A Framework for Liberal Learning in an Engineering College.

Dr. Pradeep Kashinath Waychal, College of Engineering Pune

Pradeep Waychal has close to 30 years of experience in renowned academic and business organizations. He has been the founder and head of Innovation Center of College of Engineering Pune. Prior to that, for over 20 years, he has worked with a multinational corporation, Patni Computer Systems where he has played varied roles in delivery, corporate and sales organizations. He has led large international business relationships and incubated Centre of Excellences for business intelligence, process consulting and verification and validation. He has headed the corporate product and technology innovations and quality and delivery innovation departments. He has designed and delivered workshops in the areas of problem solving, project management and innovation management that were received very well by the participants. Pradeep was on the apex senior management group before proceeding on to pursue his academic, research and social interests. Before Patni, he has worked at IIT Delhi, IIT Bombay, SGGS College of Engineering and Crompton Greaves R & D Electronics in different research and academic positions. Pradeep Waychal has also published papers in peer reviewed journals, presented keynote invited talks in many high profile international conferences and was involved in a few copyrights/patents. His teams have won a range of awards in Six Sigma and Knowledge Management at international events. He has been associated with initiatives from NASSCOM, CSI, ISO and ISBSG among others. Pradeep Waychal has completed Ph.D in the area of Information Technology and Innovation Management from IIT Bombay and has an M.Tech. in electrical engineering from IIT Delhi.

Prof. Anil Dattatraya Sahasrabudhe, College of Engineering, Pune

Anil Sahasrabudhe completed his Bachelor of Engineering at Karnataka University securing top honors and a gold medal. He earned his Master of Engineering with distinction and Ph.D. from Indian Institute of Science, Bangalore. He had a short stint in industry, Tata Consulting Engineers, before taking to academics. He has over 27 years of teaching, research and administrative experience in North Eastern Regional Institute of Technology, Itanagar, Indian Institute of Technology, Guwahati and College of Engineering, Pune. He has guided four Ph.D.s and over 50 bachelor's and master's projects. He is a member of ASME, ASI, and ISTE.

A Framework for Liberal Learning in an Engineering College

Abstract

This paper discusses experience of running a course in Liberal Learning for over 300 sophomore students of non circuit branches at a premier engineering college in India. The primary goals of the course were to introduce a lifelong learning process that allows students to extend their knowledge horizons beyond engineering, help them appreciate the interplay of engineering and other disciplines, and make them better learners.

Liberal Learning has been in use in different forms in different civilizations. Aristotle had defined it as learning of a free man and emphasized the importance of the spirit in which the learning is pursued. In the last few centuries, industrialization re-defined educational agenda. It introduced industry oriented engineering courses that did not pay much attention to liberal learning. Recent trends show that liberal learning is regaining its importance. Some leading institutes like Princeton, Yale, and CMU run programs for engineers to help them gain a clear appreciation of technology and the socio-political forces that shape it. The Indian engineering education system has been slow in adopting this paradigm.

We define liberal learning as "self-learning in self-chosen liberal areas with self-defined scope". This covers a vast knowledge space. To ensure that students do not get lost in the space, we developed a guiding framework. This framework consists of process and data. The process has four distinct and slightly overlapping elements. They are define, harvest, synthesize and share. The data elements include student, area, faculty, sub-area, and cluster. Course assessment consisted of mid-term and end-term presentations which were evaluated by the peers and moderated by the faculty mentors. Results of self appraisals with respect to the learning attributes and the consequent development plans were also examined during the assessment.

Introduction

In today's knowledge economy, educational institutes need to recognize that lifelong and interdisciplinary learning are the most critical skills, and take steps to inculcate them in students. A course in Liberal Learning offers a good solution to achieve that objective. This is a different paradigm for both the students and faculty, though. The current K-12 education does not prepare students for such a course and the engineering education does not require faculty to try out such a concept. While some of the faculty members do experiment with different techniques in the area; rolling out such a course across institute demands careful crafting of a comprehensive framework and its systematic implementation.

This paper starts by explaining concepts behind education, learning, and liberal learning. Then it discusses liberal learning in engineering education and describes the framework that was used. The framework has two parts – process and data. The process consists of phases called define, harvest, synthesize and share, and the data consists of student, area, faculty, sub-area, and cluster entities. The framework also describes qualities of great learners including various learning approaches and styles that form the basis for preparing development plans of students. Further, the paper discusses the assessment model, presents feedback collected from the students, and ends with concluding remarks.

Education and Learning

Education is the essence of life. It increases the worth or value of life. In a broader sense, it engenders harmonious development of the physical, mental, moral, spiritual, and social faculties of an individual maximizing sense of fulfillment and creating value for society at large. Further, it creates desire or thirst for knowledge and equips one to apply that knowledge in appropriate ways.

Steve Abram[1] says that information becomes knowledge through learning. This could be extended to say that knowledge becomes wisdom through learning. Learning can use a variety of methods as shown in the pyramid of learning (Figure 1) developed by E. J. Wood of National Training Laboratory, Bethel Maine Campus[2]. The pyramid shows various methods of learning and corresponding knowledge retention rates for average students. Merely attending lectures is the least effective method. Self-reading and use of audiovisuals cause increased retention. Demonstration, discussion, and practice take retention to the next level and teaching provides the best retention. We believe that effectiveness of learning may show the same behavior as retention.

We have proposed some modifications to the learning pyramid as shown in figure 2. Various methods like questioning, reflecting, and experimenting have been incorporated in the Wood's pyramid. However, no attempt is made to give specific numbers for the effectiveness or retention of learning. The pyramid has the least effective method at the bottom which is just passively attending lectures and speeches. That is followed by actively attending lectures - "actively" implying thinking on what is being said and asking questions based on that. This is superseded by intensely reflecting or experimenting and writing notes. At the next level comes smartly linking the concepts learnt to other related concepts, which could be in the same or other subjects. Then comes networking with global experts. This can result in collaboration on real life projects / problems. This is just one step short of the ultimate learning method, which is passionate teaching. Overall, the easiest but the most inefficient method is merely hearing lectures and speeches and the most difficult but the most effective method is teaching.

The knowledge space undergoes continuous churn. Theories undergo incremental or radical changes. For example, light was seen as consisting first of particle, then of wave and now of both particle and wave. So the overall lifelong learning has to also include unlearning and relearning. Alvin Toffler[3], the renowned futurist, says: "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn".

Learning requires thinking that is a multi level activity. Bloom's taxonomy has modeled that very well. It is considered to be a fundamental and essential idea within the education community as noted by H.G. Shane[4]and Anderson and Sosniak[5]. The taxonomy was revised in 2001 from its six levels that were originally devised in the 1950s. It offers a language to qualitatively express different kinds of thinking and provides a way to organize thinking skills into six levels from remembering, understanding, applying, analyzing, evaluating and creating. The taxonomy was adopted by Pohl[6] for classroom planning and is regarded as one of the most universally applied models.

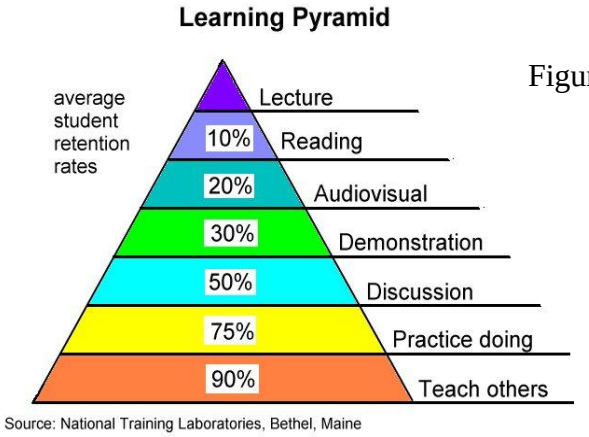

Figure 1: Learning Pyramid

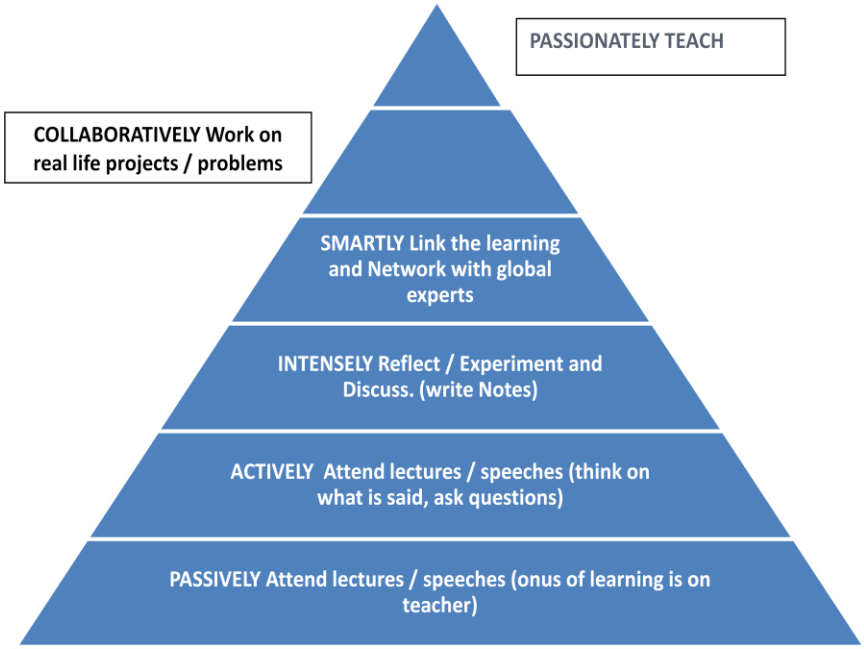

Figure 2: Pyramid of Learning

Learning can happen in a variety of ways as indicated by the learning pyramids and can have different outcomes as explained by Bloom's taxonomy. In both models, the constructs at higher levels provide higher levels of learning. Education traditionally has been operating at the lower levels and must move up. Liberal Learning provides an avenue for that.

Liberal Learning

Liberal Learning [footnote-1] was prevalent even in ancient civilizations. Aristotle had defined it as learning of a free man and emphasized the importance of the spirit in which the learning is pursued. In university systems, it is defined as that part of a student's whole education which looks first of all to his life as a responsible human

[1] Literature talks about Liberal Learning, Liberal Education and General Education. They have different but overlapping meaning and coverage. We have used liberal learning as mechanism of self learning for engineering students in non engineering areas.

being and citizen for larger duration[7]. Moreover, in the system, the goals of liberal education were thought to be separate and distinct from the goals of specialized education. Only recently greater integration of the two has been sought. Echoing the ideas of educational philosopher John Dewey, the Harvard Redbook explicitly addressed the relationship between the goals of general education and preparation for a vocation through specialized study, arguing: "These two sides of life are not entirely separable, and it would be false to imagine education for the one as quite distinct from education for the other…".[7] Today, this thought is gaining wide spread acceptance. Educators are calling on colleges and universities to integrate students' learning across liberal and specialized education, recognizing that the goals of either are not only similar, but often overlapping.[8,9]

Liberal Learning and Engineering Education

In most parts of the world, engineering education started and took roots in early to mid-nineteenth century. It went through, like other specialized streams, the changes with respect to liberal education. Only a few decades ago, it incorporated liberal education in its curricula. Today the engineering educators wholeheartedly agree with statements such as "humanities and social science courses are very important in preparing engineers" and that the undergraduate engineering curriculum should "prepare students to assume community leadership roles."[10.] Cherrice and Klein [11] point out that many of the engineering "grand challenges" require a multi-disciplinary approach and integration of engineering and liberal arts disciplines. While Miller and Olds [12] had discussed the importance of liberal learning for engineers; recently Wheeler and McDonald[13] urged that undergraduate engineering education should form the basis for lifelong learning. Karl[14] also observed that engineering education needs to emphasize technological, interpersonal, and social-technical competence.

Steneck, et.al.[15] assert that Liberal Learning can contribute significantly to many of the ABET program (and other similar programs that are in vogue in different countries) outcomes and is even essential to some of them such as, functioning in multidisciplinary teams, understanding the impact of engineering solutions in global and societal contexts, and life-long learning. Liberal learning broadens students' perspectives and helps them develop as individuals and members of an inclusive society in which their technical products and services are used.

These research findings have brought in significant fortunes to liberal learning. It is increasingly becoming an integral part of engineering curricula all over the world. Leading institutes like Princeton, Yale, and CMU run programs for engineers to help them gain a clear appreciation of technology and the socio-political forces that shape it. While the Indian engineering education system has been slow in adopting the paradigm, an autonomous college has taken the first step by introducing an one credit course on liberal learning to its sophomore students of non circuit branches i.e. mechanical, production, metallurgy and civil.

Liberal Learning at Our College

Literature refers to liberal learning, liberal education, and general education as courses in non-professional areas that are required to develop complete professionals. The courses, it is assumed, are taught like any other courses and therefore do not really help build life-long learning skills. We have attempted a different approach. We have defined Liberal Learning as "self-learning in self-chosen liberal areas with self-defined scope". Unlike a standard course, the course does not have a defined syllabus, identified text or reference books, classroom lectures, and standard examinations. Students define their own syllabus, hunt or harvest for learning resources, study them to develop their own viewpoints (synthesize) and find appropriate ways to share learning with peers.

The focus is more on inculcating life-long learning skills in contrast to ensuring that all requisite non-professional courses are covered. The liberal learning course and the approach adopted have the following benefits.

Building diverse knowledge base

There is sufficient evidence that individuals with diverse knowledge tend to perform better. For example, Mick Pearce, an architect with interest in ecology, had accepted an intriguing challenge from Old Mutual, an insurance and real estate conglomerate, to build in the tropical city of Harare, capital of Zimbabwe, an attractive, functioning office building that did not require air conditioning. His interest in ecology led him to study colonies of termites that store their food at the center of a tower like mound of mud and dirt maintained at around 25 degree Celsius. They do so by constructing mud tubes around the mound and by opening and closing them at different times of the day. Pearce used the same principle along with his architectural expertise to construct the Old Mutual building that saved $3.5m of capital and huge recurring operating expenditure[16]. Tim Brown, the CEO of IDEO, has pointed out the growing need for professionals who are so inquisitive about the world that they're willing to venture into any area. They can explore insights from many different perspectives and recognize patterns across them to serve universal human needs.

Scaling new challenges

The current education system forces students to adopt examination oriented learning and studying, and does not develop knowledge base that is required for scaling real life professional challenges. When they enter the workforce, they face a very different world wherein they encounter unusual and unstructured problems that require different skills and methodologies than they have mastered. Further, they have to learn new topics from various fields on their own without help of a teacher or tutor. They can succeed in doing so if they know the art and science of liberal learning.

Honing Learning Styles

Learning styles are relatively stable preferences students have for ways of receiving and processing information. Many learning style models have been formulated and instruments developed to assess preferences that are benefitting millions of users. Examples of learning styles are: active v/s reflective and visual v/s verbal. Active learners rely on activities while reflective learners take recourse to reflection. Visual learners benefit from visual cues like pictures and charts and verbal learners feel comfortable with words. In real life, we have to use all the learning styles and therefore achieve balance between them. We can rely on our stronger styles to learn difficult areas and hone our weaker styles to learn easier areas. Liberal learning can provide the required opportunities to experiment and bring in the required balance.

Liberal Learning Framework

When you are charting a completely new territory, you require navigational tools to find your way around. In the same way, when you are learning a new topic on your own, you require a framework. Therefore, we developed one for our liberal learning course[17]. The framework is not there to stifle creativity, freedom or excitement of learning something new but is more like a compass to know your location and provide directions so that you can take well thought and smarter decisions to reach the desired place.

Its data elements are student, area, faculty, sub area and cluster as depicted in figure 3. The areas were identified by the college academic leadership and included philosophy, medicine, social sciences, environmental sciences, sports, defense studies. We sought faculty volunteers to mentor the students. The mentors were required to have interest and not expertise in the area. They were also expected to have experience of learning new areas. The sub-areas and external experts were identified by respective area mentors and students. Sub-area students were divided in clusters of about 15 students. They were allocated a faculty mentor, a student convener and a co-convener. With the help of mentors, students decided their individual topics and corresponding focus questions. The purpose of the course was not only to generate reports or effect learning in certain areas but also to create better learners. Students carried out self-appraisal in terms of the attributes of great learners and their learning approaches and styles and prepared a development plan consisting of two strengths for consolidation and two weaknesses for improvement. The attributes used were self-belief, curious and inquiring mind, questioning and listening skills, flexibility / openness, networking, awareness of knowledge expanse, deeper learning approach, enjoy solving challenging problems and balanced learning styles.

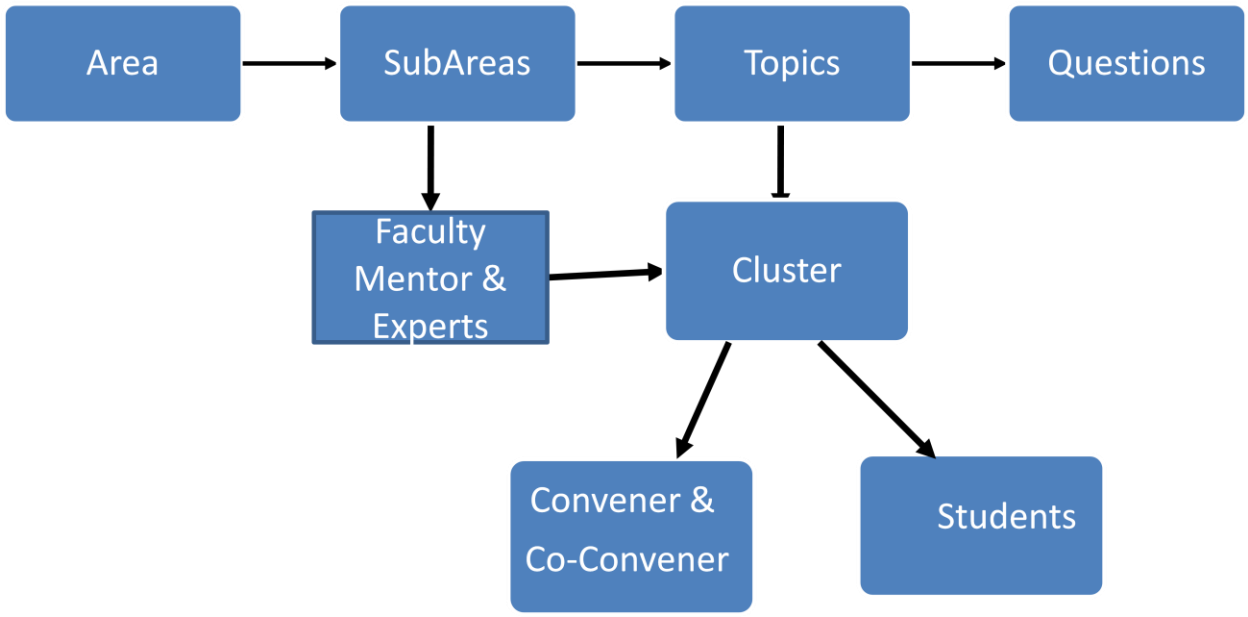

Figure 3: Data elements of the framework

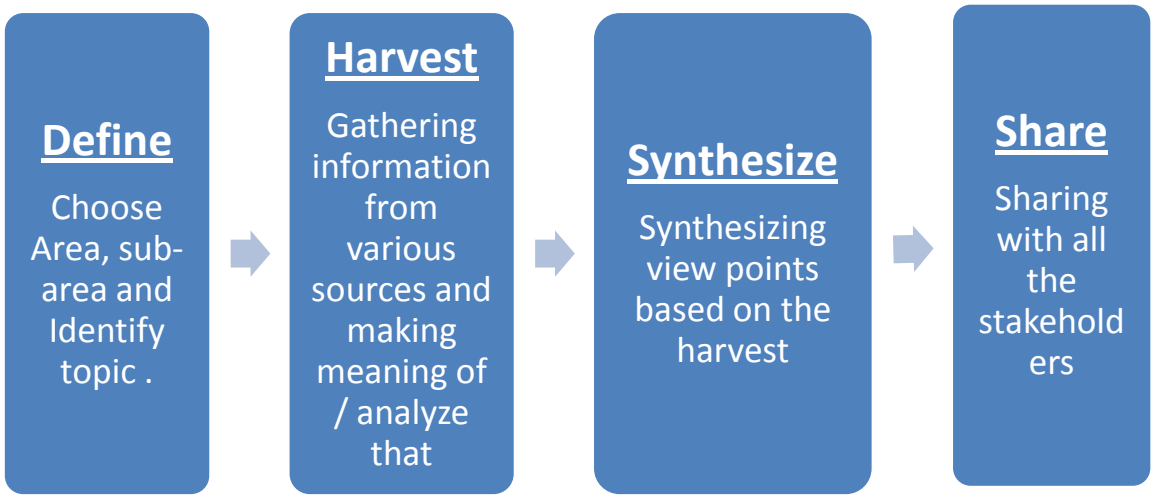

Figure 4: Process elements of the framework

The process elements are define, harvest, synthesize and share as depicted in figure 4.

In the ”define” phase, each student chose an area and a sub-area and identified a topic. The “harvest” phase required them to gather information from various sources and perform meaningful analysis. In the synthesis phase, they were expected to think through a viewpoint based on the harvested information. The share phase entailed presenting the learning contents and experience with the help of reports / articles, presentations, video films. It was recommended that students spend around one week to define, six weeks to harvest, four weeks to synthesize and three weeks to share. All the four phases are elaborated in the next paragraphs.

Define: This consisted of identifying areas, sub areas, topics and focus questions. Students described topics that they liked the most and considered at least three topics before choosing the final one. Once they chose topics, they thought about them for a few days and listed possible questions. They took help of experts, faculty mentors, and others to enhance the question set. The last stage of the define phase was to arrive at five focus questions.

Harvest: After finalizing their topics and the corresponding focus questions, students gathered information through literature i.e. books, journal papers, and newspaper articles. They also contacted the identified experts and interacted with them in person or over the Internet. They also explored media coverage of their topics. They were not mandated but expected to meet their mentors on regular basis. Some of them carried out surveys to get insight into their topics.

Synthesize: Students were expected to put together all the things that they had learnt and understood to create a coherent whole. Such a synthesis was required to be done at information, knowledge, or wisdom levels, but students mostly ended up doing it at information or knowledge level. As an example, gathering information about a particular regime and just organizing it in a particular way is called “information synthesis”. Analyzing the reasons for the fall of a regime and coming up with a new perspective is called “knowledge synthesis”, and performing such analysis for many fallen regimes and arriving at general principles behind such events, is called as “wisdom synthesis”.

Share: The phase was designed to share learning with cluster peers and evaluate performance. We had developed the presentation templates for both mid semester and end semester examination and encouraged to use them. Some clusters also sought written reports and some others included live performances. We had given liberty to use native languages for sharing.

Execution and Results

At the start of the semester, orientation sessions were held for students to explain the background of the course and the detailed execution process. After that they registered for the course and proposed their preferences for different areas. All but fifteen students were allocated their top preferences. The fifteen students, did not get their top preferences because their top areas were chosen by less than 10 students and hence withdrawn. They were provided their next priority areas. The withdrawn areas were agriculture, education, and linguistics that had 9, 6 and 0 students, respectively. Even though many students came from rural background, agriculture was chosen by only a handful. Perhaps they really aspire to be a part of the urban society. Education as a domain has not been attractive resulting in a few takers for it. It was surprising that there were no takers for Linguistics. Literature perhaps might have received better acceptance. The final allocation of students was as per the table given below.

Fine Arts	Busi-ness	Defens e Studies	Environ-mental Sciences	Lingui-stics	Medi-cine	Perform-ing Arts	Philo-sophy	Social Science	Sports & Athletics	Total
Students Allocated	35	41	34	28	20	29	10	44	72	313
Male Students	28	34	29	20	12	16	8	32	70	237
Female Students	7	7	5	8	8	13	2	12	2	77
% Female Students	20%	17%	15%	29%	40%	45%	20%	27%	3%	25%

Table 1: Allocation of students to different areas.

It is interesting to note the overall and gender wise distribution of students among topics. Sports, business, and defense studies earned better patronage. Female students chose traditional areas like fine arts, performing arts and medicine. Although they have chosen engineering career, their extracurricular interest seemed to have followed the stereotypes.

Before the start of the semester, a session was conducted for all the faculty members to explain the course paradigm and the execution process including role of faculty mentors. Volunteers were sought for mentoring different areas. Their choices were as follows:

Area	Fine Arts	Busi-ness	Defense Studies	Education	Environ-mental Sciences	Lingui -stics	Medi-cine	Perform-ing Arts	Philo-sophy	Social Science	Sports & Athletics
Total Faculty	2	4	3	3	2	1	2	7	4	7	0

Table 2: Number of faculty volunteered for different areas

There was a clear mismatch between choices of faculty and students. Faculty members did not appear keen on field topics like Sports. So, some of the faculty members who were active in sports were requested to take on mentoring roles. Since this was a voluntary effort and required adapting to a new paradigm and process, we announced that certificates would be conferred on faculty members who completed the mentoring.

Once the faculty mentors were enlisted, they had meetings with their area students and arrived at various sub areas and topics, and prepared lists of external experts. These meetings also resulted in the formation of clusters of about 15 students each and identification of conveners and co-conveners.

The course did not include contact hours and was completely executed over Moodle (an online learning management system). Many students were new to the system and hence required hand-holding and follow-up. We developed a departmental dashboard to observe students' progress through various stages like Moodle registration, topic definition, self-appraisal and development plan preparation. We sought graduate students to coordinate the course execution in their departments and own the dashboards. They, in general, provided valuable support.

We requested faculty mentors to announce a weekly meeting time to their students. While all faculty members did that, very few students actually met their mentors. Of course, such meetings were optional.

The mid-term examination was declared over Moodle. Initially, we faced poor attendance. Then students were informed through emails, class meetings and notice boards about the examination schedule and that there would be no re-examination. The subsequent areas immediately saw better attendance.

All participating classes were visited twice in the semester to discuss the course process with the students and to address their questions and suggestions. In the first meeting, we had to explain the course communication process that was relying on emails and Moodle and urge them to get used to the new system. In the second meeting, we had to instruct to bring in more openness and subjectivity in their focus questions and encourage them to expand their circle of experts beyond friends, relatives and coaches.

The assessment method is shown in table 2. In the mid-semester exam the choice of topic and harvest were evaluated with a small weightage for sharing skills, and in the end- semester examination all aspects except choice of topic were assessed. For both examinations peer evaluation technique was recommended. Almost all the clusters followed this technique. Some of the faculty mentors tried other models such as, asking students to provide handwritten reports and demonstrate their skills especially in the arts areas.

Aspect	Elements	% Weightage	Mid Sem	End Sem
Choice of topic	Novelty, Relevance, Reasoning, Process	5 %	5 %	0 %
Harvest	Comprehensiveness and diversity of the study	25 %	20 %	5 %
Synthesis	Originality of the viewpoints, Value of the viewpoints	30 %	0 %	30 %
Sharing	Methods of sharing, effectiveness of the sharing	30 %	5 %	25 %
Becoming great learner	Plan and result of the plan	10 %	0 %	10 %
Total		100 %	30	70 %

Table 3: The assessment model

The following rubrics for presentation, harvest, synthesis and development plan, respectively were used.

(Very Poor) -0	(Poor)-1	(Neutral)-2	(Impressive) -3	(Role Model)- >4
Very bad Slides, Very poor start and closure. No eye contact at all. Total lack of confidence (I want to get out asap)	Bad Slides. Poor start and closure. Very little eye contact. Defensive body lang (taking support,, hands in pocket)	Everything just Ok but no pull factor. Ok start – No issues but no engaging start either. Ok closure. Action plan may not be right. Little eye contact. Rigidity.	Very good slides. Pull Factor. Engaged audience. Good closure, QA handling and action plan. Good eye contact. And defensive body lang.	Excellent slides. Engaged audience right from the start. Impressive closure, excellent handling of QA and Action Plan. Excellent eye contact. Exuding confidence.

Table 4: Rubric for evaluating presentation

(Very Poor) -0	(Poor)-1	(Neutral)-2	(Impressive) -3	(Role Model)- >4
No reading of books, papers / articles., no contact with experts.	Limited reading (< 3) of books and papers / articles with not so good understanding ., Limited contact / discussion with an expert	Ok reading (< 5) of books and papers / articles with just ok understanding, Ok contact/ discussion with 2 experts and just ok outcome.	Very good (< 10) reading of books and papers / articles with complete understanding . Very good contact/ discussion with 3 experts with excellent outcomes	Allround and in depth reading (> 10) of books and papers / articles with superb understanding. Excellent contact/ discussion with 4 experts with exceptional outcomes.

Table 5: Rubric for evaluating harvest

(Very Poor) -0	(Poor)-1	(Neutral)-2	(Impressive) -3	(Role Model)- >4
No synthesis at all.	An attempt to synthesize with poor outcomes.	Synthesized at informational level (just organized info)	Synthesized at knowledge level with ok outcome	Synthesized at knowledge level with impressive outcome

Table 6: Rubric for evaluating synthesis

(Very Poor) -0	(Poor)-1	(Neutral)-2	(Impressive) -3	(Role Model)- >4
No development plan was prepared	Development plan was prepared but not executed .	Ok execution of dev plan. Do see some improvement .	Good execution of the dev plan. Do see good improvement	Excellent execution of dev plan. Do see excellent improvement

Table 7: Rubric for evaluating development plans

The final evaluation of these 314 students was as follows;

Grade	AA	AB	BB	BC	CC	CD	DD	FF
Students	56	79	75	40	41	5	5	12

Table 8: Final Grades

It has followed a bell shaped curve that is skewed towards the left. All evaluations were normalized to make sure that the grades were spread uniformly across the spectrum.

We are reproducing a few sample studies to provide flavor of the course.

Area	Sub Area	Topic	Focus Question 1	Focus Question 2	Focus Question 3	Focus Question 4	Focus Question 5
Social Science	History	Partition of India	What was the situation before partition of India?	What were the causes of the partition?	How did the partition take place?	What were the effects of the partition on Hindustan and Pakistan?	What were the feelings of citizens in India and Pakistan?
Sports	Other Sports	Rowing	What is the history of rowing?	What is Perfect rowing technique? Why?	Why rowing so popular in India compared to other countries?	What should we do or contribute to improve rowing in India?	What are the different types of rowing boats and what are the parameters for designing of a rowing boat?
Defense	Sub-Area 3	War and Economics	What was effect of World war II on world economy ?	What was effect of oil war on prices of oil ?	What was effect of cold war and decline of USSR on war world economy ?	What was effect of China war on Indian Economy ?	What was Effect of Kargil war on Indian economy ?

Table 9: Sample studies

A total of 123 students filled in the feedback form that consisted of two questions, one thing that they liked about the course and one thing they disliked. Figures 5 and 6 present the consolidated feedback:

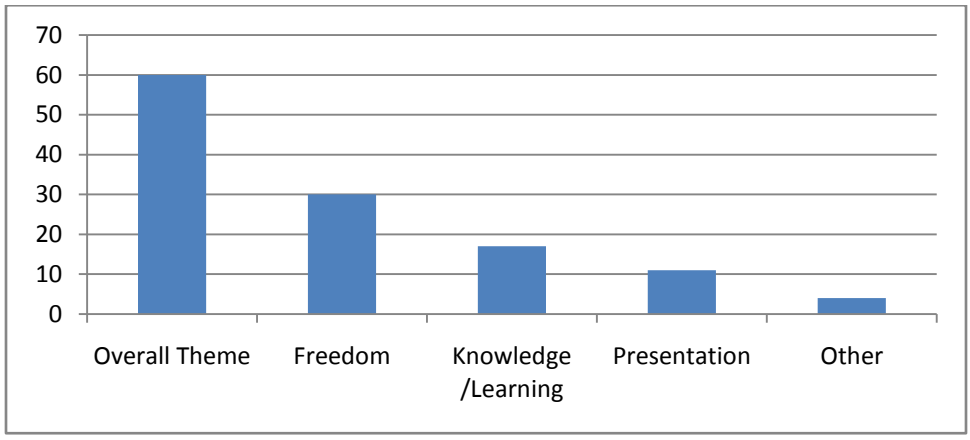

Figure 5: One thing that students liked about the course.

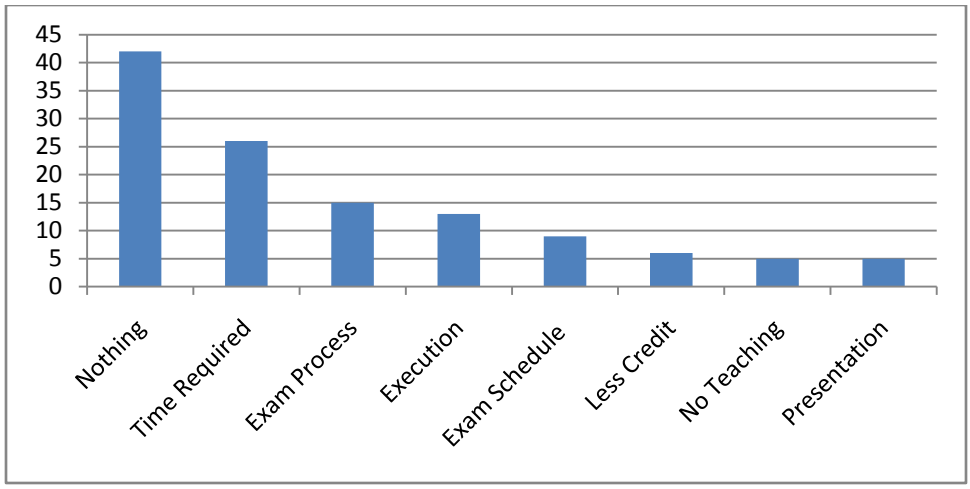

Figure 6: One thing that students disliked about the course.

Students seem to have liked the course and its approach. Besides the overall theme, they liked the freedom offered to them to choose topics and opportunities to make presentations. Interestingly, one third of the students who provided feedback did not dislike anything. Some of them wanted more time and more credit for the course which can be considered as positive feedback. The way the examination was conducted and scheduled seemed to have made some students unhappy. Some of them wanted a standard written examination or an oral interview for the course. The comments related to execution were about lack of experts, not being able to find the right area / mentor, less practical approach, use of Moodle and inadequate understanding of "synthesis". Some students wanted regular instruction for the course and some others disliked the presentation part. Most of the faculty enjoyed mentoring the course and suggested regular meeting schedule with the students for future iterations.

Conclusion

There is no doubt about the criticality of lifelong learning skills in diverse areas. A liberal learning course certainly offers a good solution for that. For such a course, given the existing K-12 education system, students do require guiding framework. We implemented the course using a framework resulting in a successful course as indicated by the feedback of students and faculty mentors. Since this was a new paradigm, we wanted to pilot it on a smaller population. However, we did not have that luxury and had to administer the course for a cohort of 300+ students spread over 4 departments. The 35 faculty mentors represented almost all the 12 departments. Overall it was a big change management exercise that took place quite smoothly. We did face some challenges. Some of the students could not understand complex concepts like development plan and synthesis. It took significant efforts to educate students on the modalities of the course which did not have regular contact hours and which relied on an application like Moodle for its communication requirements. Going forward, we will have to take care of the challenges to reap more benefits from the course. We are planning to include contact hours in the next iteration of the course and will have to ensure that the faculty members do not teach but just facilitate learning during the contact hours. There is good potential to analyze choices of the areas and student performance with respect to determinants like gender, grade point average, social background, and self-appraisal with respect to learning attributes of the students.

Acknowledgements

Our colleague, Prof B N Chaudahri initiated the idea of introducing the course and provided wholehearted support in its execution. The senate approved the course and the execution process and encouraged the faculty members to take on mentoring roles. Many faculty members volunteered and spared their valuable time to mentor students. We acknowledge their contribution and sincerely thank all of them. We also would like to thank Mr. Abhay Joshi for bringing in linguistic improvements in the paper. We are grateful to the anonymous reviewers of the paper and Prof Atsushi Akera, the chair of the ASEE-LEES division for their insightful review comments.

References

[1] Steve Abram, "Getting Out in Front of the Curve", http://www.theconferencecircuit.com/2011/06/13/steve-abram-getting-out-in-front-of-the-curve/, 2011
[2] E J Wood, "Problem-Based Learning: Exploiting Knowledge of how People Learn to Promote Effective Learning", BEE-j Volume3: May 2004
[3] Toffler Alvin, Heidi Toffler , Rowan Gibson, "Rethinking the Future: Rethinking Business Principles, Competition, Control and Complexity, Leadership, Markets and the World", Nicholas Brealey Publishing; New edition, 1997
[4] Harold G. Shane, " Significant Writings That Have Influenced the Curriculum: 1906-81", The Phi Delta Kappan, Vol. 62, No. 5, Diamond Jubilee Issue — Education: Our Heritage and Our Future (Jan., 1981), pp. 311-314
[5] Anderson LW, LA Sosniak, " Bloom's taxonomy: A forty-year retrospective. Ninety-third yearbook of the National Societyfor the Study of Education", Chicago: University of Chicago, 1994
[6] Pohl, 2000, "Learning to Think, Thinking to Learn", pp. 7-8
[7] The Harvard Committee on the Objectives of a General Education in a Free Society (1945). General education in a free society: Report of the Harvard Committee. Cambridge, MA: Harvard University Press., 1945
[8] Stark, J. S. and Lowther, M.A. (1988). Strengthening the ties that bind: Integrating undergraduate liberal and professional education. Ann Arbor: Regents of the University of Michigan.
[9] Shulman, L. S. (1997). Professing the Liberal Arts. In R. Orrill (Ed.), Education and democracy: Re-imagining liberal learning in America. New York: The College Entrance Examination Board.
[10] Harper Betty, Lattuca Lisa, Yin Alexander, Terenzini Patrick, "Liberal Education For The Engineer Of 2020: Are Administrators On Board?", ASEE 2010
[11] Traver Cherrice, J. Douglas Klein, "Integration Of Engineering And The Liberal Arts: A Two-Way Street", ASEE 2010
[12] Miller Ronald L., Olds, Barbara M "Connections: Integrated First Year Engineering Education at the Colorado School of Mines", 1995 IEEE Frontiers in Education Conference.
[13] Wheeler Edward, Mcdonald, Robert L., " Writing in Engineering Courses," October 2000 Journal of Engineering Education 481-486
[14] Karl, Smith, "Structuring learning goals to meet goals of engineering education", Engineering educator Dec 1981 p 221-26
[15] Steneck, Nicholas H, Olds Barbaaa, Neeley Kathryn, "Recommendations for liberal education in engineering: A White Paper from the Liberal Education Division of the American Society for Engineering Education" ASEE June 2002
[16] http://www.architectsforpeace.org/mickprofile.php
[17] Pradeep Waychal, "Liberal Learning handbook", College of Engineering, Pune, India, 2012