

Importance of Interdisciplinary Courses in Engineering Education

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Abstract: Interdisciplinary courses are essential in aligning the students towards the current trend. It helps in reducing the gap between colleges and industries. It helps in crossing boundaries and creating something new. This work is a study into the necessity of Interdisciplinary Courses in the present engineering education. Efforts were put up to gather information from students pursuing their engineering degree all over India. Survey was conducted through questionnaires. The study was based on 3 criteria: awareness, necessity and evaluation of Interdisciplinary Courses. Majority of the survey-takers converged on the need of Interdisciplinary courses in the present engineering scenario.

Keywords: *Interdisciplinary courses; survey; engineering; curriculum;*

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1. Introduction

India is the largest producer of English speaking engineers in the world. Engineering is a preferred career choice for a large number of students at the 10 + 2 level in India. Many of the reputed engineering colleges (IITs and NITs) are highly selective in their admission process

with the number of available seats being only 1-2% of the number applying. A large number of private

engineering colleges have been set up. Though there is a mechanism for accreditation (National Board of Accreditation) and an umbrella agency, the All India Council of Technical Education (AICTE) set up to monitor and control engineering education, the quality of engineering education in many institutions is suspect due to various reasons such as the syllabi, faculty, placement, availability of facilities to name a few.

An engineering graduate is expected to be technically competent, conceptually clear, and good at basics and ability to apply the studied knowledge. While engineering education provides the foundation of this knowledge but as technology is gradually progressing towards efficient ways to progress, the need for in-depth specialization has been at an all-time high. This also brings in a need to integrate these specialized fields and diversify the present engineering education to help the student be on par with the current industrial standards and trends. Interdisciplinary courses may be one of the solution in enhancing the engineering education.

Interdisciplinary courses involve the combining of two or more academic disciplines into one activity (e.g., a research project). It is about creating something new by crossing boundaries, and thinking across them. It is related to an interdisciplinary field, which is an organizational unit that crosses traditional boundaries between academic or schools of thought, as new needs and professions emerge. Interdisciplinary studies involve students in a range of thought, from scientific to humanistic. Courses are designed to illuminate principles, methods, and skills that cross disciplinary boundaries. These programs are intended for students whose interests do not conform to standard academic programs.

Interdisciplinary is most often used in educational circles when researchers from two or more disciplines pool their approaches and modify them so that they are better suited to the problem at hand, including the case of the team-taught course where students are required to understand a given subject in terms of multiple traditional disciplines. Because most participants in inter-disciplinary ventures were trained in traditional disciplines, they must learn to appreciate differing of perspectives and methods. An interdisciplinary program may not succeed if its members remain stuck in their disciplines (and in disciplinary attitudes). On the other hand, and from the disciplinary perspective, much interdisciplinary work may be seen as "soft," lacking in rigor, or ideologically motivated; these beliefs place barriers in the career paths of those who choose interdisciplinary work [1].

2. Literature Review

At the forefront of research in the present day scenario, Boix Mansilla in his patent- Assessing expert interdisciplinary work at the frontier: an empirical exploration Veronica' coins the fact that Interdisciplinary work is the norm and pure disciplinary pursuits are the exception. There is awareness that the Interdisciplinary research is a vital form of knowledge production and which is accompanied by an increasing unease about the dubious quality of interdisciplinary inquiry. He also says the assessing Interdisciplinary work is a challenge [2].

As the title of the symposium issue of the Washington University Journal of Law and Policy suggests, new technologies play a vital role in shaping the development of patent policy, just as patent system plays in the development of new technologies. Both are two faces of the same coin [3]. Large multidisciplinary areas often pose an insurmountable barrier in securing a comprehensive overview of its intellectual structure on account of wide diversity and volume of research. Robert J.W Tijssen in his article- 'A quantitative assessment of interdisciplinary structures in science and technology: Co-classification analysis of energy research' has shown that a systematic, qualitative examination of the contents of the area's research publications offers an empirical solution to surpass the barrier.

The analysis yields quantitative measures of-

- i) The level of contribution of Interdisciplinary in research fields.
- ii) The strength of Interdisciplinary relation between these fields.

- iii) Graphical representation in the form of maps to show Interdisciplinary structure in single fields [4].

J. Perkins and J Tryssenaar in their article - 'Making interdisciplinary education effective for rehabilitation students', said that Interdisciplinary education has been recommended as a way of preparing students for team practice after graduation. The Northern Studies Stream of McMaster University's School of Occupational Therapy and Physiotherapy in Ontario, Canada, combined students from Occupational Therapy and Physiotherapy program for small group tutorials. The evaluation was found to be positive, suggesting some characteristics of students like level of experience and maturity and the session design features, that maybe useful and helpful in planning of future Interdisciplinary education experiences [5].

In the article- 'The case for Interdisciplinary Studies Response to Professor Benson's Five Arguments' by William H Newell, it is said that Interdisciplinary studies rest on series conceptual confusion. Professor Benson assumes that Interdisciplinary studies are concerned with "Connection between disciplines". In his view, the problem solving conception of Interdisciplinary studies is the most fruitful. He also says that out of the resulting disciplinary insight, the interdisciplinary fashions a response to the question that would ideally be a complete answer but which at the least leads to a greater appreciation [6].

3. Methodology

This study was conducted with a sample of 407 students across different branches from 34 different engineering colleges all over India. The survey was conducted for 2nd, 3rd, 4th year students and engineering graduates. But 4th year engineering students were the main subjects of the survey. Out of them, 75% of the subjects were final year engineering students, 12% were from pre-final year, 11% were from 2nd year and the remaining were graduates.

Students of final years of engineering were given more preference because of their better understanding of the state of the current engineering curriculum and interdisciplinary courses offered by their institute.

A suitable questionnaire was designed to conduct the survey in the month of August 2016. Data for this study was gathered during the month of August and September 2016. The questionnaire consists of 2 parts. The first part is framed to collect the basic information from the students namely, the name of their college, the branch of engineering, year of study etc. The 2nd part consisted of the questions for the

survey. Students were required to answer 18 questions out of which one was open ended and the others were multiple choice questions.

The questions were divided such that it tested the students' awareness towards interdisciplinary to choose those courses. The open ended question allowed the students' to tell the course that they want as a part of their curriculum but is not introduced in their institute.

The survey was conducted using Google forms. The collected data were compiled and relevant graphs were plotted to help draw conclusions. Percentage distribution of the responses are clear indicators of the preferences of the students. The results are concluded based on the assumption that the responses obtained from the students are honest and legit.

4. Results and discussion

Interdisciplinary course should be an integral part of engineering education because these courses show a student's inclination towards learning on the basis of progress in their field of interest. This is shown by the responses in the sample space

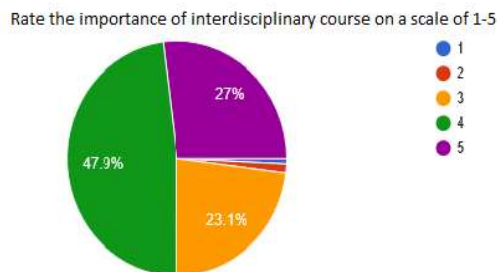


Fig 1: Response on rating of interdisciplinary course

96.8% of the students were in agreement that interdisciplinary courses must be an integral part of the curriculum while the rest disagreed. This is reflected in the students rating the interdisciplinary courses (on a scale of 1-5). 27% felt it had the most importance, 47.9% felt it had importance, 23.1% had a neutral opinion, while the rest felt that it was less important.

When asked about the awareness of the interdisciplinary courses in their present curriculum, 74.7% had a clear picture about this while 25.3% were not aware before taking this survey.

I am aware of the Interdisciplinary courses (IDC) in the curriculum
(407 responses)

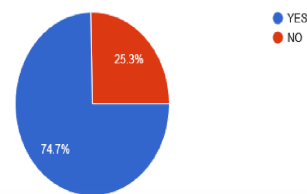


Fig 2: Response on awareness about interdisciplinary learning

The number of interdisciplinary courses studied/opted greatly depends on interest in cross domain studies and not on awareness, 46.4% have opted up to 2 interdisciplinary courses, while 26.8% have opted 3-5 courses and a small amount of 5.4% opted more than 5 courses and the remaining 21.4% are either yet to opt or not opted interdisciplinary courses.

The major factor that influences students to take up interdisciplinary courses is their self-interest. The responses show that about 66.1% of the students are influenced to take interdisciplinary courses by their own interest, 61.7% are influenced by scope of the subject, while 15.7% are influenced by the course instructor handling the course. Surprisingly, only 10.1% feel they are influenced by their peers.

When asked if pre-requisites are necessary for taking up interdisciplinary courses 75.4% (307/407) agreed, as it is better to know the basic concepts beforehand. While 24.6% (100/407) disagreed with it saying prior knowledge does not have any effect in the current study keeping in mind the student's adaptability. Survey suggests that students prefer having pre knowledge about the interdisciplinary subjects since it would help them grasp the new concepts quicker and also be thorough with it. However it also depends on one's ability and interest in the subject.

146 students out of 407 were satisfied with the interdisciplinary courses offered by their institution, while the rest of them felt that they needed more exposure to wider range of topics with the purview of current situation and the present technology that is being operated in the world rather than what the college offers.

I would like to take Interdisciplinary courses in the form of (407 responses)

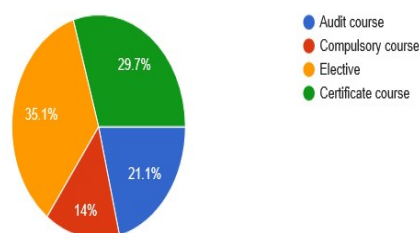


Fig 3: Response on ideal form of offering interdisciplinary course

Interdisciplinary courses can be offered in various forms, 35.1% of students prefer them as an elective as they have the liberty to choose what's important to them. 29.7 % of them agreed it should be in the form of certificate courses as it would bring extra weightage to their curriculum. 21.1% say that it should be in the form of audit courses and the rest 14% feel that it should be in the form of compulsory courses for the students' benefit.

The kind of evaluation procedure for Interdisciplinary Courses should be (Multiple Opinions could be chosen) (407 responses)

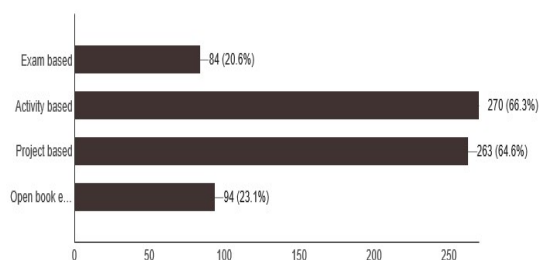


Fig 4: Response on ideal procedure of evaluation for interdisciplinary course

When students were asked if industrial experts should lecture few topics of interdisciplinary subjects, about 94.8% of them responded affirmatively while the rest were negative. Industrial teaching is one of the important tools in improving the quality of education. Large number of students favoring the idea of bringing in industrial experts to lecture certain courses highlighted the necessity of integrating Industrial teaching to the curriculum. This method would keep them at par and help them adapt to the current industrial trend. Speaking of lab facility 70% of the students felt that labs should be made mandatory for IDC while the rest disagreed with this.

As any course needs evaluation, 66.3% of them felt that activity based evaluation gives healthy results while project based takes away 64.6% votes. Only 20.6 % of them agreed with exam based evaluation and the remaining 23.1 % opted for open book type.

Opting Interdisciplinary course helps to improve his/her approach towards industrial requirement. According to the current scenario Interdisciplinary courses are offered from 3rd year. The students are made to study fundamentals of various disciplines in the first year and an introduction of core subjects in the 2nd year. 40.3% of the students felt that the Interdisciplinary course should be introduced from second year onwards, 28.5% of them suggested 3rd year to be ideal for its introduction, and only a 6.5% of them felt that the course should be limited to Final year. Another 25.1% of the students voted for its presence in all the 4 years. A majority of students favored 2nd year for the introduction of the interdisciplinary courses which denotes their interest in learning interdisciplinary subjects. Taking such subjects as early as 2nd year provides them opportunity to learn more such courses and encourages them to involve in interdisciplinary projects.

Which year of engineering is ideal for introduction of Interdisciplinary courses (407 responses)

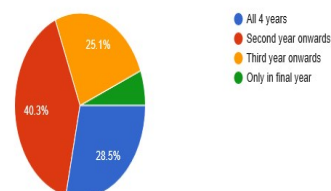


Fig 5: Response on ideal time for introduction of interdisciplinary courses

When asked for reasons for not opting interdisciplinary courses, 65.8% of the students feel there is a lack of awareness among them, 50.4% fear about the alien syllabus, 34.4% say that there is a lack of pre-requisite that is present while 41.3% feel that non-availability of required courses is a reason.

Courses introduced in the first year incorporate the basics of all disciplines. Almost all the engineering institutes offer these courses for the betterment of students' approach in problem solving and analyzing blended concepts during the course of their study. Out of 407 students 207 of them (i.e. 51.1%) opinionated 'yes' when asked if they felt the courses introduced in the first year were interdisciplinary in nature. For the remaining 48.9% of the students the

first year engineering courses fell short in serving the purpose of IDC.

Interdisciplinary Courses should be included in the curriculum because it
(Multiple Opinions could be chosen)

(407 responses)

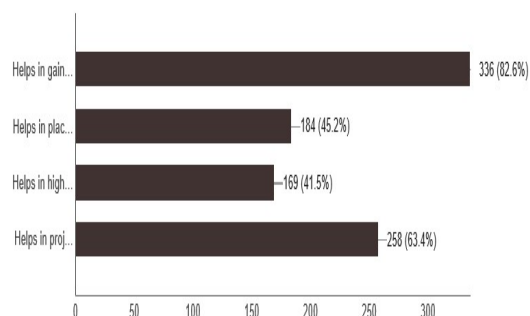


Fig 6: response on need for the inclusion of interdisciplinary course

Interdisciplinary courses should be part of the curriculum because it helps in gaining knowledge. This is echoed by the student responses, about 82.6% feel it helps in gaining knowledge. 63.4% feel Interdisciplinary courses helps in projects, 45.2% feel it helps in placements, while 41.5% feel it helps in pursuing education.

5. Conclusion

Interdisciplinary courses play a vital role in the growth of the institution as well as individual. Most industries today work on incorporating the idea of multiple disciplines thus it is necessary for the institutions to include interdisciplinary studies in undergraduate program. Interdisciplinary learning incites the creativity among students and helps them explore and understand the subjects better. They motivate research and projects through exchange of ideas between various disciplines. The survey focuses on identifying students' awareness and their involvement in Interdisciplinary learning. Questions asked to the students helped in critically examining the need of Interdisciplinary course, method of learning, mode of evaluation etc. from student's perspective. Large response in favour of inclusion of interdisciplinary course in the curriculum stresses its importance. Faculty and institution play a crucial role in promoting the course. New methods of learning, activity based evaluation and lecture from the industrial experts motivates students to opt interdisciplinary learning. The course helps students to think beyond boundaries and inculcates among students critical thinking and art of problem solving.

Thus Interdisciplinary course sets the tone for better career options and improves the quality of education.

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