Evaluation of Intellectual Property Course Offerings for undergraduate engineering students in the Mid Atlantic Region

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Abstract

For more than half a century the United States has led the world in scientific discovery and innovation. However, in today's rapidly evolving competitive world, the United States can no longer take its supremacy for granted. The decline of the United States' share of intellectual property (IP) is one indication of its loss of competitiveness.

According to studies carried out by the National Science Foundation (NSF) in 2004, the United States is losing its dominance in the fields of science and innovation. In January 2008 the NSF again noticed the decline in US technological dominance. Because innovative ideas tend to be developed by younger engineers or scientists, an area that cries out is the improvement of undergraduate engineers who are currently illiterate in IP, in general, and of the role of IP in innovation, in particular.

Based on website surveys conducted for a previous paper, it was found that none of the top 10 schools of engineering (as rated by U.S. News) offered any mandatory or core courses in Intellectual Property in their undergraduate engineering curriculum. To further explore the reasons for this gap we surveyed the deans of engineering schools in the mid Atlantic region. The purpose of this survey was to explore if intellectual property is being given the required importance in the undergraduate engineering curriculum at engineering schools in the Mid Atlantic region. Conclusions from the survey findings of this research project will be compared with earlier findings obtained while evaluating the IP course offerings at the top engineering schools nationwide.

What is Intellectual Property?

The term "intellectual property" generically describes intangible property rights – which cannot be seen or touched – which are created by one's intellectual creative efforts (Rockman 2004). Intellectual efforts, in most cases, are granted patents or copyrights by governments which give their creator or owner the exclusive ability to control and profit from these.

Why is Intellectual Property important to our economy?

"Today, I.P. is the currency of our new economy," Forbes magazine noted (Raymond 2002). This is a relevant quote for today's business environment where knowledge is power. Nowhere is that more apparent than in today's information-driven, high technology economy. Fueled by the growing demand for new and improved technology, engineers, scientists and companies have a vested interest in protecting the wealth generated by their innovative ideas and inventions. Financial success depends upon whether inventions related to products, business ideas and services are protected by the various safeguards of intellectual property (Rockman 2004).

Commercially useful ideas, inventions, products and business services are the foundation of many highly successful businesses. As a result, successful business owners and entrepreneurs typically place a high value on the exclusive rights granted to intellectual property developed by their employees. The market value of many publicly traded hi-tech companies is largely dependent upon whether or not the company has been successful in obtaining and enforcing its patent rights.

Loss of U.S. Dominance in I.P.

The U.S.'s loss of its worldwide dominance in the sciences is evidenced by the decline in refereed scientific journal articles (Broad 2004). Refereed journal articles are leading indicators for patents and IP (Broad 2004). Less intellectual property developed translates into lower innovation which in turn reduces the value created by the economy. Less value being added to the economy results in slower growth which is bad for the nation overall. Thus, intellectual property creation can directly affect economic growth and the overall well being of the United States.

Patents are one of the areas of international competition. Americans still win large numbers of them, but the percentage is falling as foreigners, especially Asians, have become more active and in some fields have seized the innovation lead. The United States' share of its own industrial patents has fallen steadily over the decades and now stands at 52% (Broad 2004). Senator Tom Daschle, former Senate democratic leader, noted that America is standing at a pivotal moment and that America's dominant position in the scientific world is being shaken (Broad 2004). One reason for this is the globalization of research and development which exerts considerable pressure on the American system. The United States is not be able to prevent rivals from developing new technologies; The US can remain dominant only by continuing to innovate faster than everyone else. But this will not be easy; to keep its leading position in the world, the United States must get better at fostering technological entrepreneurship at home (Segal 2004). One part of a solution is to teach undergraduate engineers about I.P so as engineers in the work force they can better promote technological entrepreneurship. A more difficult test for the United States' future is whether or not it can maintain and improve the environment for innovation. This is a goal which can also be achieved by promoting intellectual property education for engineers who are the prime innovators in our society. As recently as January 2008, the National Science Board said that the United States' dominance in scientific and technological innovation is still being threatened by economic innovation particularly in Asia (Dean 2008). This shows that over the last half a decade or so, the situation has not changed and that foreign rival countries are fast catching up to the US in the field of technological innovation. This grim situation can be improved by teaching undergraduate engineers the value of IP and how to establish IP based on innovations that they develop.

Increasing need for intellectual property courses as part of the engineering curricula

Innovations tend to be developed by younger engineers and scientists. This insight is not lost on developing nations such as China and India who have significantly increased the number of engineers and scientists in recent years. During the same time engineering and science education in the US has slowed and actually declined. According to Purdue University president, Martin

Jischke (2006), the United States has tremendous potential to make progress in the fields of science and technology but the problem is that it is falling behind in production of graduates in these fields (Jischke 2006). He further goes on to say that if the current trend continues, by 2010, more than 90 percent of all scientists and engineers in the world will live in Asia (Jischke 2006).

Thus it is not surprising that the US is losing its historic preeminence in developing IP. Educating more US undergraduate engineering and science students is part of the solution to help increase innovation for engineers and scientists. The other part of the solution is to increase the awareness of the value of intellectual property at all levels of education, particularly at the undergraduate level.

Yet IP is generally not taught to undergraduate or graduate engineering students. Courses are more likely to be organized around broader issues of trade, development, or asset management with some analytical focus on the role of IP included as a module (Maskus 2005). Some professors who teach IP related courses do not themselves have extensive experience in IP and how it works. Furthermore, engineering programs do not offer much training in IP issues, referring would-be inventors to other disciplines for information.

A strong emphasis is given to IP courses at certain top MBA programs such as Duke University, Harvard Business School and MIT's Sloan School of Business; but at most engineering schools few, if any of the courses cover IP and IP is certainly not the primary focus of such courses. In sum, engineering departments tend to rely on other academic programs to provide training in IP, or even refer their scholars and graduate students to the university licensing offices (Maskus 2005). As a result, most graduating undergraduate engineers have little or no knowledge of IP which puts them at a disadvantage as they do not understand how much of a contribution their innovations can make to the overall US society.

State of IP Education in U.S. Undergraduate Engineering Programs

According to earlier studies done by Gandhi and Merino, it was shown that out of the top 9 US engineering schools (as ranked by US News) chosen nation wide, not a single department within the engineering schools offered a course to the undergraduates that was entirely dedicated to intellectual property (Gandhi and Merino 2008). The closest thing offered was a course on Technology Management, in which one of the topics discussed is management of intellectual property (Gandhi and Merino 2008).

The authors of this paper decided to further extend the earlier findings and compare them specifically with schools in the Mid Atlantic Region. The schools selected in the Mid Atlantic Region in no particular order of preference were:

Exhibit 1. Schools in the Mid Atlantic Region Selected for conducting the I.P. Survey

	Name of University surveyed
1.	Stevens Institute of Technology
2.	RPI
3.	Rowan

4.	Leheigh University

Survey Questions

The Deans of Engineering at the Selected Schools in the Mid Atlantic Region were sent out the following survey questions based on which we evaluated the situation of I.P in undergraduate engineering education in the Mid Atlantic Region.

Exhibit 2. Survey Questions Distributed to Engineering Schools in the Mid Atlantic

Question #	**Question sent to the Dean of Engineering so as to evaluate I.P. Presence in Undergraduate Engineering in the Mid Atlantic Region**
1	Do you consider a fundamental understanding of Intellectual Property (I.P) to be a necessary part of an undergraduate engineer's education curriculum? (Yes/No)
2	How important would you rate I.P to be as part of an undergraduate engineering curriculum? (1 – 5 scale)
3	Do you require your undergraduate engineering majors to take any courses in I.P.? (Yes/No)
3a	If Yes, How many courses are the undergraduate engineering students required to take in I.P? (Specify a number)
3b	If No, Do you plan on introducing any new I.P. courses at the undergraduate level for engineering majors? (Yes/No)
4	Do undergraduate engineering students receive some education in I.P.? (Yes/No)
4a	If Yes, how many hours of lecture do the students get in their program 1 – 2 hours 3 – 5 hours 6 – 8 hours

Results of Survey

The results of the survey that was distributed to the deans of engineering of the selected schools are shown in Exhibit 3

Exhibit 3. Results of the Survey Distributed to the Deans on Engineering

Question >> Surveyee V	**1**	**2**	**3**	**3a**	**3b**	**4**	**4a**
1	Yes	4	No	N.A.	No	Yes	3-5 hours
2	No	3	No	N.A.	No	Yes	1-2 hours
3	Yes	4	No	N.A.	Yes	Yes	3-5 hours
4	Yes	4	No	N.A.	No	Yes	3-5 hours

Analysis of Results

From the results collected from the survey, our analysis was as follows and is shown in Exhibit 4.

Exhibit 4. Analysis of the results

Question #	**Analysis for the question**
1	75% of the Deans of Engineering Surveyed said that they considered a fundamental understanding of IP to be a necessary part of an undergraduate engineer's education
2	75% of the Deans of Engineering surveyed said that they rated I.P to be an important part of the undergraduate engineering curriculum.
3	None of the schools surveyed required their undergraduate engineering majors to take any courses in I.P.
3a	Not Applicable because none of the schools had a required IP course.
3b	Only 25% of the schools surveyed said they planned on introducing any new I.P. courses at the undergraduate level for engineering majors.
4	All the schools said that their undergraduate engineering majors received a miniscule amount of I.P education.
4a	75% of the schools surveyed reported that their undergraduate engineering majors receive 3 – 5 hours of I.P education in their entire program.

Findings

As seen from Exhibit 4, it is evident that none of the schools chosen in the Mid Atlantic Region offer the engineering undergraduates anything more than a token understanding of Intellectual Property. Despite the majority of the Deans of Engineering clearly stating that they considered Intellectual Property to be an important part of an undergraduate engineer's curriculum, 75% are NOT planning on introducing any new courses in intellectual property for the undergraduate engineers.

When comparing these findings with the earlier study done by the authors, the findings match and show that the trends for intellectual property education in the Mid Atlantic Region match the nationwide trend of not having enough emphasis being provided to the IP education of our undergraduate engineers.

Recommendations for future research

It would be worthwhile to look into why none of the schools offer more courses on intellectual property to their undergraduate engineers. Simultaneously, we should also consider evaluating why the majority of the schools do not plan on introducing any new courses in the field of intellectual property. Specific reasons should be sought out such as lack of finances to start up these new courses or lack of qualified faculty to teach these new courses on intellectual property.

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Biographies about the authors

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Jimmy Gandhi holds a B.S from Illinois Institute of Technology in Engineering Management, an M.S from California State University, Northridge, in Engineering Management and is currently working on his Ph.D. at Stevens Institute of Technology in Engineering Management, with a concentration in Project Management. His research interests are in the field of Risk Management with respect to outsourcing of complex systems. He is affiliated with the School of Systems and Enterprises at Stevens Institute of Technology in Hoboken, NJ. He has co-authored and been the editor for several books on Entrepreneurship along with Dr. Donald Merino and is also a member of several professional organizations, in whose academic conferences he participates regularly.

Donald N. Merino.
Donald N. Merino is a tenured full professor and the Alexander Crombie Humphreys Chaired Professor of Economics of Engineering at Stevens Institute of Technology. He teaches Engineering Economy, Decision Analysis, Total Quality Management, and Strategic Planning. He is Founder Emeritus of the undergraduate Bachelor of Engineering in Engineering Management (BEEM) and the Executive Master in Technology Management (EMTM) Program at Stevens.

He won the Morton Distinguished Teaching Award for full professors at Stevens. John Wiley published his book, "The Selection Process for Capital Projects". Dr. Merino received two Centennial certificates from the ASEE in Engineering Economics and Engineering Management. He is past Chair of the Engineering Management Division and Engineering Economy Division of ASEE.
Dr. Merino was awarded the ASEM and ASEE Bernard Sarchet Award. He is an ASEM and ASEE Fellow and past president of ASEM. Dr. Merino has 25 years of industrial experience in positions of increasing managerial / executive responsibilities. Since joining academe 24 years ago, he has published 32 refereed journal articles and conference papers and over 50 research reports.

Appendix

Provided in this Appendix are the schools chosen for the previous study carried out on intellectual property courses offered in the US to undergraduate engineering majors. Furthermore, we have also included the questions used in the survey and the results collected. This information is provided for a better understanding when comparing the results of that study with the findings in this paper.

US News and World Report Undergraduate Engineering Schools – Top 9

Ranking	Name of University surveyed
1.	Massachusetts Institute of Technology
2.	Stanford University
3.	University of California, Berkeley
4.	Georgia Institute of Technology
5.	University of Illinois, Urbana
6.	California Institute of Technology
7.	Carnegie Mellon University
8.	University of Southern California
9.	Cornell University

Survey Questions

Question #	Question answered through research done on university/department website
1.	Does the engineering school offer any courses on intellectual property? If yes, how many?
2.	Are these courses required or electives for certain undergraduate engineering majors or all majors?
3.	If required or elective, how many I.P. courses are undergraduate engineering students expected to take?
4.	Are these intellectual property courses for the undergraduate majors offered exclusively through the school of engineering or jointly with another school?
5.	What happened when the website was searched for IP courses? Was the website responsive to the inquiry about IP courses?

Results of Survey

Exhibit: Results of Survey

Question >> Schools V	1	2	3	4
1 MIT	No	No	None	Not applicable
2. Stanford	No	No	None	Not applicable
3. UC – Berkeley	No	No	None	Not applicable
4. Georgia Tech	No	No	None	Not applicable
5. University of Illinois – Urbana	No	No	None	Not applicable
6. Cal Tech	No	No	None	Not applicable
7. Carnegie Mellon Univ	No	No	None	Not applicable
8. Univ. of Southern California	No	No	None	Not applicable
9. Cornell University	No	No	None	Not applicable