An Internet Delivered Course: Intellectual Property Law For Engineers And Scientists

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Abstract - **Practically every engineering and science student will someday come face to face with the intellectual property laws that grant exclusive rights in inventions and creative works. However, the engineering and science school curriculums in a majority of our technology education institutions are conspicuously void of courses directed to this important subject. To address this situation, an internet based course titled "Intellectual Property Law for Engineers" has been created and presented for several years at the College of Engineering at the University of Illinois at Chicago. The substantive material of the course can be properly presented by a series of internet audio lectures that maintain the interest of the students. Student questions and comments are handled by e-mail and synchronous chat room sessions are available with all students participating.**

Index Terms *- Distance learning, Intellectual Property Law for Engineers and Scientists, Internet delivery of course materials, Patents, copyrights and trade secrets.*

INTRODUCTION

Invention, creativity and innovation have always been synonymous with advances in engineering, science, and technology [1]. Today, every industrialized nation of the world has adopted an intellectual property protection system that provides exclusive rights to inventors and creators for a limited term as a quid pro quo for the public disclosure of inventions and creations. As a result, a unique development made anywhere can be protected globally.

As technology itself has become more pervasive and more complex over the centuries, so have the laws governing the exclusive rights granted to inventors and creators become more complex and less comprehensible. Today, those in the engineering, science and technology communities can fully expect at several times in their careers to come face to face with the laws of intellectual property. For this reason, there is a need today to provide a comprehensive course covering intellectual property rights in understandable, non-legal jargon to engineers and scientists at undergraduate, masters and doctorate levels. The purpose of this paper is to present for your consideration how a course on intellectual property rights can be readily adopted for inclusion in existing engineering, science and creative process curricula at all levels.

WHAT IS INTELLECTUAL PROPERTY?

Once an invention or other creative work is completed, the inventor or creator has, of course, the right of ownership of the invention, writing, song, software, sculpture, etc. that the inventor or creator has developed. However, to promote science and the useful arts, the law has created certain rights enabling the inventor and creator to obtain exclusive control over the use and duplication of the invention or creative work thus completed [2]. These laws, dating back to the late 1400's, encourage invention and creation within the realm enacting such laws. In the beginning, exclusive rights were also granted to one who brought a new technology into the realm, even though that technology was imported from some other region [3]. Today, the world's intellectual property laws reward only the inventors and creators of new technology and artistic works, and do not reward those who import old technologies into a new country. Thus, the one obtaining protection must be the inventor or the creator of the particular technology or creative work for which such protection is sought [4]. The inventor or creator also has the right to endow others, such as an employer, with the exclusive right to exploit the invention and/or creation.

Most of the vehicles for intellectual property protection are generally known to those in the engineering, science and technology community. The most well-known, of course, is the patent, which protects any new and non-obvious machine, article of manufacture, composition of matter, process, or any improvement thereof, that has been created by man or woman. To be patentable, the invention must also be useful, and fall within one of the categories of patentable subject matter. Abstract ideas and concepts do not fall within the category of patentable subject matter, for example [5].

Copyright is another vehicle of intellectual property protection that has lately impacted the engineering and scientific community, since software can be protected either under the copyright laws or the patent laws. The copyright laws protect any work of copyrightable subject matter, such as software, books, music, lyrics, television shows, blue prints, architectural drawings and the structures prepared from those drawings, and the expression of many other artistic and creative endeavors [6].

In addition, where a certain process or material can be maintained in secret, such as a chemical formula or the program embedded in software, trade secrets may be the best

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vehicle for maintaining exclusivity over that particular work. Of course, trade secret protection will not be viable with regard to any machine, apparatus or device where the subject matter of the invention is immediately apparent upon a showing of the device embodying the innovation. For example, merely looking at a semiconductor chip does not reveal the program embedded in the chip.

Also, certain protection is afforded under the trademark and unfair competition laws, which protect any symbol, name or other indicia used to identify a producer or seller as the source of a product or service. This would include names of products, logos, package designs and shapes, and any other indicia that the offeror of a product or service uses to distinguish their goods from those of someone else.

Recently, mask works applied to semiconductor materials became protectable under the United States Copyright Laws. Such protection gives the creator of the mask work the exclusive right to apply the mask work to semiconductors, and to allow others to do the same [8].

THE AWARENESS OF INTELLECTUAL PROPERTY RIGHTS

Over the last few years, intellectual property has bubbled to the surface of public awareness. Many of the news items that are brought to the attention of the American public on the front pages of newspapers today relate to problems, and solutions, that have their origin in the intellectual property laws.

Many countries that presently face a severe AIDS epidemic have begun treating their AIDS patients with a series of pharmaceutical AIDS "cocktails" made of a combination of several patented drug products. Some governments have gone around the patent laws, and obtained less expensive drug cocktails from non-licensed manufacturing sources.

The copyright laws provide a composer of music, and the company that records that music on a tangible medium (disc), control over the reproduction, distribution and performance of that composition. The recording industry has recently begun filing lawsuits against 500 or so people at a time, including senior citizens and teenagers, and obtaining injunctions against them and promises from them not to illegally download music again.

The issues discussed above, and many others, open the intellectual property debate to not only (1) what the existing intellectual property ground rules are, but also (2) what they should or should not be. For the purposes of this discussion, the questions of what should or should not be protected by the intellectual property laws I shall leave for another forum, and direct my present comments to:

1. The importance of offering intellectual property instruction to students in the engineering, science and technology disciplines;
2. A brief summarization of the subject matter that should be imparted to engineering, science and technology students;
3. A proposed pedagogical approach to imparting intellectual property principles to engineering, science and technology students;
4. How this pedagogical approach has been implemented successfully in the College of Engineering at a major university; and
5. The results of and student reactions to this course of study.

WHY TEACH INTELLECTUAL PROPERTY RIGHTS TO ENGINEERING AND SCIENCE STUDENTS

It is quite clear that over the course of recorded history, much of the innovation that has driven the world forward has come from those who have technology, engineering and/or creative studies as a significant part of their curriculum vitae, and have participated in the academic and pedagogical regimens of these disciplines. The intellectual property laws will ultimately be used by these individuals to benefit from the exclusive use of the technology they develop.

In my view, it is imperative that instruction in intellectual property subject matter be available to those students who will most likely be exposed to the rules governing the protection and use of their creative and innovative efforts. The engineers and scientists who emerge from our educational institutions and proceed to invent, create, develop and manage technology and other creative works throughout their lifetime should have a background in those laws that relate to novel, unobvious and original creations that propel technology and science ahead.

Presently offered courses do not provide the in depth educational substance or time sufficient to cover the broad spectrum of intellectual property laws to which the students will be exposed during their careers. Also, this author has not previously seen any text directed to the issues of intellectual property for consumption by students in an engineering and scientific curriculum. As a result, most students who graduate with degrees in engineering and science have no background as to how the laws of intellectual property work, nor a proper reference source of such information.

As a general statement, it may be said that each time I have contacted an inventor, or a creator of a copyrightable work, for the purpose of advising them on the protection of their inventions or creative works, it appears that I am explaining the intellectual property laws and concepts from ground zero. This is unfortunate, because an inventor can disclose his invention to the public prematurely, thus destroying his/her ability to obtain intellectual property rights under the patent laws. As an example, an inventor attempting to obtain patent protection on an invention that he/she has been using, or that has been exposed to the public over the last thirteen months, has lost any right to obtain protection, and has in effect dedicated his/her invention to the public [9]. Had this inventor been educated to seek protection for his/her invention under the intellectual property laws prior to making a public disclosure, his/her options on protecting and controlling the dissemination of the invention would have been retained.

Also, with the development of software today being, in some instances, the result of modifications to existing software, the software developer must know the limits of their free use of prior materials in their newly developed software, particularly under the copyright laws. The "open source" debate continues to rage regarding the policy of the copyright law, however under today's law, copying certain features of a previous program constitutes infringement of the copyright law, possibly leading to injunctions and fines.

Many of today's engineering students will also be at the forefront of managing the innovations that will benefit the welfare of the human race in coming years. Among such managerial tasks will be those that you have most knowledge of: the institutional research and development grants that are the mainstay of many research colleges and universities. The management of these grants usually requires oversight over inventions developed using grant resources, and the patenting of, and otherwise protecting, the innovations according to the provisions of the grants. The managerial skills necessary to properly carry these grant projects to fruition will require knowledge of the patent and intellectual property provisions to which those working under the grant resources will necessarily have to adhere. In addition, many institutions now provide facilities for incubator projects upon which new start up companies rely. Management of innovative developments resulting from such incubator projects will also require the knowledge of the intellectual property laws to provide optimum benefit to both the organization taking advantage of the incubator facilities and the academic institution [10].

Engineering and science students, whether they become entrepreneurs, or work in industrial, government or academic environments, should be aware of the freedom they have to use the proprietary or patented or copyrighted products or processes of others in their development and research efforts, and also how to best protect the innovations and creative efforts that result from their own work.

THE CONTENT OF A COURSE ON INTELLECTUAL PROPERTY RIGHTS

Working in conjunction with the College of Engineering at the University of Illinois at Chicago, we have developed intellectual property law course material that we recommend be offered to engineering and science students. The suggested content includes the following:

1. An overview of intellectual property law, defining terms, identifying the several intellectual property vehicles, and discussing when each should be used.
2. The strategic use of intellectual property by entrepreneurs and business organizations.
3. How to obtain important information from a modern U.S. patent document.
4. The historical foundation of the Intellectual Property Laws.
5. The categories of patentable subject matter.
6. The requirement that an invention must be novel to be patented, and the time limits for filing a patent application.
7. The requirement of non-obviousness.
8. The patenting process, including who may obtain a patent.
9. The different types of searches of prior art that can be conducted.
10. The content, and inventor's review, of a properly prepared patent application.
11. "Claims" that define the invention to be protected by a patent.
12. The examination procedure of a patent application before the United States Patent and Trademark Office (USPTO).
13. Design patents, and how they can be effectively used.
14. The patenting of computer-related software programs.
15. The patenting of biotechnology inventions.
16. Patent protection for methods of doing business.
17. How to obtain global patent protection for your invention, at minimum expenditure of costs and resources.
18. The enforcement of the patent right, including how to avoid infringing someone else's patent.
19. Patent assignments and licenses.
20. Employment contract provisions that relate to intellectual property.
21. The engineer and scientist as an expert witness, and professional ethics.
22. Copyrights, including copyright registration for computer programs, automated databases and online works.
23. The Digital Millennium Copyright Act, which prevents the circumvention of technological protection measures, such as anti-copying programs embedded in CD's and DVD's.
24. Trade secrets, including steps to be taken to prevent theft of trade secrets. Also covered are confidential disclosures as a means of protecting ones intellectual property.
25. Trademarks within the context of technological development.

Depending upon the length of the semester, and the number of times per week the course is presented, the course material listed above can be tailored to fit the students' time requirements. In our course presented to the engineering students at the University of Illinois at Chicago, certain of the above subjects are omitted. However, the text that is now available for the course does include sufficient detail on each of the above subjects to be added to the course material as desired [11].

A PROPOSED PEDAGOGICAL APPROACH TO IMPARTING INTELLECTUAL PROPERTY RIGHTS PRINCIPLES TO ENGINEERING AND SCIENCE STUDENTS OVER THE INTERNET

A. How an Internet Delivered Course Can Work

Internet education allows the educator to instantly communicate and exchange information with anyone in the world at any time. Students are accepted into the course from

worldwide locations, and the course delivery system increases student access to advanced learning sources and opportunities. Instructional materials are available 24 hours a day, and can be accessed repeatedly by a student. Learning is self-regulated, requiring more discipline from the student because the student decides the pace at which he/she will access the lectures and complete the assignments. By requiring weekly submittal of homework assignments, the instructor maintains a degree of control over the student's pace, and provides the student with somewhat instant feedback.

Distance learning provides educational opportunities to those in remote geographical areas, those who have work or family obligations that prohibit attendance at a traditional learning environment or institution, or cannot pursue an education due to a disability. The students have the ability to decide when to log on to the course material, eliminating conflict with their schedules. Thus, our program is valuable to people with limited access to educational institutions, and also to students with limited financial resources. Also, instructional material can be shared among different educators and academic institutions. Once established in an electronic format, the course material is easy to modify and keep up to date.

At the University of Illinois at Chicago, we use the Blackboard Version 6 program as the platform for our internet courses. Course material is delivered to the students via audio, text and slides. The slides provide the key points of each lecture, and an audio file projecting the voice of the instructor is streamed from the UIC server and is associated with each slide. Hyperlinks are provided to direct the student to replay the material, such as a video presentation of Hollywood's version of a patent infringement lawsuit. The syllabus of the course is posted for easy access by the students.

The initial step in course development was to prepare 16 lectures on selected subjects of Intellectual Property Law. Each of these lectures was scripted, and a series of Power Point slides was simultaneously prepared to accompany the lecture material. Each lecture was uploaded into the audio system server of the Blackboard program, and the Power Point slides were timed to be displayed at the corresponding place in the lecture. Besides the lecture material, various adlibs and attempts at poor humor were also infused into the oral presentation.

The instructor prepared electronic textbook material in HTML, which provides the core reference material for the course. There is no need for the instructor or student to learn HTML, since the text-editor translates to HTML. HTML is accessed by a web browser, and the electronic textbook can be updated and republished immediately. Hyperlinks allow the student to be transported to additional course materials, such as added references, bookmark pages or a further audio explanation.

A streaming file distribution system is utilized, where the media file is kept in a central server and is played before it is completely received. The local computer used by the student does not keep a copy of the media file; it just plays the material. This enhances the security of the educational materials. The University of Illinois at Chicago uses dedicated servers and personnel to monitor and deliver course materials reliably over the web. The efforts of the existing University computer center helps to keep the cost of delivering the course at a minimum by offering all of the necessary hardware, software, input devices and server resources free of charge. Using the Blackboard courseinfo software, registered tuition-paying students can log in, see all the classes in which they are enrolled, gain access to the lecture materials and the associated assignments, communicate with the instructor and/or other students, and check the progress of their grades. All lectures are in downloadable format, which is convenient for those students who desire to take their own notes while listening to the instructor. The students cannot gain access to the program unless they obtain a password from the school, upon payment of the appropriate tuition.

The course information program includes a management tool for organization of the lecture material, communications with the students, and calculating and displaying grades. At the end of each lecture, an assignment consisting of three or four questions is posted for access by the students. Each student is required to respond to these assignment questions by posting their answers into a "digital dropbox" in the Blackboard program, and the assignment answers are then printed by the instructor. The instructor grades the papers, and adds comments where necessary. The graded and marked-up papers are then either transmitted to the students by fax or handout, or the comments are placed back onto the digital format of the assignment answer and transferred back to the student over the internet. Either of these methods are appropriate, depending upon the number of students in the class, and the workload of the instructor.

It has been our experience that most students print the lecture for each week, and use the printed lecture material to follow the audio portion presented by the instructor before answering the assignment questions. Most of the assignment questions are of the Socratic or essay type, where the absolute answer is less important then the analytical process used by the student to reach the answer. This is a learning process that is somewhat new and challenging to engineering students. However, as will be discussed below, our students have shown enthusiasm in adapting to this "different" pedagogical approach.

In accordance with school policy, the midterm and final exams are all proctored, even as to those students who reside away from the campus. The exams of distant students are faxed and/or mailed to the student after grading. Grades of all assignments are entered into the Blackboard program, which automatically calculates the student's real time grade. The program can be adjusted to provide varying weighted values to exams and homework assignments. Multiple choice assignments and exams are not used.

B. A Course on Intellectual Property Rights is Fully Suitable to Delivery Over the Internet

The class materials prepared for our course on intellectual property were specifically designed for internet delivery. We have discovered that approximately 6 to 8 months lead time is required to set up the course. The key factor in the success of an online course is the time and effort the instructor dedicates to making the students participation a remarkable experience, such that the students find the course interesting and motivating. We have found that the subject of intellectual property law offered to engineering students can be delivered in both an interesting and a motivating way.

The content of our intellectual property law course, without the legal jargon, is particularly suitable for delivery and presentation to students over the internet in an asynchronous environment. Student's questions are answered by the use of e-mails that pass between each student and the instructor. I find myself continually communicating with my students regarding their perception of the concepts of intellectual property rights that are presented in the course.

The feedback from our students has been rather positive, and they have told me that they have had no difficulty understanding the material as it is delivered to them over the internet. Student feedback also showed strong agreement that it was convenient to have universal access to course material via the web. They noted the ability of taking a lecture at any time or place they desired. They also appreciated having one homework assignment/quiz for each lecture, and help sessions available before each examination. Students remarked that they found that the intellectual property course was enjoyable as a refreshing break from the theoretical grind of calculations usual to engineering education.

UIC's course development experience has proven that when properly prepared and presented, the subject of intellectual property rights can be effectively delivered to engineering and science students over the internet, using a delivery style that maintains positive student interest.

THE ADVANTAGES OF A) OFFERING A COURSE ON INTELLECTUAL PROPERTY RIGHTS, B) TO ENGINEERING AND SCIENCE STUDENTS, C) OVER THE INTERNET

For the past seventeen years, I have been an Adjunct Professor of Intellectual Property Law at the John Marshall Law School in Chicago, Illinois. My course is taught directly, face-to-face to my students at the law school. Like other adjunct professors at our school, I enjoy the face-to-face teaching experience. Therefore, I was initially reluctant to begin teaching a course at the College of Engineering at UIC over the internet for fear that such a teaching modality would not provide the interest that a part-time instructor gains from the classroom experience. However, once I became immersed in the internet delivery process, it appeared to me that there are two primary advantages of this educational system. The first is that students who work full-time jobs, and reside far from the college campus, can still gain a degree through enrollment in the Masters of Engineering program offered by UIC, totally over the internet, of which my two courses, Engineering Law and Intellectual Property Law for Engineers are a part. I have had students taking my courses while residing in Saudi Arabia, Hong Kong, California, Toronto and Halifax, Nova Scotia. One of my students who resided in suburban Chicago was transferred to the Florida facility of her company. She continued to take the course, and complete the course, although she moved to Florida in the middle of the semester. The change was seamless.

When it comes time for the proctored exams to be administered, our exams are electronically transmitted to a university or other facility near the student, and the student takes the exam under the proctorship of a professor or supervisor, who is renumerated a small amount for his/her services. The exams are then faxed or mailed to me for grading.

A second major advantage in this day of decreasing resources available to institutions of higher education, is the fact that the school can enroll and obtain tuition from a student who is nowhere near the college campus, and who otherwise could not be an enrollee of the school's programs. This past semester, four students in Hong Kong paid tuition to take our courses at the University of Illinois located in Chicago, Illinois. This alone is one of the mind boggling features of a combination of the internet and the educational experience. Thus, the delivery of a properly thought out intellectual property course and other courses via the internet provides students who cannot physically come to the university facility with the opportunity to take courses and earn a degree that would otherwise be unobtainable.

We also perceive that a course in intellectual property rights will be sought by students in other university disciplines, such as business administration, medical and dental students among others. It is my perception that intellectual property today is a subject of interest to many across a wide spectrum. However, the subject still remains a mystery to all but the approximately 30,000 patent attorneys and agents who are currently practicing in the United States [12].

CONCLUSION

The results of, and the student reactions to our internet delivered course at the College of Engineering at UIC reflect an enthusiasm among the students as shown in the answers to their assignment questions and to their exams. While some students present just a perfunctory answer to a question just to furnish an answer, a vast majority of the students respond by presenting a thorough and analytical answer to each question, sometimes expressing their own personal views as a way of reaching their conclusion. This is the advantage of the Socratic method, where the right or wrong answer doesn't matter, but it is how the student reached their answer that is graded. I have personally noted that the majority of students energetically apply themselves to the subject matter, and find it interesting.

As a measure of the enthusiastic way in which our courses have been received, several of my students were encouraged to apply to law school to pursue careers as intellectual property attorneys. I have been asked to offer my recommendation for several of these students. Thus, it is my experience that by using course delivery technology over the internet that was not available even a few years ago, and tailoring the substantive course material to the modality of distance learning, both an interesting, effective and substantively rewarding course presentation of important material for engineering and science students can be achieved.

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