77] Furthermore, it is unlikely such graduates will have had the requisite coursework to satisfy the requirements of Category B, let alone Category C, as courses in chemistry, physics, and the like are generally unrelated to the core computer science curriculum or the careers these students are likely to seek upon graduation. Thus, unless those graduates entered into their undergraduate program with the specific goal to be a patent practitioner – thereby enrolling in the requisite coursework – it is unlikely they will ever be rendered patent bar eligible, unless they return to school to take the required courses.

Insofar as applicants with unaccredited computer science degrees return to school to satisfy the requirements of Category B, the USPTO's scientific and technical requirements as applied to these applicants still fail to recognize the practical value these applicants would bring to the practice of patent prosecution. For example, it is unlikely these applicants will independently prosecute many applications directed to the chemical and biomedical arts (at least not without significant collaboration with inventors or other specialized assistants), thereby rendering superfluous any extraneous education in chemistry, physics, and the like that these applicants earned *only* to become patent bar eligible.

The selection and seemingly strong defense of the enumerated degrees of Category A by the USPTO – evidenced at least by the USPTO's requirement that a degree *exactly* matches a Category A degree – is anything but transparent. Adherence to these standards not only irrationally excludes

[76] *Accredited Programs*, ABET, https://amspub.abet.org/aps/name-search?searchType=institution.
[77] *Best Computer Science Schools*, U.S. NEWS (Mar. 16, 2020), https://www.usnews.com/best-graduate-schools/top-science-schools/computer-science-rankings.

applicants of all genders who have the requisite training to succeed as patent practitioners, but also unnecessarily excludes women by failing to acknowledge the degrees in which women are statistically more likely to obtain. Further still, these requirements fail to recognize that an education in most, if not all, of the Category A subjects is unlikely to impart any significant value on the preparation of design patents – patents directed to the ornamental and aesthetic design of a product. The USPTO imposes the same eligibility requirements on applicants (perhaps with an industrial design education) who only wish work within the design patent space.[78]

III. PROPOSED SOLUTIONS TO FOSTER GREATER GENDER DIVERSITY IN THE PATENT BAR

A. Solution One: Expanding Category A Eligibility

The simplest way in which the USPTO could foster gender diversity within the patent bar would be to be broaden the scope of Category A by including more STEM and STEM-adjacent bachelor's degrees. As many universities move in the direction of program diversification and more specialized degrees,[79] the number of students – regardless of gender – graduating with degrees in "EXACTLY" one of the thirty-two currently enumerated degrees will continue to decline, or at least remain stagnant.

It is indisputable that some level of scientific and technical training adds value to the practice of patent prosecution, particularly for complex chemical, biotechnical, and software applications. However, the unwavering adherence to only a small set of bachelor's degrees unnecessarily blocks many qualified women who have the same basic scientific and critical thinking skills as applicants with degrees in Category A subjects from pursuing careers in patent prosecution. Moreover, the growing diversity of patent applications and business demands "encourage patent agents and attorneys to look beyond their particular technical training when representing parties in the USPTO."[80] That is, patent practitioners with backgrounds in, for example, chemistry are growing more and more likely to draft and prosecute applications related to more diverse areas of technology. For example, while it is unlikely that, based solely on their degree or undergraduate coursework, a practitioner with a Ph.D. in chemistry would draft an application for a rotary engine any better than would a practitioner with a B.S. degree in computer science, patent practitioners are continuously challenged to expand the breadths of their practices. Even when patent practitioners do "stay in their lane," they will inevitably come across inventions that may fall within their general technology area, but are so specialized within that area that the practitioner's technical training and experience fail to provide any meaningful contribution to their understanding of the invention.

Relaxing the stringent requirements of Category A to embrace more STEM-adjacent degrees – both those within traditional STEM programs (*e.g.*, mathematics, biological sciences, psychology, biomechanical engineers, robotics, etc.) and those that are tangential to STEM (*e.g.*, nursing, pharmacy, etc.) – will not only diversify patent bar membership in terms of gender, but will also diversify the expertise of the patent bar, which will ultimately result in improved services to inventors. Applicants with degrees in these unenumerated subjects have the same, or even *more*, basic scientific training and skills that are useful to any patent practitioner.[81] By expanding Category A to include degrees in which statistically more women pursue, such as nursing, biological sciences, pharmacy, health sciences, product design, and the like, the USPTO would undoubtedly open the door for many more women to pursue patent prosecution.

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[78] For a deeper analysis of the impacts of the USPTO's eligibility requirements on the gender disparity within design patents, *see* Christopher Buccafusco & Jeanne Curtis, *The Design Patent Par: An Occupational Licensing Failure*, 37 CARDOZO ARTS & ENT. L.J. 263 (2019)..

[79] *See, e.g.*, Kathy Blake, *University and college programs are diversifying to meet continuing education students' needs*, BUS. N.C. (Aug. 31, 2017), https://businessnc.com/university-and-college-programs-are-diversifying-to-meet-continuing-education-students-needs/.

[80] William Hubbard, *Razing the Patent Bar*, 59 ARIZ. L. REV. 383, 406 (2017).

[81] *See supra* note 74.

B. Solution Two: Removing Undue Requirements on Program Accreditation & Coursework

Another solution to bring more women into the fold would be to remove the additional hurdles required of applicants having computer science degrees from unaccredited institutions, and to remove arbitrary requirements (*e.g.*, sequence/timing of courses, grade requirements, etc.) for scientific coursework.

1. Computer Science Accreditation

Regarding computer science accreditation, this solution is likely to have significant gender-neutral effects, as only about 19% of all computer science graduates are women. That is, in theory, this solution could even widen the gender gap – or at least have no impact on balancing the gender gap – as it embraces *all* individuals with computer science degrees (a technology heavily dominated by men), regardless of gender. Therefore, it is possible that removing accreditation requirements could cause a greater number of men with computer science degrees to be admitted, as compared to their female counterparts. By that same token, however, this solution would provide an equal opportunity for the 19% of women with computer science degrees to be admitted, thereby raising the overall *number* of women within the patent bar. An outcome that is by no means contrary to the goals of this paper.

The number of patent applications directed to the field of computer science only continues to increase. Since 2012, over half of the annual total of issued U.S. utility patents have been software related.[82] In view of the high demand for patent practitioners with this area of expertise, there is no legitimate reason why any person possessing a degree in this field should be precluded from inclusion, especially considering that many of the top computer science programs in the country forego accreditation.

Moreover, as noted above, many computer science students do not enter their undergraduate computer science programs with a specific intent to become patent practitioners. By the time they are exposed to this career path, oftentimes after graduation, it is too late to obtain the requisite Category B coursework at little cost. "It should have been easy – I have an engineering degree and $200," recounted Jess Miers, an Applied Computer Science graduate, with a minor in Computer Software Engineering, from George Mason University (GMU).[83] Notably, the path to obtaining her degree in *Applied* Computer Science was more rigorous than that of GMU's Computer Science program.[84] While GMU's Computer Science program was ABET accredited, its *Applied* Computer Science program was not.[85] After obtaining her degree, Miers was accepted to law school, and sought to take the patent bar exam the summer before courses began.[86] "I couldn't even get past the application."[87] Miers' application for the patent bar exam was rejected.[88] She reapplied, highlighting her relevant experience, and was denied a second time.[89] Not having the requisite coursework for Category B, let alone the time as an incoming law student to commit to enrolling in such coursework, Miers gave up on her pursuit of a career in patent prosecution.[90]

Under the current requirements, USPTO excludes interested applicants, like Miers, from eligibility for reasons that are unfounded. Where there are already so few female patent practitioners with

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[82] Raymond Millien, *Alice Who? Over Half the U.S. Utility Patents Issued Annually are Software Related!*, IP WATCHDOG (May 21, 2017), https://www.ipwatchdog.com/2017/05/21/alice-over-half-u-s-utility-patents-issued-annually-software/id=83367/.
[83] Jess Miers, *My Patent Bar Rejection Story*, CTRL-ALT-DISSENT (Jul. 7, 2019), https://ctrlaltdissent.com/2019/07/07/my-patent-bar-rejection-story/.
[84] *Id.*
[85] *Id.*
[86] *Id.*
[87] *Id.*
[88] *Id.*
[89] *Id.*
[90] *Id.*

a background in computer science, it is unfortunate that when a woman in this specialty does decide to pursue a career path in IP, that career may not be practically feasible for her based on her undergraduate training. Thus, she must pivot and find a new career – one that will not prohibit her from full participation, acceptance, and success. It is irrational for the USPTO to expect young computer science undergraduates to have the forethought to enroll in coursework unnecessary for their degree – especially when those undergraduates attend the most prestigious computer science programs in the country.[91] By maintaining this expectation, the USPTO ultimately pushes these applicants to seek careers elsewhere.

2. Requirements for Coursework

As described and argued in detail above, the arbitrary requirements set forth in Category B with respect to grades and sequence of coursework, exclude qualified candidates regardless of their gender. Where Category B emphasizes significant training in chemistry and/or physics, requiring at *minimum* 24 credits in these subjects unless paired with a large number of biology-related or engineering courses,[92] it allows immediate eligibility for some degrees that have significantly less training in these core subjects.[93] Moreover, in some cases, the curriculum for Category A degrees does not even condition graduation on a grade of C- or above.[94] If anything, these additional requirements set forth by the USPTO expose an inconsistent understanding of the exact scientific and technical requirements needed to "render [patent] applicants valuable service."[95]

As with removing the computer science accreditation requirements, this solution is likely to have gender-neutral effects, to the extent that it paves an equal path for both men and women alike. Nevertheless, it too will necessarily result in an increased number of female and diverse candidates, resulting in an increase of the overall number of women who can ultimately practice patent prosecution.

C. Solution Three: Introducing an Apprentice Model

Finally, the USPTO could re-adopt an apprentice model. Under this approach, an individual who spends a certain number of years of practicing the routine tasks of patent prosecution under the guidance of a registered patent practitioner, could be eligible for the patent bar exam, regardless of their educational background.

This model would not be new to the USPTO. From 1922 to 1934, applicants for the patent bar demonstrated their eligibility by an apprenticeship model, alone (i.e., there was no patent bar exam).[96] This procedure was replaced in 1934 with the registration exam.[97] Moreover, at least for a time around 1990, the USPTO allowed individuals to become eligible for the registration exam after having "a long apprenticeship under a registered patent attorney."[98] During that time, the apprenticeship was provided as a fourth option, in addition to what resembles today's Category A, Category B, and Category C.[99]

In 2004, when the USPTO transitioned from paper to digital examinations for admission to the patent bar, it sought comments prior to enacting its proposed rule.[100] One comment suggested the requirement of an apprenticeship prior to being admitted to take the examination.[101] Reflecting upon

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[91] *See* ABET, *supra* note 76; U.S. NEWS, supra note 77.
[92] *See* GRB 2020, *supra* note 3, at 4.
[93] *See supra* note 74.
[94] *Id.*
[95] *See* GRB 2020, *supra* note 3, at 1.
[96] Changes to Representation of Others Before the United States Patent and Trademark Office, 1283 OFF. GAZ. PAT. OFFICE (Nov. 16, 2004) at cmt. 33 [hereinafter, "Changes Before USPTO"].
[97] *Id.*; *See* Port et al., *supra* note 11.
[98] *Premsler v. Lehman*, 71 F.3d 387, 388-89 (Fed. Cir. 1995).
[99] *Id.* at 388.
[100] Changes to Representations of Others Before the USPTO, 68 Fed. Reg. 69,442 (Dec. 12, 2003) (to be codified at 37 C.F.R. pts. 1, 2, 10, & 11).
[101] Changes Before USPTO, *see supra* note 96.

records of the USPTO Commissioner from 1933 (*i.e.*, immediately prior to the introduction of the written examination), the USPTO asserted that regulation of the apprenticeship model was "was administratively difficult due, in part, to the lack of any objective standards."[102] The response noted the "voluminous" influx of requests from individual applicants that were neither reliable nor satisfactory.[103] Specifically, the USPTO cited the 1933 Commissioner's recollection of a particular applicant's evidence of prosecution experience that was "perfunctory" and "certainly not sufficient."[104] Providing no specific reasons and failing to acknowledge the 1990 adoption of an apprenticeship model, the USPTO stated in its 2004 response that "[i]t would be difficult to avoid the weaknesses in the apprenticeship system employed prior to 1934 if the Office were to adopt the proposed apprenticeship or work system, even when coupled with the registration examination."[105]

The USPTO's response to this comment is remiss in failing to consider the significant advances in administrative recordkeeping and technology since 1934. In this regard, the USPTO could easily implement administrative protocol to track a potential applicant's progress in her apprenticeship. For example, it could require that an interested applicant register with the USPTO upon starting her apprenticeship, providing the name of the patent attorney and/or law firm with whom she will work. It could also require that the apprenticeship last a certain amount of time (*e.g.*, three to five years) and set intermediate checkpoints at which the applicant must demonstrate a certain level of objective experience. This model would not be so different than apprentice-type models adopted by several state bars, such as California, which requires that legal apprentices pass and submit monthly and biannual progress reports to the state bar.[106] It would also not be so different from the recent, albeit likely temporary, adoption of "diploma privilege" by many state bars in response to the COVID-19 pandemic.[107]

Adoption of an apprenticeship model would increase diversity within the practice of patent prosecution, including gender diversity. Presently, many reputable patent law firms of all sizes hire unregistered technicians (e.g., Technical Specialists, Technical Advisors, Patent Engineers, etc.) to assist in the preparation and prosecution of applications.[108] The tasks these technicians perform are generally no different than those assigned to registered patent agents or junior patent attorneys, with the exception of independently signing and filing papers, and communicating directly with the USPTO.[109] Nevertheless, under the current landscape, law firms tend to condition employment in these positions as "patent bar eligible," in order to onboard talent that can be retained and cultivated within the firm long-term. If the USPTO were to adopt an apprenticeship model, however, law firms would no longer be constrained to applicants who are necessarily "patent bar eligible" under the current requirements. As a result, the applicant pool for positions at IP firms would be more diverse, providing firms with greater opportunities to overcome issues in the pipeline of qualified and diverse candidates, as well as the flexibility to seek those candidates that are the best fits for the culture of the particular firm.

Furthermore, an apprenticeship model would provide a fiscal advantage to law firms, allowing them to dedicate more resources and training to its apprentices. As noted above, the tasks (other than signing and filing papers) that are typically assigned to technical specialists, are generally no different

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[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] *Id.*
[106] Corey Adwar, *How to Become a Lawyer Without a Law Degree*, SLATE (Aug. 2, 2014), https://slate.com/business/2014/08/states-that-allow-bar-exams- without-law-degrees-require-apprenticeships-instead-of-law-school.html (explaining that Maine, New York, Vermont, Virginia, Washington, and Wyoming also include paths to practicing law via an apprenticeship).
[107] *See generally* Valerie Strauss, *Why this pandemic is a good time to stop forcing prospective lawyers to take bar exams*, THE WASH. POST (July 13, 2020), https://www.washingtonpost.com/ education/2020/07/13/why-this-pandemic-is-good-time-stop-forcing-prospective-lawyers-take-bar-exams/.
[108] *See, e.g.*, *Technical Specialists*, FINNEGAN, https://www.finnegan.com/en/careers/roles/technical-specialists.html ; *see also* AIPLA, *supra* note 59 at 75.
[109] Vid Mohan-Ram, *Working in Intellectual Property Law Without a Law Degree*, SCI. (Oct. 5, 2001, 8:00 AM), https://www.sciencemag.org/careers/2001/10/working-intellectual-property-law-without-law-degree.

than those that are assigned to registered patent agents or junior patent attorneys at the same firms. Yet patent agents and patent attorneys often come at a higher price to law firms when it comes to salary.[110] Thus, an untrained patent agent will typically cost a firm more than a technical specialist apprentice, while both would require the same investment of training and resources before realizing any profit for the firm. While the higher salaries of untrained patent agents may be recouped, in part, with higher billing rates, it is unlikely that these billing rates will be fully realized until after several years of training, particularly in view of the steep learning curve of the practice.

Of course, even if such an apprenticeship model is adopted, there would undoubtedly be many law firms that still condition employment on their own technical and educational standards, which could potentially be more stringent than the USPTO's current requirements depending on the needs of the firm. Nevertheless, it is likely that many IP firms would welcome such a change, as there would be little impact on their current training regimens, and they would be able to bolster their business by bringing in a more diverse population of young professionals.

IV. Impacts on the Patent System

It goes unsaid that the reason for the USPTO's adherence to stringent scientific and technical requirements is to maintain a high level of patent quality within the United States. That is, the USPTO appears to believe that, in order to effectuate its statutory authority to "render [patent applicants] valuable service, advice, and assistance in the presentation or prosecution of their patent applications or other business before the [USPTO]," it must require a specific level of scientific and technical expertise from its registered practitioners.[111] Thus, it appears the USPTO believes there is a direct correlation between the scientific knowledge of practitioners, as evidenced by the Category A, B, and C requirements, and the quality of the patent process. Accordingly, it is necessary to consider the impact that the three proposed solutions, identified above, would have on patent quality within the United States.

It is further necessary to consider and evaluate the overall tangential benefits that would result by relaxing the scientific and technical requirements in accordance with the proposed solutions.

A. Impacts on Patent Quality

None of the proposed modifications would significantly affect patent quality. The term "patent quality" is inherently subjective and can have any number of meanings to any particular individual. In evaluating patent quality, the USPTO looks to seven factors.[112] These factors are generally based on (1) the quality of the USPTO's responses to a patent applicant arguments; (2) the quality of the patent applicant's actions taken during prosecution; (3) the perceived quality of the overall patent process (as measured through external quality surveys of patent applications an practitioners); (4) the quality of an examiner's "prior art" search; (5) the degree to which the examiner follows best examination practices; (6) the degree to which the global USPTO data is indicative of compact, yet robust, prosecution; and, (7) the perceived quality of the overall patent process (as measured through internal quality surveys of patent examiners).[113]

Other definitions for "patent quality" exist, for example, by the Organization for Economic Co-operation and Development (OECD), which provides:

> The patent quality index is a composite indicator based on size dimensions of patents' underlying quality: forward citations (number of citations a patent receives); backward citations (number of patents and

[110] *Id.*
[111] 35 U.S.C. § 2(b)(2)(D); *see also* GRB 2020, *supra* note 3, at 1.
[112] *Adoption of Metrics for the Enhancement of Patent Quality Fiscal Year 2011*, U.S. PATENT & TRADEMARK OFFICE, https://www.uspto.gov/sites/default/files/patents/init_events/ qual_comp_metric.pdf.
[113] *Id.*

> scientific papers a patent cites); patent family size, *i.e.*, the number of countries in which the patent is taken; number of claims; generality index, measuring the dispersion of citing patents over technology classes; and grant lag. The index does not use weights.[114]

A 2016 study found that, according to the OECD's definition, the United States, having much more stringent requirements for patent bar membership, had negligible improvements in patent quality, particularly as compared to countries such as Canada and Japan, which are the two developed countries with the least rigorous requirements for entry into the patent bar.[115]

As a comparison, to become a registered patent practitioner in Canada, an individual must take a patent exam, much like the United States.[116] In order to qualify for that exam, the individual must (1) be a resident of Canada and must have been employed for at least two years as an examiner in the Canadian patent office; (2) have worked in Canada in the area of Canadian patent law and practice for at least two years; or (3) have worked in a patent law and practice, including preparation and prosecution of applications for at least two years as a registered patent agent in good standing.[117] No demonstration of technical or scientific expertise is required. However, it is worth noting that even absent technical requirements, the global pass rate of Canada's exam in 2019 was a mere 38% (based on a total of 128 candidates).[118]

Similarly, in Japan, a technical degree is not required to become a patent practitioner.[119] Like Canada and the United States, Japan has an examination, which includes multiple-choice questions, essays, and an oral examination.[120] An individual must pass each portion of the exam before moving on to the next, and the exam tests for skills on the laws and regulations relating to patents, utility models, designs, and trademarks; treaties on industrial property rights; and the laws and regulations of being a patent attorney.[121]

Based on these eligibility standards, the authors of the aforementioned 2016 study presumed that, if having a technical degree had a direct correlation to patent quality, each of Japan and Canada would demonstrate an overall lower patent quality than the United States.[122] However, by applying the OECD definition of patent quality, the authors found "no significant difference in patent quality between the countries of the United States, the United Kingdom, Japan, France, Canada and Germany, even though these countries have very disparate standards regarding admission to the patent bar."[123] Although the OECD metrics depend more on the quality of the patented technology itself, as opposed to the quality of the drafting and prosecution of that patent, it remains difficult to envisage, particularly in view of these data, that the solutions proposed above having meaningful negative impacts on patent quality, even when considering more qualitative and/or subjective definitions of "patent quality."

Rather, amending the eligibility requirements to be more inclusive–through any one or more of the solutions proposed herein–would necessarily promote more inventor involvement in the patent prosecution process. In the current patent system, patent practitioners already must collaborate with

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[114] OECD, OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD 2011: INNOVATION AND GROWTH IN KNOWLEDGE ECONOMIES 190 (2011).
[115] Kenneth L. Port et al., *In Pursuit of Patent Quality (And Reflection of Reification)*, 20 MARQ. INTELL. PROP. L. REV. 79, 113 (2016). That is, as compared to the United States, the UK, France and Germany, each of Japan and Canada have the lowest bar to entry, as no technical degree is required.
[116] *Id.* at 97.
[117] *Id.* Moreover, the Canadian exam "consists of four papers written over four days on patent drafting, patent validity, patent office practice, and patent infringement."
[118] *Patent Agent Qualifying Examination – 2019 Report*, CIPO (Nov. 2019), https://www.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/eng/h_wr04695.html.
[119] *See* Port et al., *supra* note 115, at 95.
[120] *Id.*
[121] *Id.*
[122] *Id.* at 98–99.
[123] *Id.* at 113.

inventors on the drafting and prosecution process, as the practitioner is a mere "learned hand" trained in the intricate details and nuances of patent law. Being a successful and reliable patent practitioner is not predicated on being an expert in the subject-area in which the patent application lies. Because it is the invention of the *inventor*, the patent practitioner must work closely with the inventor to ensure accurate description and scope of the application.

While having a scientific education is undoubtedly useful, it is not necessary, as inventors are very often readily available and eager to educate and train the practitioner on their innovation. Relaxing the scientific and technical requirements for patent bar eligibility would encourage this collaborative relationship between the patent practitioner and the inventor, as the patent practitioner may not have the same level of technical expertise as the inventor. Although an argument could be made that increased collaboration would increase costs of the preparation and prosecution of patent applications–which could disparately impact female patent practitioners–this cost does not render these solutions impractical. For example, alternative fee arrangements are available (e.g., fixed-fees, etc.) that could help recoup costs for both the busy inventor (who has several inventions of interest), as well as the practitioner. Alternatively, even if increased prosecution costs proved impossible to overcome as a result of increased inventor-practitioner collaboration, these increased costs could even *enhance* patent quality, as clients and inventors would ultimately only seek protection for their most valuable inventions, leaving overworked patent practitioners with the capacity to focus on clear and effective prosecution strategies.

Regardless of cost considerations, increased practitioner-inventor collaboration would necessarily *increase* patent quality, as the inventor would have greater oversight and involvement in the patent process, thereby ensuring the accuracy of the application and written description, as well as of the practitioner's arguments made during prosecution. Ultimately, by improving transparency and collaboration in the practitioner-inventor relationship, more women inventors, after engaging with patent practitioners more closely, may be led to consider new, alternative careers in patent law.

B. Tangential Impacts on Patent System and Advocacy

Other than having little, if any, negative impact on patent quality, increasing the diversity of the patent bar will have significant tangential benefits on the patent system. In particular, diverse inventors would substantively benefit from access to diverse patent practitioners. Increasing the number of women patent practitioners would allow more women to envision themselves as a valuable piece of the patent system puzzle, resulting in more female inventors pursuing their ideas through patent protection and/or more female STEM students recognizing patent law as a viable and lucrative alternative career path at an early stage of their education.[124]

Specifically, women inventors would directly benefit from having access to women practitioners, who have both the substantive expertise and qualitative experiences to more effectively communicate with these women as compared to their male peers. Research shows that women in the workplace are perceived by their managers to be more effective in all functional areas across an organization, particularly as compared to their male counterparts.[125] In particular, women excel in taking initiative, acting with resilience, practicing self-development, driving for results, and displaying high integrity and honesty–all invaluable skills in the practice of patent law and patent prosecution.[126] "When given those opportunities, women are just as likely to succeed in higher level positions as men."[127] The increased effectiveness in inventor-practitioner communications would allow women inventors to feel more

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[124] *See* Eric Goldman & Jess Miers, *Boosting Patentee Diversity By Relaxing the Technical Barriers to Patent Bar Membership* (June 30, 2019), https://www.uspto.gov/sites/default/files/documents/SUCCESSAct-Goldman-etal.pdf (Comments regarding the SUCCESS Act (Docket No. PTO–C–2019–0010) to the U.S. Patent & Trademark Office (USPTO) on behalf of 22 signatories).
[125] Jack Zenger & Joseph Folkman, *Research: Women Score Higher Than Men in Most Leadership Skills*, HARV. BUS. REV. (June 25, 2019), https://hbr.org/2019/06/research-women-score-higher-than-men-in-most-leadership-skills.
[126] *Id.*
[127] *Id.*

comfortable seeking patent counsel, knowing there are ample qualified women who can help them succeed with their ideas.

On April 6, 2000, inventor Sara T. Blakely filed her patent application, for what would eventually lead her to, at the time, becoming the youngest self-made female billionaire.[128] Blakely did not have a STEM education and forewent a legal career after her poor performance on the Law School Admission Test (LSAT).[129] But Blakely had an idea for an invention, and decided to seek patent protection. She began searching for a patent attorney in Georgia:

> Well, of course, I wanted a woman, I thought it would be much easier to explain my idea, and I couldn't find one. So, I called the Georgia Chamber of Commerce, and I asked for a recommendation of a female patent attorney, and the Chamber of Commerce actually said there's not a single female patent attorney right now in the whole state of Georgia.[130]

Blakely ultimately filed her patent *pro se*, and after just over a year of prosecution, her patent on SPANX® was issued.[131]

Increasing the number of women patent practitioners would blaze a trail for women inventors, like Blakely, to envision themselves within the patent system and to pursue protection for their ideas. Women patent practitioners can leverage their access to vast professional and personal networks to cultivate the ideas of female inventors. It is worth noting that not all patent-worthy inventions arise from discoveries within the STEM workplace.[132] While it is true that many do, assuming that STEM is the only source of valuable and meaningful inventions detrimentally overlooks those, like Blakely's, that could improve everyday life, particularly the everyday lives of women.

Women have unique skills sets of communication, initiative, resilience, integrity and grit that would help develop and enhance the practice of patent law within the United States, and would bring diversity to the current pool of inventors. However, they are unnecessarily excluded as the result of an archaic and rigid eligibility system. It is past time for the USPTO to take an active role in acknowledging the institutionally perpetuated bias against women manifested in its arbitrary scientific and technical requirements, and use its discretion to give women more opportunities to participate in patent prosecution. Such actions will only benefit the USPTO, the members of its patent bar, and women, by fostering, cultivating, and progressing inclusion and innovation within the U.S. patent system.

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[128] U.S. Patent No. 6,276,176 B1 (issued Aug. 21, 2001); Antonia Farzan, *The fabulous life of Spanx billionaire Sara Blakely*, Bus. Insider (May 21, 2015), https://www.businessinsider.com/the-fabulous-life-of-spanx-billionaire-sara-blakely-2015-5.

[129] Debra Cassens Weiss, *Billionaire Spanx Inventor Gave Up Idea of Law School After Doing Poorly on LSAT*, ABA J. (Mar. 8, 2012), https://www.abajournal.com/news/article/billionaire_spanx_inventor_gave_up_idea_of_law_school_after_doing_poorly_on.

[130] Sara T. Blakely, CEO Spanx, Inc., Keynote Address at the Inc. Women's Summit: How Spanx Got Started (Dec. 1, 2011).

[131] *Id.*; U.S. Patent No. 6,276,176 B1, *supra* note 128.

[132] *See, e.g.*, Blakely, *supra* note 130. Blakely's idea arose after buying a pair of cream pants with money she had saved from her job selling fax machines door-to-door. She was unhappy with the traditional shapers that were available, since they were "thick and left lines or bulges on the thigh." On a whim, Blakely cut the feet off of her control top pantyhose and wore the pants to a party. "I looked I looked fabulous, I felt great, I had no panty lines, I looked thinner and smoother . . . And I remember thinking, 'This should exist for women.'"