ACCELERATING INTER-DISCIPLINARY COURSE BASED ENGINEERING EDUCATION

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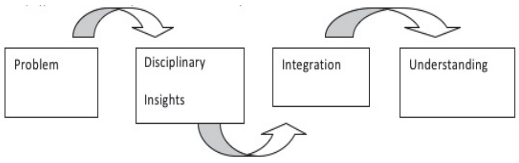
Abstract

Education prepares an individual with the capability of understanding, exploring and implementing subjects with maximum efficiency. In today's correlated world, every issue or any subject for that matter does not stand alone isolated. A single insight from a disciplinary framework is not sufficient to resolve complex problems. Each discipline today has significant connections with other disciplines. Inter-disciplinary education is a knowledge view and curriculum approach that applies methodology from more than one discipline to examine a problem, issue, topic or work. This method education helps students understand the connection between various disciplines. Consider the field of engineering; it is not solely efficient to study merely the technical aspects of a particular subject. An engineer must also understand the economical aspects of technology so as to bring optimum technology for society. Similarly, there are various other disciplines of study which require knowledge of other multiple to have the best outcome of learning. A learning which is gathered from all angles and sources is the one that creates the most value. Understanding of how different fields work will empower an individual with awareness and complete wisdom to execute in a more efficient way. Various institutions across the globe are planning to implement the inter-disciplinary inclination to many courses. The statistics are however lower than required. The paper focuses on the outcomes of inter-disciplinary study, its effective implementation and how it will benefit students all across the globe. There is an enormous need to accelerate this method of education.

Keywords- Interdisciplinary, integration

I. INTRODUCTION

The meaning of Interdisciplinary education continues to be contested by critics. A primary focus of the ongoing meaning over it concerns with integration. In context of interdisciplinary education it is the process by which ideas, data, information, methods, tools, concepts and theories from two or more disciplines are synthesized, connected or blended. Interdisciplinary instruction entails the use and integration of methods and analytical frameworks from more than one academic discipline to examine a theme, issue, question or topic. The hallmark of interdisciplinary education is integration of notions and guiding principles from multiple disciplines to systematically form a more complete, and hopefully coherent, framework of analysis that offers a richer understanding of the issue under examination [1].



II. THE NEED

Engineering education alone does not prepare a student to deal with real worlds problems. The goal of engineering education is to solve the problems of the world. These problems should be solved with optimum knowledge. This knowledge should include the economics of an issue, the social impact of an issue and much more. There have been various occasions where not understanding issue like social impact, law or economics has led to failures.

An emerging viewpoint in higher education emphasizes that a thorough understanding of today's real life problems requires interdisciplinary reflection. For instance, when society and policymakers address the question of whether to raise the minimum wage they will certainly draw from economics, theories of social justice and social psychology. Clearly, insight from a single disciplinary framework is not sufficient to help resolve such a complex issue. Students who are regularly exposed to classroom conversations and assignments that tackle real-world problems in an interdisciplinary fashion; engage in significant learning, realize cognitive gains, and are better positioned to understand challenging problems and to frame viable solutions [2].

Interdisciplinary studies can also take advantage of opportunities to work with partners who are able to offer and support enriched learning experiences and opportunities for young people's wider involvement in society. For instance, a student or professional working on building an electronic device for a client organization. Every requirement from any side will require certain laws, pricing and social impact that an engineer must understand. Sure one can hire an external person for the job- but increases pricing and lowers the understanding from a manufactures side. A better approach is that the engineer himself understands those aspects and optimizes his operations according to them. This will enable the engineer to deliver the product with maximum quality.

To build a product or service one has to understand the reflective thinking of the consumer. For this to take place, an engineer must start thinking in a wider scope from the scratch. One must understand factors like costing of the product, social impact or the demand trend. If a product/service is begun with keeping in mind, the outcome will be the best. Designing solely on technical engineering knowledge will never succeed.

As an example, consider the knowledge of law which is very crucial in any field. In engineering it is one the most essential requirements. In the present world's competition and government regulations had led to law-bounded productive world. An engineer working on any project or product must understand whether his work is within the bound of international/national laws.

Another important aspect is costing of any project. The knowledge of how to build a strong costing model is essential. This leads to more investment, which eventually leads to more effective resources.

In addition to the knowledge supporting productivity, an engineer must possess qualities of team work and professional ethics. Enough emphasizes should be given to individual leadership i.e. working in a team and possessing ethics. Individual leadership is quality of leading part of team for whichever one is responsible. One must learn responsibility of being in a team, irrespective if you are the commander. This is not to be confused with conventional personality development course.

III. Real-World Examples in support

There are many instances in present world interdisciplinary understanding of which have been greatly taken or are required by professionals and academicians.

A. Financial Engineering Curing Cancer

One of the best examples to state out is what many researchers say- 'Can financial Engineering cure cancer? '. Well, the researchers involved in this agree with the statement to the fullest. Cancer is one of the biggest challenges confronting modern society. Conventional and basic requirement to find the cure for cancer is medicine, biology and medical electronics. However, the problem will not be solved with the conventional focus. The financial aspect of

cancer research has come out to be a crucial part of achieving the cure. The funding involved in cancer drug-development is complex and needs to be understood from an engineering point of view. Financial Engineering concepts such as portfolio theory and securitization facilitate the funding operations. Researchers have found that by structuring biomedical research funding in research-backed obligation format, incentives to reduce the disease are distributed among broader community of stakeholders. As a result significantly greater number resources can be gathered, which in turn will lead to attract leading experts to join the effort. This will lead to instilling confidence among the investors [3].

B. Use of Game Theory

Another great instance of this method of engineering education is the understanding of one of the most important concepts of Economics- Game Theory. Electrical and Computer Science Engineers are investing great interest in this subject. Historically, engineers had to contend with technical questions-such as power constraints and relative merits of centralization-decentralization. However, with the rise of the Internet they have to deal with human agency too. The internet flow of data is today managed by not one but many providers today. The reliability of these operations depends upon collaboration and competition between these different providers. In other words, why does Internet work even though it is made up of individual networks? Game theory provides a way of answering that question [4].

IV. IMPLEMENTING EFFECTIVE INTERDSICIPLINARY EDUCATION

The first step towards interdisciplinary education has to be addition of sufficient cross-disciplinary courses in each field. Whether it may be mechanical or an electronic engineer, each requires basic knowledge of certain subjects which will help them deliver better. The following subjects must be added to the curriculum:

- Engineering Law: Covering the application of law and legal strategy in engineering.
- Economics: Understanding of production, distribution and consumption of products.
- Marketing: Understanding of communicating value of product to consumers.
- History: Historical case studies of how technology has impacted societies around the globe

It is essential to include these subjects with appropriate credits so that the student understands them effectively.

In addition to this, students must also compile a report for any project they do which includes the finances involved, laws taken into consideration, estimating economics of the product and case studies from the past that they learnt from. Appropriate marks should be allotted for the particular sections of the report.

It is must be understood that these courses must be added as mandatory subjects and not as electives. To ensure effective outcome of the course-curriculum the following measures should be implemented:

- It is planned around clear purposes.
- It is based upon experiences, case studies and outcomes drawn from the subjects.
- It should ensure progression in skills and in knowledge and understanding
- It can provide opportunities for mixed-stage learning which is interest-based.
- Opportunities to interact with students of different disciplines in order to learn and build networking.

V. CHALLENGES

There are many challenges today that are hindering Interdisciplinary Education today. The center of all the problems is- Realization of integrated and coordinated teaching between different disciplinary subjects. For instance, at a particular university professors did their teaching separately from others.

VI. CONCLUSION

It very essential to include knowledge of other disciplines in any particular engineering field of study. In today's world engineering education is no longer a isolated discipline. Every engineering field needs knowledge of disciplines like finance or economics. The curriculum of interdisciplinary education will impart a integrated understanding to students which will empower them to find solution to many problems that our society is facing. This method of education should be implemented as part of the engineering under-graduate curriculum for all branches. The student must learn how to use essential knowledge of cross-disciplinary subject to make their work effective and optimum. Education institutions and Researchers across the globe are believing in this method and advise immediate implementation of it.

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