A Framework for Developing Intellectual Property Perspective among Computer Science Students

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Abstract

Intellectual property rights are being discussed and have become as policy issues in this era of knowledge. Every organization, industry in every sector is striving hard to protect, create, and convert their intangible assets to tangible ones through intellectual property rights. In this scenario, young students comprising majority work force of information technology field are to be sensitized about intellectual property rights at the beginning of their career. With this background, as a facilitator of this course a frame work was developed to impart intellectual property rights education to computer science students. This paper discusses how students are introduced to concepts in a unit wise manner and as the course makes progress, how challenges are dealt pedagogically to reach the outcomes of the course.

Key words: Intellectual property rights, pedagogy, information technology, learning goals, critical thinking.

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1. Introduction:

Knowledge and critical thinking skills on Intellectual Property rights(IPR)are becoming increasingly relevant in the present knowledge driven economy. These rights are further categorized such as patents, copyrights, trademarks, trade secrets, geographical indicators, design patents [1,2]. Knowledge based industries suchas information technology (IT), IT enabled servicesare striving hard to provide business solutions to their customers. In this context, knowledge and exposure to intricacies of intellectual property rights in global economy is important [3]. Various sectors like health care, ICT, education, agriculture need to pay attention to the IP rights in safe-guarding the assets they are creating. Organizations acquire assets in various forms such as development of new frameworks, tools techniques in the process of their delivery excellence. At this juncture, identifying such assets, understanding their potential towards intellectual property protection and security are crucial for the organization [4-7]. Hence it is important to inculcate the culture and awareness on theseperspectivesacross the organization especially solution enablers [8]. With continuous growth of knowledge creation, skilled human capital developmentis vital reflecting importance of educational and training institutions in this journey [9]. Inculcating awareness and imparting these skills on IPR to the students is important and equally challenging.

Intellectual property rights course is being taught for Computer science Master's degree curriculum in some of the Universities globally. Integrating computer science and IPR concepts is a pedagogic challenge as both of these are cognitively different as the former demands core computing skills. IP protection as a subject and a curriculum on intellectual property rights (IPR) needs an interdisciplinary approach given that students from various engineering disciplines will be opting to this course.On the other hand, scope of IPR course covers aspects of practical use cases and applying to business processes, automation across the businesses. Hence it can be used as vehicle to nurture entrepreneurial skills among the students.It is also important that graduates of computing discipline to possess an understanding on IPR so that they can add more value when they join industries because they can apply these concepts in day to day scenarios protecting the assets of both the organization and as well as their customers. In this present paper we propose a frame work to introduce IP education to non-law students based on experience in facilitating this course. One of the motivations behind choice of this population is that it is important for these students to be aware of and apply the concepts of IP in their first job in information technology. Information technology positions expect their employees to be aware of such aspects as the deliverables to the customers do not breach any contracts and property rights which otherwise will be very costly for the employer towards handling lawsuits etc. In the present work, we consider the students of master's degree in computer science (M.Tech.) and experiences from facilitating Intellectual Property (IP) course. The framework proposed is based on outcome based curriculum and active engagement pedagogies by considering the challenges faced in teaching this course to computer science students and analyzing their performance in various assessments.

2. Development of Frame work:

The course curriculum comprises of five units namely, i) Introduction and conceptual frame work of IPR ii) International Conventions and Treaties iii) The legal regime of IPR in India iv) IPR and emerging areas and v) Overview of Cyber law.The learning objective of the course is to impart legal education adequate enough to understand various regulatory frameworks and identify the IP that can transform to assets.

Fig.1. Framework for teaching IPR course

Figure 1 depicts various aspects considered in the framework and the following sections describe each of the dimensions mentioned here.

2.1 Delivery challenges:

- Changing the perceptions of the students
- Generating sustainable interest in the subject
- Overcoming traditional outlook of academics
- Creating interest among students and engaging them intellectually.

2.2 Aspects of Mindset and learning styles of the students:

During beginning of the course, the motivation level of the participants was very low and classes were not very interactive. Also the performance of the students in assessment 1 is quite poor. Considering these aspects, we explored options of enabling the students to work in short groups comprising two to three people based on their preference. In general, class room based pedagogies implicitly might appear to be suitable for reflective

[682]

learnings which might not be the case. In IP course, we provide presentation material and further reading avenues to the students for self-reflection and review.An attempt is made to establish connect with the students keeping the aspects of learning styles [10] and personality styles [11] and analysis is carried out for the batch of 30 students as described in table 1and table 2 respectively.

Table 1: Learning Styles of the Students in IP course of size 30

Learning Style	Population	Inference/reasoning
Active	15	Active learners prefer practical activities, experimentation and find exploration related tasks more interesting. IPR has scope towards active engagement through real life case studies.
Reflective	22	They assimilate the concept through careful reflection, using their own thought process.
Sensing	26	Most of the participants preferred to connect the concept towards real world. One of the challenges of IPR course is that most of the contentof this course is abstract and they required aptitude towards analyzing the legal aspects; Hence instructors are expected to identify case studies and scenarios where a particular concept is used in the business.
Intuitive	8	Some of the concepts of IPR course are very factual and requires memorization and most of them had a challenge to remember these and feel the lectures are quite boredom.
Visual	30	Participants in general prefer visual tools like pictures, graphs.
Verbal	18	As the name indicates, some participants preferred the instructor to be read the lines that were written on the black board, they perceive it to be more appealing and engaging.
Sequential	21	Participants with this learning style appear to be evaluating the course in terms of logical sequencing of the concepts, topics and modules being taught. This is one of the challenges in facilitating IPR course where it is difficult to establish such sequence as the course deal with code of conduct, various sections in the law; their subsections as a descriptive prescription to evaluate options and choosing the most appropriate one.
Global	22	Global learners prefer to see how the curriculum and pedagogical aspects and relate to their prior knowledge which is again a challenge to engage them in the courses like intellectual properties.

Table 2: Personality Styles of the Students in IP course of size 30

Style	Population	Inference/reasoning
Extrovert	21	Extroverts prefer learning in groups –the observation from the class is consistent with Myers-Briggs type theory.
Introvert	9	It is also observed that this population were active in self -

		study activities, take home assignments
Thinking	15	It is noticed that most of the participants (as indicated in the numbers) followed the IPR guidelines during reflection of case studies instead of subjective arguments
Feeling	5	
Judging	21	The participants were spontaneous and cautious about their opinion as they prefer validation of their arguments against IPR guidelines.
Perceiving	4	

2.3 Curriculum and Delivery aspects:

The present approach integrates the three aspects –learning styles, curriculum and pedagogy where, we have considered and integrated approach addressing some of the effective learning principles [12], learning goals and pedagogical aspects.

2.3.1 Effective Learning Principles:

a. *Prior knowledge of the participants:*
New knowledge construction can be enabled by drawing examples and scenarios from the subject they have already learnt by setting up of teaching and learning context for various diverse aspects of IP. The nature of exercises and examples of this course are different compared to traditional courses like engineering chemistry, thermodynamics etc. Hence it is challenging opportunity in teaching this course is active engagement of the participants in practicing the use cases, exercises.

b. *Motivation:*
Motivation can be perceived as a product of expectation in terms of course level outcomes and value on specific skills they acquire upon completion of the course. Balancing the both plays an important role towards effective learning of the participants.

c. *Critical thinking:*
Students are expected to apply the knowledge and skills they acquire and evaluate options for a given scenario to arrive at most appropriate one. While teaching this course facilitator needs to reinforce the concepts taught so that the process helps the students acquire mastery on the subject.

d. *Active engagement:*
The case studies on impeachment, violations on IP rights help in drawing the attention of the participants as they can explore and learn by solving these cases and reflecting upon them.

e. *Holistic learning:*
Participants can be provided avenues to reflect on evaluating their own abilities including the aspect of their own strategies and approaches how they are working that help both their intellectual quotient and the performance.

2.3.2 Learning goals:
- Enabling participants understand interdisciplinary innovation

- Just-in time approach towards imparting legal knowledge keeping the prior knowledge (computer science) of the participants

2.3.3 Pedagogical Aspects and Approach:

Intellectual property may be taught at three different levels, basic, intermediate and advanced keeping breadth and depth of coverage in view. In this course, considering the learning objectives of the course, the topics were dealt at basic and intermediate level. The first three aspects of effective learning principles are considered during initial topics such as introduction, overview of intellectual property rights; Once they are familiar with the subject the rest of the three (d, e)principles are addressed using class room lectures, government websites, texts, WIPO, case studies, and web based resources.

2.4 Execution:

In subsequent sessions, referring to item (a) in section 2 of effective learning principles, a real life case study [13] was discussed in an informal way and gradually it took a turn towards the intricacies involved when the facilitator took the advantage of it for introducing the terminology of the subject. For some, it was quite boring as they could not involve themselves. To get them into discussion mode, the next session was planned using day-to-day examples such as shopping, dining etc., where Value Added Tax is added. Using these scenarios, explained about how VAT and GATT are the outcomes of the TRIPS (Trade related Aspects of Intellectual Property Rights) that forced the member countries to review the legal aspects. This helped in enabling the participants involved in business models and IP. At this juncture one of the sessions was exclusively dealt on technology transfer to emphasize the importance of IP and its relevance towards sustainable and inclusive growth of the economy by taking a case study of IIT Bombay [14]. With this the context setting, relevance and importance of IP for engineers is illustrated.

With examples and reflections the class could come to a juncture, where they could say that industries dwell upon the legal and regulatory affairs that have direct impact on their business and IP deals with these aspects. They could decipher that IP education is a key business skill to take the organisation to the next level. Unit wise all the concepts were dealt in the steps d,e and f. Case studies were chosen very carefully so that they could relate to it either in their core discipline context or real life scenario. This helped in a way to engage the students intellectually.

2.4 Evaluation and Assessment pattern:

The knowledge construction and assessment approaches are appropriate to align with the goal of imparting transferable skills so that the participants can use these during their first job [15] The University follows a continuous evaluation pattern for each semester. As an integral part of the same three mid semester exams were conducted each mid exam comprising of questions being evaluated for 20 marks. Out of three mid semester exams two are being chosen and assignments are being assessed for 10 marks. The facilitator was taking the same as a parameter for assessing the delivery effectiveness.These assessment instruments are aligned with revised Bloom's taxonomy [16]. In order to identify appropriate assessment and pedagogical instrument, it will be convenient to classify the concepts of the course

curriculum into 4 knowledge areas namely, factual knowledge (K1), application knowledge (K2), critical thinking (K3) and meta cognitive knowledge (K4). Metacognition is expected to address aspects of individual's own thinking [17]. Considering the scope of the curriculum and the objectives we made an attempt to concentrate on first three knowledge areas and questions are designed accordingly as illustrated in table below:

Unit	Type	Level of cognition	Sample question
Introduction and conceptual frameworks of IPR	K1	Understanding	Describe Trade Related aspects of Intellectual Property rights?
International conventions and treaties	K2	Application Knowledge	Explain Value Added Tax and list out its impact on daily life through surcharges.
The legal regime of IPR in India	K2	Application knowledge	List out key aspects of Protection of Plant Varieties and Farmer's Rights (PPVFR), keeping bio diversity aspects in view.
IPR and emerging areas	K3	Analysis, Synthesis, Evaluate	Analyze the case study of Pochampalliikkat Sari [18] and evaluate the options on protecting such geographical indicators.
Overview of cyber law	K1	Recall	Explain the cyber law in the context of companies that develop educational software. Illustrate how software can be protected by cyber law.

3   Results

The performance of the students might be observed in Fig. 2 for all the three midsemester exams where it might be observed that more number of students has scored below 40% in all the mid exams. It clearly indicates that the subject is not being well understood by the students. A session was devoted to understand their difficulty person by person. Facilitator could conclude that most of them felt difficulty with the terminology, some of the students said that they could not reproduce it on the paper during exams as they could not remember even though they have studied. The reason, subject being new, they need a different cognitive skill contrast to their core domain (computer science) time and practice. The same was told in the class so that the spirits are maintained high.In the second and third mid semester exams, the performance was consistently high and in particular mid semester III was good. There are two factors that influenced the ill performance of the students in mid semester II and III one being irregularity to the class and the other lack of interest towards the subject. Intellectually stimulated discussions discussing the scope of patentability and scope of protection in various categories was discussed among themselves showing an inclination towards the subject. As novelty, innovation are frequently discussed in the context of IP protection, students are forced to understand the technical details in a deeper sense and driving them to think in the entrepreneurial path. There were no students in mid semester I who scored between 81-90, whereas the other two semesters have.
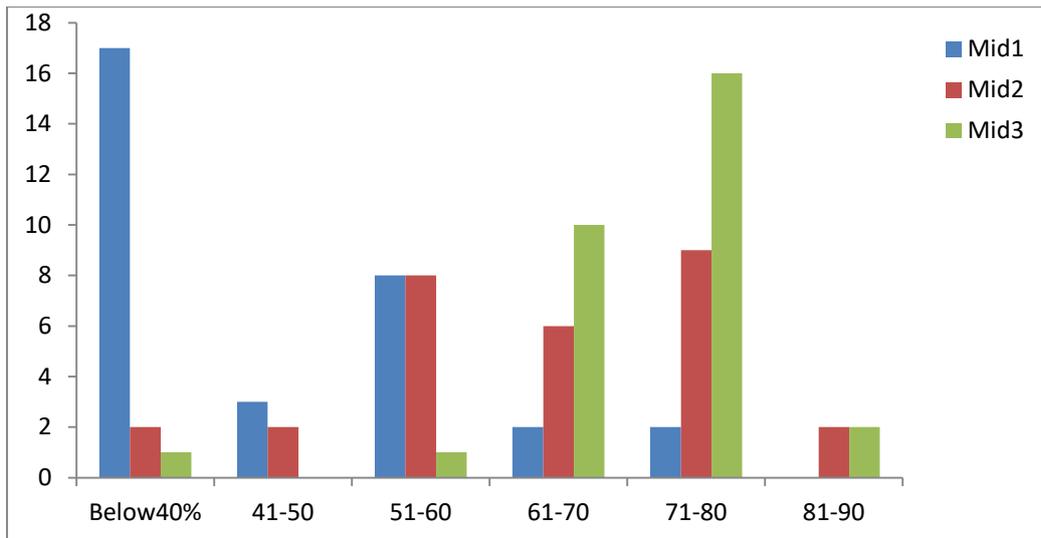
Fig.2. Performance of students during Mid Semester Exams I, II, III

3.1 Feedback questionnaire

A feedback questionnaire (Annexure 1) was made to understand the delivery effectiveness and the learning objective of the course is achieved or not. Unbiased feedbackis ascertained by maintaining the anonymity of the students. The same was conveyed to the students while taking the feedback. Fig.3 gives the description of the delivery effectiveness and Fig.4 gives overall impression of the students on the course.
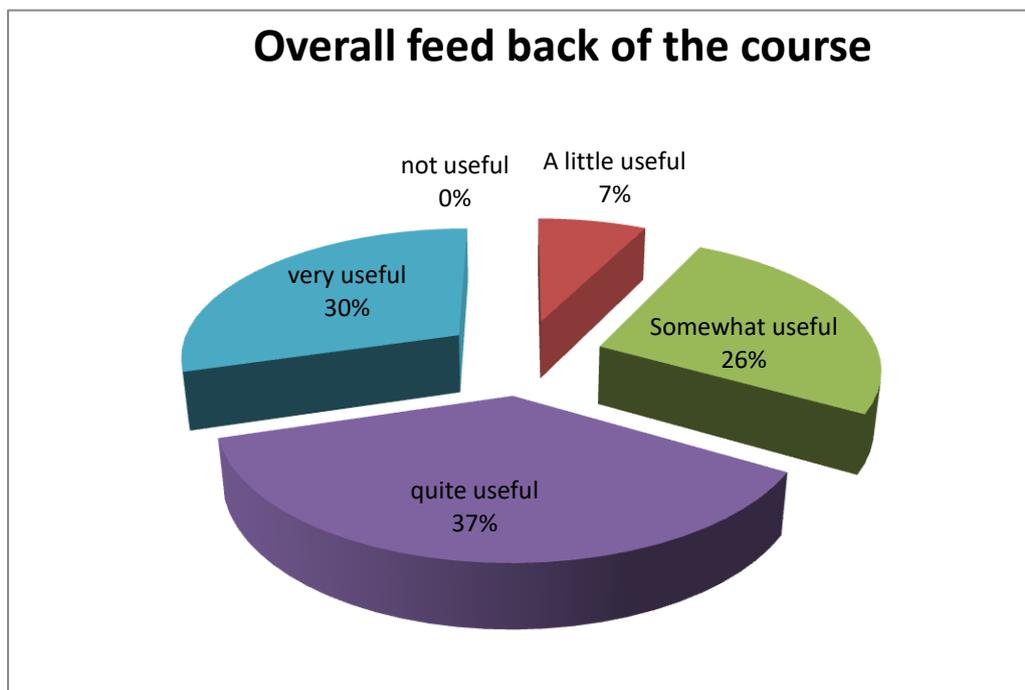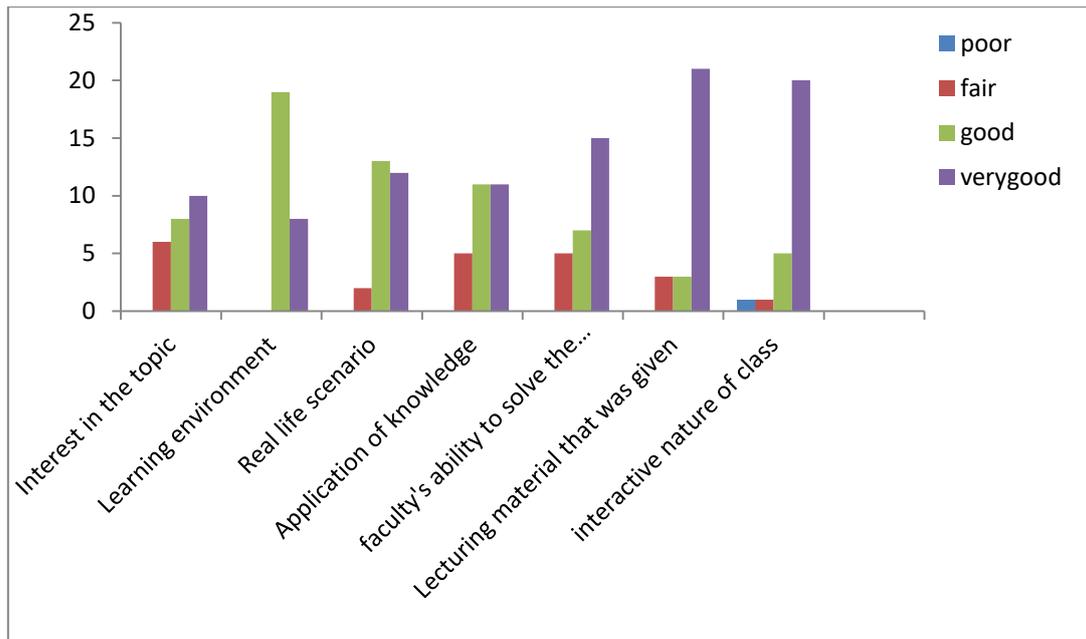

Fig.3. Course feed back

Fig.4. Feedback regarding the class room environment

4   Conclusions

Globally economy is undergoing several changes, due to flow of capital, increase in population and hence a shift towards need based research in health care, food and energy is expected [19, 20]. Understanding the concepts of Intellectual Property Rights and internalizing abstract concepts is important for the students and enable them to be relevant in knowledge economy especially when they join their first job. On the other hand, it is important that the future employees are imparted with the necessary skills that are vital to industrial growth both in the form of asset creation and survival with sustainable development. The present work provides an outcome based approach aligned with Bloom's levels of cognition, considering the knowledge areas into four categories. The assessment questions are designed on the basis of the classification to balance both lower order and as well as critical thinking skills. The real life scenarios and case studies helped in facilitating engaging learning environment and the participants find the abstract concepts of the course interesting. In the process the participants could appreciate the importance and relevance of IPR.

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