Assessing Undergraduate Engineering Programmes using Alumni Feedback

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Abstract: A survey was conducted among the alumni of various engineering colleges affiliated to a technical university located in the eastern part of India. The survey intended to obtain alumni responses on three aspects – alumni's own assessment on the attainment of learning outcomes from the curricular components; their views on the requisite knowledge and skills essential for an engineer to perform effectively in the workplace; and their opinion on the additional curricular components that could enhance the students' employability skills. The results reveal that the respondents are dissatisfied with the learning outcomes they attained from the curriculum components. The respondents also perceive that adaptability, stress management, lifelong learning and teamwork are the key skills that need be acquired by an engineer. Additionally, they also opine that work-connected learning, group projects and career advice are some other curricular features that could enhance students' employability skills.

Keywords: alumni, assessment, curriculum, technical skills, soft skills, engineering graduates

1. Introduction

The primary objective of engineering education is to instil appropriate engineering knowledge and skills onto the students so that they are able to function as effective engineers during their professional career. This education also strives at providing knowledge that infuses certain skills and training aiding towards lifelong development, thus producing engineers who would be assets in today's volatile conditions the world over. But understanding whether this key objective is being achieved or not on a continuous basis, can only be learnt through proper assessment methods. Assessment focusing on learning outcomes of engineering programmes has today become an imperative measurement factor for quality improvement in engineering education. Providing quality engineering education involves many factors. The important ones are – proper infrastructure facilities and learning resources, relevant course design, effective pedagogical approaches and teaching evaluation, learning outcomes (knowledge, skills and abilities) acquired by students, students' achievements, positive and valuable learning experiences provided to the students, research and development facilities, training and placement opportunities, and scope for regular industry-institute interface both for the students and the faculty. These quality factors are also routinely measured by engineering accreditation agencies or boards for engineering programme accreditation.

Assessment of learning outcomes and quality of engineering programmes can be accomplished with the participation of several stakeholders namely, students, alumni, teachers, and employers. Employers' expectations from fresh engineering graduates, students' satisfaction and perceived learning outcomes, alumni feedback are some of the aspects that help the engineering educators to design, restructure, improve and deliver quality engineering education, thus leading the institutions on the path of growth and excellence.

This article discusses the role and significance of alumni participation in improving quality education by analysing their views on the attainment of the requisite technical and soft skills from the curriculum during their engineering studies. The paper also reviews the views and suggestions given by the alumni from the perspective of their own experience in improving the students' skills in the long run.

2. Related Studies

A robust liaison with the alumni community is imperative and integral for the development of any academic institution because the benefits are perceived to be more. The role of alumni in engineering education is indispensable and their viewpoints add more benefit to curriculum enhancement and acts as an indicator for measuring the quality of teaching. Alumni participation and feedback thus is a chief factor affecting university and college rankings. Alumni have always been obligated to their alma maters by extending their help and support to their fellow-graduates to get the first jobs.

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Impact of alumni achievement on academic institutions is always high as they are the ones who build up the reputation of the institutes. Successful and well-known alumni are role models for the students of their alma maters, irrespective of the period when they graduated. The alumni occupy a distinct

position to appraise the efficacies of their studies in their profession. As experienced engineers they are well aware of the attributes required of fresh engineering graduates to excel in their professional careers. Without active alumni participation and recommendations from them, the engineering curriculum assessment and enhancement can never be complete and successful. The alumni also develop the industry involvement in academic institutions by providing projects that benefit both industry and academia (Gallo, M. 2012; Ebert, & Harbor, 2015; McAlexander & Koenig, 2001; Puerzer & Rooney, 2002). Academic institutions must enhance and establish a strong link with industry for better academic output and productivity. Institutions must therefore invest time in alumni relations, so that the 'one-time students become lifelong customers.' Alumni are also the 'source of fund raisers'. They do word-of-mouth marketing of their alma maters among their professional and social contacts. They are the brand ambassadors of their institutions at both national and international level. They spread the knowledge and skills gained from their institutions among their social and professional networks (Puerzer & Rooney, 2002; Heywood, 2005). Therefore, institutions must maintain the communication network with alumni and must make them an integral part of the institution. "Alumni are not the part of the institution's past; instead, they are the part of the institution's future" (Gillian Saunders-Smitsa & Erik de Graaffb, 2012).

Students are extensively acknowledged as the most important stakeholders followed by employers and alumni in the assessment of learning outcomes. In general, employers get inducted into the different institutes and universities as a member in the Board of Governors as a representative from Industry. Employers have forever been playing a crucial role in assessment of learning outcomes. But the stakeholder that is often unnoticed in assessment is the alumni, the graduates of the institute concerned (McMasters & Cummings, 2003; Skari, 2014). Alumni are the most valuable resources of any academic institution. To improve the academic excellence of the institution the contribution of alumni is crucial. At all times, alumni and their achievements boost the reputation of their alma maters. In addition, alumni are known to put forth their influence favourably through the alumni networks to promote their institutions. But, previous studies reveal that engineering institutes do not seem to make full use of the potential of their alumni, and alumni network (Gillian Saunders-Smitsa & Erik de Graaffb, 2012; Heywood, 2005).

Heywood (2005) even calls the alumni as mentors of the existing curriculum since many of them head or would be heading positions that recruit fresh engineering graduates, or work with them or guide and train them. In addition, with their wide engineering experience they can provide feedback on the quality and effectiveness of the existing curriculum. Alumni feedback helps in changing the pattern or structure of an existing curriculum and giving shape to a new one. Further, the author also suggests that alumni are well-acquainted with the skills and knowledge that future engineers should possess to function as successful professionals. Yet oddly, studies on alumni have received less area of attention in engineering educational research. This type of research study gained its importance only in the late 90s in United States of America with the preamble of ABET criteria (Pinelli, 1995; Gallo, 2013; ABET 2000). The report of Shoemaker (1998) claims that till 1998, no conference was held on alumni related research in United States of America.

A study by Heywood (2005) conveys that the author could not find any formal alumni research in engineering education, with an exception of exit questionnaires in the European context. Compared to other countries, India is lagging even further behind when it comes to alumni related research. The National Board of Accreditation (NBA) is an accreditation board of India that recognizes and recommends the institutions to take inputs from the alumni (NBA, 2014). But studies on alumni related feedback are very few and far between.

3. The Current Study

A survey was conducted among engineering alumni of a technical university located in the eastern part of India. The alumni graduated between 2014 and 2018 took part in this survey. Administration of the questionnaire was done by the authors over a period of three and half months, from the 1st week of December 2019 to mid of March, 2020.

The most extensively used tool in collecting data in research is questionnaires. Chivore (1992) describes that questionnaire is a document consisting of questions designed to acquire information from the sample participants in survey research. This study used questionnaires as an instrument for conducting and collecting data from the alumni participants. A web-based survey was conducted using Google forms and participants were asked to fill up the entire questionnaire. The e-mail ids were randomly collected from the database of the parent university and were approached using these electronic mails. The mails were sent to 1647 alumni who had studied engineering to one particular state university. A total of nine hundred and eighty (980) alumni participated and responded to the questionnaire after four repeat reminders were sent to all the alumni. The response rate of the participants was thus 59.50%. The response rate can be considered quite good considering the fact that online response to survey questionnaires is usually low, and 'less likely to achieve response rates as high as surveys administered on paper' (Nulty, 2008).

Content Validity and Reliability of the Study Instrument

Questionnaires were prepared after extensive literature review relating to research articles, research method books, and prior studies on related topics, and after due consultation with the panel of experts. The survey instrument was validated and reviewed by a panel of experts. The panel of experts consisted of accreditation agencies, academic heads, and administrative and management experts from engineering institutions who had expertise in statistical techniques for the study at hand and had research experience of utilizing questionnaires as research tools. The sample questionnaire was sent to the expert panel to obtain their reviews independently and the identity of the other

reviewers was not revealed to any reviewer aside from the authors. An evaluation form was sent to all the reviewers, along with the sample questionnaire to examine, and comment and rate the questionnaire, and its contents.

4. Research Objectives

Following are the key research objectives that have been addressed in the study –

1. To assess the curriculum components that have aided the alumni to acquire the requisite technical skills and soft skills, during their engineering studies.
2. To review the requisite skills and knowledge required to be possessed by the engineering students so that they are able to succeed in their professional career.
3. To suggest the measures that can help the universities to assist the engineering students to improve their skills and knowledge in the long run.

5. Framework of Survey Instrument

The survey used a questionnaire as an instrument to collect data from the alumni respondents. To measure the questionnaire items a five-point Likert type scale was used. It had four sections:

- Section I accessed the respondents' profile such as name, branch of graduation and years of work experience.

- Section II collected information on the opinion of the alumni on attainment of technical and soft skills from their engineering curriculum. Six (6) items were listed and participants were asked to choose their option separately for technical skills and soft skills. A five point Likert type scale was used to measure the items. Options were None, Little, Some, Much, and Very much.

- Section III gathered information on the requisite knowledge and skills to be acquired to succeed as an engineer. From prior studies the authors gathered twenty (20) items relating to skills and knowledge that were listed using a five-point Likert type scale ranging from, Not important to Very important. The scale values were; Not important, Somewhat important, Not sure, Important, and Very important.

- Section IV had a list of five items seeking the opinions of the alumni on the programs that can prepare the students to possess employability skills for success in the long run. Not at all, Little, Some, Much, and Very much were the scale values used to gauge the questionnaires of this section.

6. Reliability and Content Validity of the Instrument

A descriptive survey design was used to find the study results. Descriptive survey design is usually preferred for collecting data relating to accessing opinions, perceptions and attitudes if the population is too large to observe directly. Maree (2007) hold the view that descriptive survey research design facilitates the researcher to gather all information, and it can be used to study the views or opinions of the participants in detail when the population is large. The data received from the respondents were analyzed using Statistical Package for the Social Sciences (SPSS) software version 20. The study used descriptive statistics to analyse the data received from the respondents. Cronbach's alpha was used to check the instrument's internal consistency and reliability. The reliability coefficient of theassessment on attainment of technical and soft skills from the curriculum was found to be 0.74, requisite skills and abilities for an engineer, was found to be 0.79, and programmes to improve students' skills in the long run was found to be 0.80. If the range of all the items is in the range of 0.65 and above, it confirms to the accepted level of reliability (George & Mallery, 2003). The values found in the study items thus conform to the accepted level of reliability.

7. Results and Discussion

The engineering disciplines from which the respondents belonged to were, Computer Science and Engineering (34%), Electronics and Communication Engineering (28%), Mechanical Engineering (22%) and Civil Engineering (16). The study sample comprised of alumni respondents who had experience of one year and above five years. The response rate received from fresh engineering graduates with one to two years of experience was 33%; 36% respondents had experience of three to four years, and 31% respondents had five years of experience or more.

A. Assessment on attainment of learning outcomes (technical and soft skills) from the curriculum components

Table 1 Assessment on attainment of technical skills from the curriculum components

	Scale values [1 – 5]				
Items	**None**	**Little**	**Some**	**Much**	**Very much**
Core subjects	-	-	30%	31%	39%
Professional electives	-	9%	27%	57%	7%
Free electives	24%	31%	1%	18%	11%
Project work	-	-	13%	30%	57%
Seminar presentations	-	-	37%	42%	21%
Laboratory experiments	-	-	55%	30%	15%

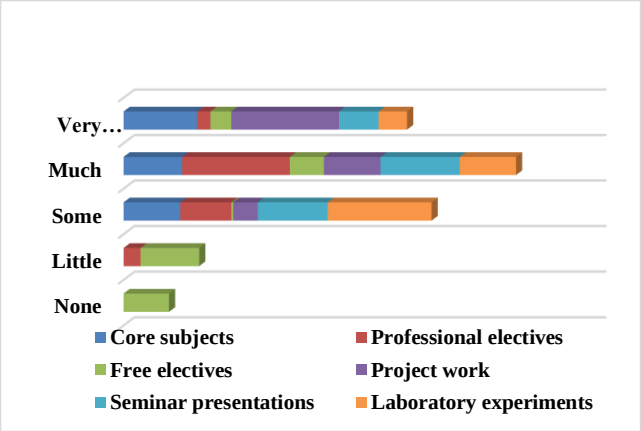

Fig. 1 Assessment by alumni on curriculum elements in attainment of Technical skills

Table 2 Assessment on attainment of soft skills from the curriculum components

Scale values [1 – 5]					
Items	**None**	**Little**	**Some**	**Much**	**Very much**
Core subjects	15%	70%	3%	9%	3%
Professional electives	40%	48%	9%	3%	-
Free electives	15%	46%	27%	12%	-
Project work	-	9%	4%	27%	60%
Seminar presentations	-	-	15%	6%	79%
Laboratory experiments	-	9%	61%	24%	6%

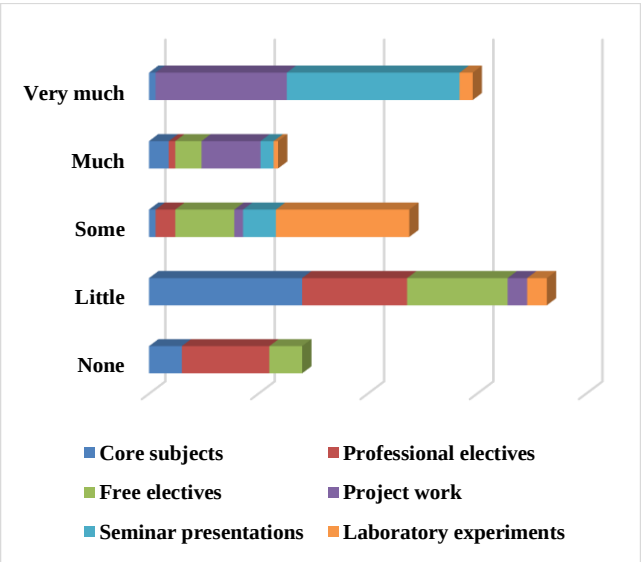

Fig.2 Assessment by alumni on curriculum elements in attainment of Soft skills

The findings from Fig. 1 and Table 1 show that 39% of the alumni agreed that core subjects "very much" helped and 31% agreed that it "much" helped in acquiring technical skills during their four year of engineering studies. But, 30% of respondents agreed that to "some" extent only the core subjects prepared them to acquire technical skills. A very high percentage of alumni (70%) felt that contribution of core subjects was "little" in acquiring soft skills. The results indicate that the engineering graduates were not content with the core subjects offered in the curriculum. The results tell us that a majority of the alumni (39%) are of the opinion that the core subjects "very much" helped and 31% have agreed with "much". But a substantial 30% have responded that the core subjects have helped them only to "some" extent. Additionally, 'core subjects' has scored highest percentage of 70% for the scale value "little" in the attainment of soft skills. Fig. 2 reveal that 'core subjects' is the only item which scored the highest percentage for "little" in the attainment of soft skills. Overall, the findings mirror that the engineering graduates were not fully content with their attainment of technical skills from the 'core subjects'. In attainment of soft skills, 15% have opined that they have not benefitted from the core subjects and majority of them (70%) have responded that the contribution of core subjects was "little". Thus the findings of Table 3 suggest that the engineering graduates are not content with the core subjects that they studied relating to attainment of soft skills.

The results also show a similar trend relating to professional electives. The respondents have pointed out that the contribution of professional electives was "much" (57%) and "little" (48%) towards acquiring technical and soft skills respectively. A majority of the respondents share the view that subjects under free electives contributed "little" to technical skills (31%), while contributing a good 46% towards soft skills attainment. Professional electives scored only 7% for the scale value "very much" (Fig.1) in attainment of technical skills which is 32% less compared to the core subjects' contribution in the scale value "very much" (Table 1). Professional electives received highest percentage (57%) for "much" and 27% for "some" with a variance of 30%. This 30% variation matches with the scale values of "very much", "much", "some" (Table 1) scored by the core subjects. The response rate of respondents on the subject of technical skills attainment communicates that more than half of the graduated respondents were quite content with the subjects they had studied under professional electives since the results show that the response rate in attainment of technical skills from professional electives are rather similar when compared with core subjects.

Fig.2 illustrates that in attainment of soft skills, 'professional electives' received negative scores from the engineering graduates such as 40% and 48% for "none" and "little". It also received the highest percentage (40%) for the scale-value "none". Furthermore, the percentage gap between "none" and "little" is 8% only. The findings of Table 2 reveal that in attainment of soft skills the engineering graduates are highly dissatisfied with the subjects they studied under professional electives category. In general, the university offers a wide range of inter-disciplinary subjects as free electives and the students get a choice to opt for the subjects they prefer to study as free electives. In attainment of soft skills, free electives received the highest response of 46% for "little" (Table 2). In attainment of technical skills, this particular component scored 31% for "little". Figures 1 and 2 also tell us that 'free electives' is the single component that received highest percentage in attainment of technical and soft skills under the scale value "little". Furthermore, it is noted that among all the components, 'free electives' alone received negative score of 24% for "none" in attainment of technical skills. These findings of Fig.1 and Fig.2 indicate that free electives and professional electives are the only two curriculum components that occupied first and second positions as per the scores they received for the scale value "little," in attainment of technical skills. Even though the students get a chance to choose subjects of their own choice to study as free electives, yet the findings show that the engineering professionals are dissatisfied with the subjects they studied as free electives during their college days. In this regard, the authors feel that the engineering graduates were either not able to decide properly about the subjects to study under free electives, or the choice subjects that were given to them were not relevant to real-life applications. Our interaction with the alumni revealed that though the university offers a range of subjects, but in most cases, the concerned engineering department decides, informs, and suggests the students to opt for a specific subject, which might or might not be useful for them. The main reason for this is the lack of adequate number of faculty members in colleges, in addition to a shortage of faculty members teaching a particular subject, which forces the colleges to offer a limited number of free electives to the students. This could be the reason why free electives earned very poor response rate in preparedness of graduates in acquiring technical and soft skills.

In technical skills aspect, project work received the highest response rate of "very much" (57%) and the scale value "much" received 30% of responses. Around 60% respondents agreed that they acquired soft skills while executing project-related work. Like project work, seminar presentation is a key curricular feature for engineering students. Students must prepare a theme related to their discipline and present the seminar using visual aids in the presence of subject experts. Seminar-presentation preparation involves certain activities such as choosing the appropriate theme, collecting the necessary materials connected to the chosen theme, presenting an open seminar in the department, and submission of a seminar report for evaluation to the Department Academic Committee (DAC) of each of the concerned engineering discipline. Overall, the skills that students tend to develop from seminar presentations are writing skills such as report writing or technical write-ups, discipline-specific knowledge, technical knowledge, self-learning, oral skills or presentation skills, self-confidence, and exposure to certain current tools and techniques relating to their disciplines. Figures 1 and 2 convey that 79% respondents agreed that their soft skills are "very much" developed from seminar presentations. The authors observe that the response rate received for the contribution of seminar presentations in attainment of soft skills at 79% is reasonably high compared to all other curriculum components. Another interesting observation is that 37% respondents were "not sure" whether they acquired technical skills from seminar presentations, while 42% felt they acquired "much" and another 21% agreed with the scale value "very much".

Laboratory experiments are a major pathway for acquiring knowledge and skills. During laboratory experiments, students conduct experiments and work in teams with their peer groups. Often students get an opportunity to learn from their errors while conducting laboratory experiments, and consequently their technical knowledge and skills develop. In the present study, 55% respondents were "not sure", while 30% respondents "much" agreed that they acquired technical skills from laboratory experiments. But a substantial 61% respondent was "not sure" and 24%acknowledged that they achieved "much" soft skills from laboratory experiments. It is interesting to note here that quite a high percentage of respondents were "Not sure" about the contribution of laboratory experiments in attainment of both technical as well soft skills.

B. Requisite knowledge and skills required to be a successful engineer

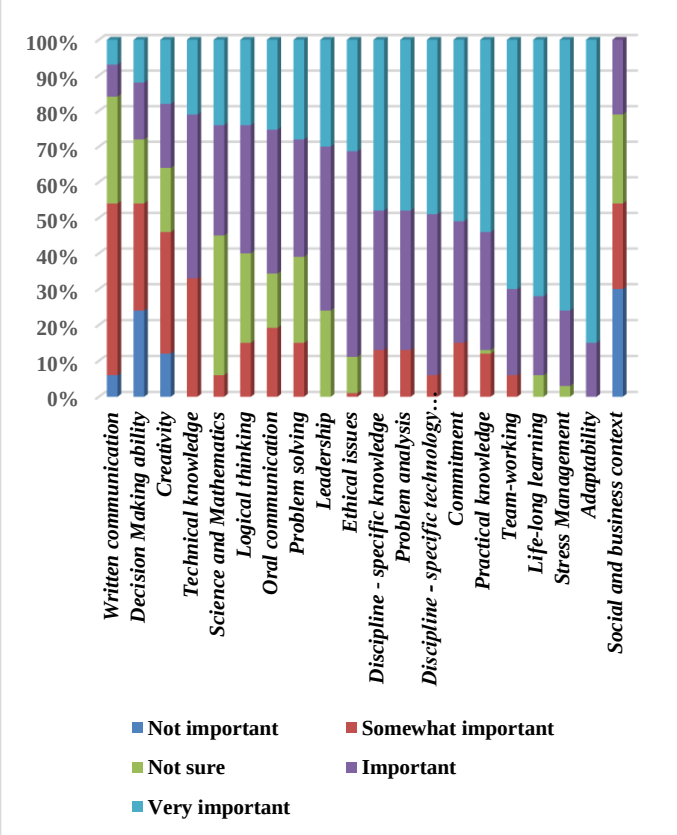

Fig. 3 Requisite knowledge and skills

Table 3 Requisite knowledge and skills to be acquired to succeed as an engineer

Scale values [1 – 5]					
Items	**1**	**2**	**3**	**4**	**5**
Written communication	6%	48%	30%	9%	7%
Decision Making ability	24%	30%	18%	16%	12%
Creativity	12%	34%	18%	18%	18%
Technical knowledge	-	33%	-	46%	21%
Science and Mathematics	-	6%	39%	31%	24%
Logical thinking	-	15%	25%	36%	24%
Oral communication	-	19%	15%	40%	25%
Problem solving	-	15%	24%	33%	28%
Leadership	-	-	24%	46%	30%
Ethical issues	-	1%	10%	57%	31%
Discipline-specific knowledge	-	13%	-	39%	48%
Problem analysis	-	13%	-	39%	48%
Discipline-specific technology & tools					
Commitment	-	15%	-	34%	51%
Practical knowledge	-	12%	1%	33%	54%
Team-work	-	6%	-	24%	70%
Life-long learning	-	-	6%	22%	72%
Stress Management	-	-	3%	21%	76%
Adaptability	-	-	-	15%	85%
Social and business context	30%	24%	25%	21%	-

1-Not important 2- Somewhat important 3- Not sure 4- Important 5- Very important

Table 3 and Fig. 3 exhibit the findings relating to necessary knowledge and skills required to be a successful engineer. Eighty-five percent (85%) of alumni participants agreed that the ability to adapt to the situations or contexts, otherwise called adaptability, is a "very important" ability needed to be possessed by an engineer. Stress management (76%), lifelong learning (72%) and teamwork (70%) occupied second, third and fourth positions as "very important" abilities/skills required for an engineer. The percentage of these three items falls under the range of 70% to 76%. The percent of response rate received for the scale value "very important" for adaptability, stress management; lifelong learning and teamwork is observed to be quite high. These items can be viewed as interrelated skills. In this 21st century, the role and responsibility of engineers are enormous. They are expected to possess multiple skills to address the global demands and needs. Therefore, acquiring additional skills is a lifelong learning process that is required from an engineer. In addition, ability to work effectively in teams is essential to plan, build and execute engineering projects. Due to change of work place and work culture, work pressure or domestic problems, engineers often suffer from stress (Meenakshi & Mohanty, 2017). To cope with these stated issues, engineers must prepare themselves to manage and overcome their stress. The findings from this study matches with the findings from a previous study conducted by the authors (Meenakshi & Mohanty, 2017). The previous study had discussed from the engineering students' perceptive, while the current one has focuses on the alumni perspective.

Knowledge on ethical issues scored "important" (57%) and "very important" (31%). This indicates that more than half of the respondents agreed that an engineer must acquire knowledge on ethical issues. Forty percent (40%) alumni selected technical knowledge, and 45% chose leadership as "important". Both, knowledge of discipline specific technology and tools, and oral communication share the equal proportion of 46% as "important" for an engineer to acquire. Forty-nine percent (49%) voted "very important" for knowledge of discipline specific technology and tools. The response rates received by this item (knowledge of discipline specific technology and tools) communicate that in this information technology age since a large number of technologies and tools related to engineering evolve continuously, the engineers are expected to keep themselves updated about them. More than half of the respondents felt

that practical knowledge is "very important" (54%) and "important" (33%). From Figure 3, it is observed that practical knowledge and knowledge of discipline specific technology and tools received high response rate in total for the scale values "very important" and "important", next to adaptability. Adaptability scored 100%, while practical knowledge and knowledge of discipline specific technology and tools scored 87%. Only this particular item received highest response rate for the scale values "very important" as well "Important" correspondingly.

Fifty-one percent (51%) respondents agreed that commitment is "very important" and 34% agreed it to be "important". Tables 2 and 3 reveal that 55% respondents were "not sure" that they acquired technical skills from laboratory experiments. On the other hand, Table 3 reveals knowledge of discipline specific technology and tools as "very important," and agreed by 49% of the alumni. These results clearly inform that laboratory experiments have not been taught well, or adequate instruments were not provided for conducting experiments to the respondents during the course of their engineering studies. Discipline specific knowledge, and problem analysis shared the same percent of response rate from the respondents for the scale values "very important" (48%), "important" (39%) and "somewhat important" (13%). Logical thinking scored 30% "important", 24% "very important" while 25% respondents were "not sure" whether logical thinking is necessary for engineers to possess to become successful in their profession. Problem solving skill gained its "importance" from its 33% of respondents, in addition to 28% of alumni considering this skill to be "very important". Strangely 39% of alumni were "not sure" whether knowledge in science and mathematics is imperative for an engineer to acquire. But, 31% respondents felt it to be "important", and 24% agreed that it is "very important" and6% respondents believed it to be "somewhat important." Knowledge in science and mathematics is the only item that received the highest response rate of 39% for the scale value "not sure". Such high percentage of 'not sure' for something that is considered integral to engineering is rather strange. But this could be because nowadays a high percentage of engineering graduates are being recruited by companies that do not require them to practice their science and maths skills. Thirty percent (30%) of alumni recognized that the item 'social and business context' is "not important" and rest of the scale values of this item scored 24% for 'somewhat important', 25 % for 'not sure' and 21% for 'important'. This item merely was agreed by one third of the respondents for its importance. Written communication received the highest response rate (48%) for the scale value "Somewhat important". In contrast, the same item was identified by nine percent (9%) and seven percent (7%) respondents as "important" and "very important" respectively. These are the lowest response rates received by the scale values "Important" and "very important". Decision making ability scored second highest response rate (24%) for the scale value "not important," next to social and business context. Twelve percent (12%) respondents felt that decision making ability is "very important" and this is the item received the second lowest response rate for "very important" next to written communication. Thirty-four percent (34%) respondents shared their views that creativity is "Somewhat important" but eighteen percent (18%) respondents equally agreed that it is "important", "very important" and "not sure" respectively. Less than one fifth of respondents (46%) recognized the need of leadership as "important" and one third of respondents (30%) felt it is "very important", while rest of the respondents (24%) were "not sure". Like leadership, 24% respondents were uncertain on problem solving. Thirty-three percent (33%) respondents were certain that problem solving is "important" and 28% believed that acquiring this skill is "very important". Table 4 shows that 24% to 39% of respondents were "not sure" of the items such as knowledge in science and mathematics, social and business context, logical thinking, problem solving, written communication and leadership.

C. Programmes to Improve Students' Employability Skills in the Long-Term

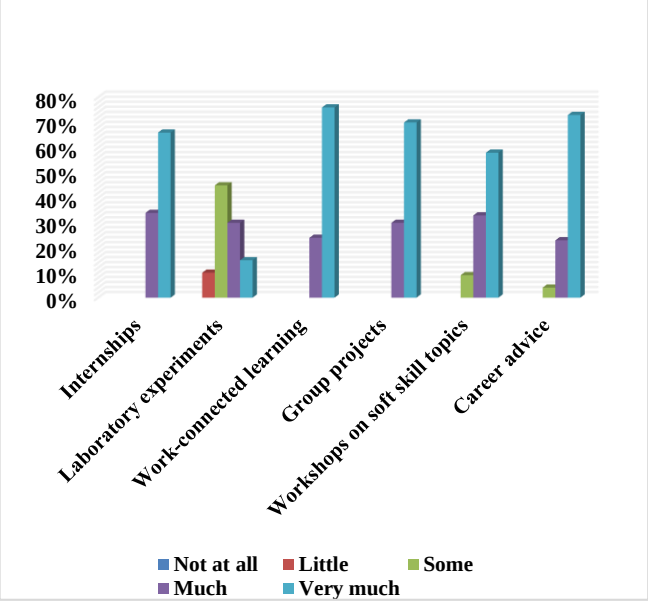

Fig. 4 Programs to improve students' skills

This section discusses and analyses the opinion of the alumni regarding the courses or programmes that universities or engineering institutions can offer to enhance the students' employability skills in the long-term. As depicted in Figure 4, 76% and 70% of alumni respondents are of the opinion that work-connected learning and group projects will "very much" enhance the students' skills. These two programmes received "much" by 24% and 30% respondents respectively. Seventy three percent (73%) of the alumni felt career advice is "very much" necessary for the students, 23% felt it will "much" help the students, while rest of the respondents (4%) believe that career advice will help up to "some" extent only.Sixty six percent (66%) of alumni respondents suggestedthat students would be "very much" able to improve their skills by attending internship training,and 34%

viewed that internships will be "much" helpful to the students.Forty five percent (45%) responded that laboratory experiments to "some" extent will improve the students' skills. However, 30% suggested it will "much" benefit the students to improve their skills in the long run. Fifteen percent (15%) strongly opined that laboratory experiments will be "very much" helpful for the students to improve their skills. Workshops on soft skill topics scored 58% for "very much", while for 33% of respondents the choice was "much" and for 9% of the respondents the choice was "some".

Figure 4 also reflects that work-connected learning is recognized by 76% respondents followed by career advice (73%), group projects (70%), internship (66%), workshops on soft skills topics (58%) and laboratory experiments (15%) as "very much" needed by the students for building up their CVs for a successful career in engineering. Only three percent (3%)response variation is observed in the scale value "very much" for the programmes work-connected learning, career advice and group projects and the range of responses received by these three programmes fall in the range of 70% to 76%. Such high affirmative responses for these categories certainly send a strong message to the authorities in universities that they need to take immediate measures to see to it that these programmes are incorporated into the engineering curriculum at the earliest, if not already done so.

8. Suggestions and Recommendations

To enhance the quality of engineering education alumni feedback is very crucial, and alumni feedback on a continuous basis must be taken on a larger scale at the institutional level. Alumni employed in industries have been always observed to foster the academia link with industries. Similarly, self-employed alumni bring fame to their alma maters and help the institutions to collaborate with new ventures. Thus based on the study findings it is suggested that each department forms an alumni association, and some nominal funding is provided to the departments to facilitate them in using the allocated funds for alumni network establishment, conducting alumni talks, and for organising students-alumni interaction programmes. This network would provide a platform for the current students to interact with the former students that would provide a major platform for the students to get firsthand insight into the engineering workplace. Students are definitely the major beneficiaries of alumni interactions. This interaction helps the students to understand workplace requirements and thus develop skills and abilities that would be useful for their professional future. It also provides an opportunity to the students to highlight their skills and potential in front of the alumni, some of whom are potential employers. Students can also gain benefit from the alumni interaction on the current technology and tools used in the industry. They can learn about workplace culture and ethics, as well the working-style of various industries. This can enhance job opportunities for the students via the alumni.

With help and support from alumni the fresh graduates can get an opportunity to acquire more practical knowledge and thus enhance their knowledge and skills by attending apprenticeship programmes. Moreover, sharing alumni experiences and struggles will certainly increase the level of motivation and confidence among the students. Alumni association must be strengthened and they must be encouraged to share their experience and knowledge on current aspects and issues. Alumni reunions should be initiated to encourage the students to be aware of the wants and expectations of industries from engineering graduates. Significance of lifelong learning, and difficulties and challenges faced by a professional engineer, can be learnt from the experiences shared by their passed-out seniors. Through alumni lectures and workshops on career guidance and seminars on current research practices, the students can be informed about the professional skills and competence required to bring betterment to the society. Alumni engaged in the teaching profession can extend their help to the students with regards to their subject matters. Institutions can send students for internship and industrial visits to organisations where the alumni work. Industry and academia relationship can thus be strengthened through the alumni. In addition, faculty members can undertake industry-focussed sponsored research with support and recommendation of the alumni. The benefits of nurturing and maintaining a robust alumni network are so huge that institutions which do not practice this are doing a great disservice to their students.

The study received responses of alumni from eight engineering disciplines who had graduated from different colleges affiliated to the university, in different years. Yet, the curricular components were observed to be the same since 2008. Only the number of subjects offered by the university under each curriculum component varies due to the restructuring of the curriculum. The study outcomes thus inform us that the curriculum elements of the study university need to be restructured at the earliest, so that the students are able to acquire the requisite technical and soft skills from their engineering curriculum. As suggested by a majority of the alumni, the institutions must establish counselling services related to the students' career. This will help the students to know the existing job opportunities, and scope for higher studies. Career advice will make the students to analyse and assess their own strengths and weaknesses vis-à-vis their future growth and development.

Institutions should also adopt work-connected learning approaches by organising lectures by industry experts, taking the students for industry visits, creating virtual labs, establishing prototypes of industrial devices and equipment, and encouraging students to do small projects for industries at micro-level. The benefit from work-connected learning is that students will get an opportunity to understand the real-world working environment. They get a chance to assess their own interests, skills and learning about career possibilities and employment opportunities. Students will be able to develop and learn and practice work-related habits and cultures. They can understand the expectations of the workplace. Further, professional contacts can be established

for future employment. Technical skills can be expanded and refined. Further, students as well the teachers will learn and relearn simultaneously. In addition, institutions must assist the students in getting internship opportunities in companies where their alumni work. Internship positions can assist towards bridging the gap between the professional world and theoretical studies for the students. It can prepare the students to become like professionals and could add value to their résumés. They can gain self-confidence and motivation by spending time with the working professionals. Professional behavior and social skills can be developed. On the other side iinternships can help the institutions to maintain healthy relationship, both with the government and industry. They can prepare the students to meet the challenges, and fulfil the demands of the society. Employers always desire graduates who are industry-ready, and this is one way by which students can be made industry-ready. Better educational experience can be provided to students by sharing each other's internship experience with peer groups and faculty members.

Furthermore, it is recommended that before restructuring the curriculum the university must undertake an alumni survey for curriculum assessment. The outcome will give a better picture to the Board of Curriculum Studies of the university regarding the benefits acquired from the existing curriculum and the programmes that need improvement. We cannot ignore the fact that alumni are not only the employees they are also the employers. Their ideas and suggestions will certainly enhance the learning experiences of the engineering programme as well benefit the university in the long term. Colleges must thus increase the involvement of alumni in their academic study boards. Any institution gains in fame and reputation because of the social and academic status of its alumni. It is high time that universities focus and assess whether the Engineering programmes address the learning outcomes that the graduates must acquire.

9. Conclusion

Engineering is the main pillar supporting a superior life in this world. We are able to move around the world and are able to create more than we ever could with our bare hands. This is possible because of the tools invented by our engineers and the engineering profession. The profession involves major functions such as operation**,** management, control and manipulation of the available resources, energy and data, thereby creating benefit for the humankind. So, it is of utmost responsibility of engineering educators to educate and train the engineering students properly and effectively, as they would be the new generation of engineers shouldering the challenges and changes required by their country for a better future for all its citizens.

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