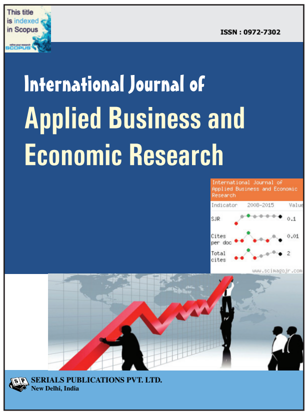

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Curriculum Innovation–Are we on the Right Track?

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ABSTRACT

Various research studies have been conducted on curriculum innovation with an objective to map it with the graduate attributes but none have emphasized the role of pedagogical/instructional techniques and effective assessment in inculcating these attributes among students.

Purpose: This paper presents an exploratory discussion framed around a questionnaire survey to undertake a critical analysis of the combination of various factors to create an intellectually challenging environment and inculcate the promised graduate attributes in the student.

Methods: A questionnaire survey was conducted with 1044 faculty of engineering as respondents to identify what type of courses, pedagogies and assessment techniques would be the best to inculcuate graduate attributes among the students pursuing undergraduate degree in engineering.

Results: The statistical analysis includes the descriptive statistics and one-way analysis of variance. The results have important implications for designing the course structure, pedagogy and assessment tools and the right selection of all the three may contribute to a higher level of competencies of learners.

Conclusion: An attribute development framework has been prepared based on the feedback which provides the right set of courses, pedagogies and assessment techniques essential to imbibe graduate attributes among the students pursuing undergraduate degree in Engineering.

Keywords: Graduate Attribute, Course Types, pedagogical Techniques, attribute development framework, Direct and Indirect Assessment Method

1. INTRODUCTION

Outcome Based Education (OBE) has recently gained importance when India represented by National Board of Accreditation (NBA) became the signatory of Washington Accord in 2014. Washington Accord, established in 1989 is an international accreditation agreement among the national bodies responsible for accrediting Bachelor level engineering programmes.

The programmes having accreditation by one signatory country is recognized at par having substantial equivalence with other signatory countries. Students pursing such programme may enter any other signatory country to practice considering that they meet the standardized academic standards set by Washington Accord.

The Indian statutory bodies like University Grant commission (UGC), All India Council for Technical Education (AICTE) concerned with higher education were focusing on bringing about reforms with an objective to upgrade the quality of education in Indian universities. Contributing to their efforts, NBA applied for the membership of Washington Accord and was granted the status of provisional member in 2007. After putting a lot of hard work, the status of permanent member was finally given to NBA (India) in 2014 in Wellington, New Zealand during the international Engineering Alliance meeting. The membership was granted after seeking votesfrom other permanent members on the decision to induct India.India being the member of Washington Accord shifted the focus on Outcome Based Education System. Outcome Based Education is considered to be one of the world's best practices in education system.

William Spaddy (1987) who first theorized the idea of OBE defines it as an approach to operate a learner centric education system that is marked by the demonstrations of desired learning outcome expected from each student. These outcomes are the results of learning demonstrated by students at the completion of time bound learning experiences. He further stated that a focus on future-driven curriculum and assessment of outcomes make OBE the most exciting and potentially successful curricular innovation. He had proposed following four principles of OBE: (*a*) Clear focus on outcomes (*b*) Design the outcomes and then deliver (*c*) High expectations (*d*) Expanded opportunities to demonstrate the outcomes.

Outcomes are reflected in students' behavior in terms of attributes (knowledge, skills and attitude) that student is expected to demonstrate upon completion of the programme of study. The national and International accrediting, regulatory, and educational organizations like NBA, ABET, etc. have developed graduate attributes and professional competency profiles of Engineering Graduates.A dozen of graduate attributes are listed as expected outcomes from the Engineering graduates include: (*i*) Engineering Knowledge (*ii*) Problem Analysis (*iii*) Design and Development (*iv*) Investigation of Complex Problems (*v*) Modern Tool Usage (*vi*) Engineer and Society (*vii*) Environment and Sustainability (*viii*) Ethics (*ix*) Individual and Team Work (*x*) Communication (*xi*) Lifelong Learning (*xii*) Project Management and Finance.

The system is completely student centric and came into existence for the benefits of students in terms of better learning outcomes. The Universities have sought to the articulation of outcomes by describing the relevant attributes of the graduates of their programme. The approach deals with defining the learning outcome for a programme taking into consideration each graduate attribute and carrying out the assessment of student's performance against these predetermined set of learning outcomes at the end of the degree programme. The attainment of learning outcomes indicates that the corresponding graduate attribute is developed in the student.

Even after embedding the graduate attributes within the programme and ensuring their attainment by using standard assessment techniques, Engineering institutions are not able to prepare the students as future global citizens to take their place in a sustainable global economy.

Indian employability assessment firm "Aspiring Minds" conducted a study of more than 1,50,000 engineering students passed in 2015 from more than 650 colleges reported that 80% of the engineering graduates are unemployable and do not possess the skills critical for the Engineers. As stated by CEO, Aspiring Minds, "Along with improving the education standards, it is quintessential that we evolve our undergraduate programmes to make them more job centric," Even after adopting the graduate attribute framework, Universities are still struggling in finding the answer to the most important question and that is "How to measure and monitor that the specified graduate attributes are inculcated in the students by the end of the programme of study".

There seem to be a wide gap between the targets set for students in terms of graduate attributes and the actual outcome. The Indian education institutions are still not able to develop an industry fit workforce of engineers. Though major revamping of curriculum and academic delivery had been proposed by the UGC, still an effective implementation is considered as the major challenge for the education institutions.

Now, the most important issue that needs to be addressed is to ensure a right mix of course structure, mode of delivery and assessment tools.

The importance of pedagogy along with the content in developing the desired set of attributes and skills cannot be denied. What is taught is as important as how it is taught and assessed. Selection of an effective method of instruction guarantees maximum participation and engagement of students in the teaching learning process. It ensures an active learning environment in which students take the responsibility of their learning.

Assessment is an implicit part of the teaching learning process in order to close the loop is measuring the extent of learning, identify the week areas and establish the evidence based future course of action.

Therefore, to develop the graduate attributes and achieve the desired learning outcomes, it is extremely important to club the right content with the selection of right pedagogy and appropriate method of assessment.

Various research studies have been conducted on curriculum innovation with an objective to map it with the graduate attributes. The focus is on embedding the graduate attributes in the curriculum by introducing courses that targets the enhancement of competencies but none have emphasized the role of pedagogical/instructional techniques and effective assessment in inculcating these attributes among students.

2. LITERATURE REVIEW

Graduate attributes are defined as the knowledge, skills and values that are required by every graduate [1]. The higher educational institutions are using graduate attributes for curriculum design and as a measure of industry ready graduates [2] [3]. But there are regular debates regarding the responsibility of higher education institutions in producing employable graduates [4].

It is recommended that graduate attributes can be imbibed only when initiatives are taken to support and integrate them with teaching and learning activities [5]. Literature in this area have emphasized on the importance of factors like content, pedagogy, co- curricular activities and assessment in order to ensure that the graduates meet the expectations of industry and the desired skills or attributes are inculcated in them. The graduates must be equipped with the right knowledge, skills and values required by their employers in the national and international market [6] [7]. There is a need of a meaningful students engagement with the graduate attributes in such a way that they are industry ready and do not take any time to accept their new identity as professionals for which an integrated systems and its implementation is needed [3].

It is suggested that the faculty has the major role in embedding the graduate attributes among the students [8]. It is the responsibility of faculty to ensure an effective and fruitful interaction with its students by making a right choice of contents, pedagogy and assessment. It is their responsibility to embed the graduate attributes in the curricula and deliver learning activities that are effective in the delivery of these attributes [3].

However, the faculty is not always able to translate the theory into practice [9]. The focus need to be shifted from teacher to learner [3], from passive to participatory pedagogies [10] and learners being partners in their learning journey [11]. It is emphasized that curriculum mapping alone is not effective and that it is vital to work on appropriate teaching and learning strategies [12].

For developing graduate attributes, the higher education institutions need to reconsider their teaching, learning and assessment strategies [12]. Once the graduate attributes have been identified, it is necessary to ensure and assess that students develop those attributes using various assessment techniques [13]. Many universities have redefined their curriculum to meet the demands of novel approaches towards teaching learning processand to promoteflexibility [14].

The literature highlights that there are gaps in the desired graduate attributes and the actually achieved ones at the end of the programme of study. These gaps motivate us to conduct this study.

3. OBJECTIVE OF THE STUDY

1. To identify and map the various course types with the graduate attributes
2. To identify a good mix of various instructional techniques and mapping them with graduate attributes
3. To identify various direct and indirect assessment tools which may be used to determine the extent of learning

This paper conducts the survey with the faculty of Engineering institutions to provide the right set of courses, pedagogies and assessment techniques that might be used to imbibe the graduate attributes among the students. The paper will provide an Attribute Development Frameowrk with ideal set of courses, pedagogies and assessment techniques that can be used by higher educational institutions.

4. RESEARCH METHODOLOGY

Within the context of this paper, several pedagogicaland assessment techniques are reviewed and examined for the Engineering Graduates that impact graduate attributes expected out of an Engineering student. A Questionnaire was developed for faculty to address following questions:

1. What type of courses are appropropriate for inculating various graduate attributes
2. What type of pedagogical techniques are appropriate for imbibing graduate attributes
3. What type of assessment techniques are appropriate for assessing the graduate attributes

The focus is on embedding the graduate attributes in the curriculum by introducing courses that targets the enhancement of competencies

Cross-sectional survey was conducted with 1044 respondents to identify what type of courses, pedagogies and assessment techniques would be the best to inculcuate graduate attributes among the students pursuing undergraduate degree in engineering. The survey was conducted with the Engineering faculty working in the higher educational institutions of India. Pilot study was conducted to improve the research instrument. The questions were desinged on Likert Scale (1 indicating Not important and 5 signifying Very Important). The cronchas alpha value is 0.82 indicating a reliable scale.

The faculty were grouped cadre wise (Professor, Associate Professor, Assistant Professor) and Programme wise (Computer Science and Engineering, Electronics and Communication Engineering, Mechanical and Automation Engineering, Civil Engineering). Descriptive statistics and one-way analysis of variance are used to answer the research questions.

5. RESULTS

Descriptive statistics such as mean and standard deviation were used to find what courses, pedgagogies and assessment were considered important by faculty for imbibing graduate attributes among the students. The results of descrptive statistics are given in table A-D of the appendix.

It can be inferred from table A that the core courses and specialization courses have the highest mean value and the by and large faculty feel that these courses play a vital role in imbibing the first four graduate attributes (Engineering knowledge, problem analysis, design and development and investigation of complex problems) as indicated by the mode value. Allied courses (Environmental Studies, Ethical Practices, Information Technology) are important in imparting the next four graduate attributes, modern tool usage, engineer and society, environment and society, ethics. Value Addition courses (Behavioral Science, English, Communication Skills, Foreign Languages) are important for imbibing next two graduate attributes, individual and team work, communication. Research based Projects play a major role in imbibing almost all the graduate attributes. Interdisciplinary and skill enhancement courses are ueseful in inculcating engineering knowledge and problem analysis.

Table B reveals that no single pedagody is appropriate for the students and it must be a good mix of various instructional techniques. Lectures, lecture and discussion, lab-based practicals, case studies, drill and practice, problem based enquiry, independednt study and projects must be used for imparting the first four grraduate attributes. Simulations are important for first five. Collaborative and cooperative learning are important for imbibing both engineering skills as well as teamwork and communication.

Various direct and indirect methods for assessment are used by faculty to assess each graduate attributes. The faculty feel that the students must be assessed using variety of assessment techniques and no single assessment technique can be considered best for evaluation of the grauduate attributes (Table C and D).

Table 1
ANOVA Results for Course Types (Cadre and Programme Wise) with $p = 0.05$

Course Type	*Cadre*	*Programmes*
Core Courses	F(2,1041) = 0.108	F(3,644) = 0.082
Specialization Courses	F(2,1041) = 0.737	F(3,644) = 0.197
Allied Courses	F(2,1041) = 1.347	F(3,644) = 0.921
Value Added Courses	F(2,1041) = 1.960	F(3,644) = 2.942
Research based Courses	F(2,1041) = 0.615	F(3,644) = 1.314
Interdisciplinary Courses	F(2,1041) = 4.708*	F(3,644) = 0.682
Skill Enhancement Courses	F(2,1041) = 1.090	F(3,644) = 1.888

Futher, one-way Analysis of Variance (ANOVA) was conducted to determine whether there was difference in faculty opinion in different cadres and programmes. It was found that there was no difference in the opinions among different cadres (Assistant Professor, Associate Professor and Professor) and Programmes (Computer Science & Engineering, Electronics & Communication Engineering, Mechanical Engineering and Civil Engineering) in majority of the cases. Further, the post-hoc test also revealed that there was no difference among different cadres.The only difference could be found was for interdisciplinary courses (cadre wise among Assistant and Associate Professors) with p = 0.009* (table 1).The results are presented in table 1-4.

Table 2
ANOVA Results for Pedagogies (Cadre and Programme Wise) with $p = 0.05$

Pedagogies	*Cadre*	*Programmes*
Lecture	F(2,1041) = 0.213	F(3,644) = 0.139
Lecture with Discussion	F(2,1041) = 0.539	F(3,644) = 0.171
Lab with Practical Hands on	F(2,1041) = 1.163	F(3,644) = 0.903
Simulation	F(2,1041) = 0.978	F(3,644) = 1.482
Role Play	F(2,1041) = 0.524	F(3,644) = 0.814
Case Studies	F(2,1041) = 3.301	F(3,644) = 0.591
Demonstrations	F(2,1041) = 1.131	F(3,644) = 1.588
Collaborative Learning	F(2,1041) = 0.326	F(3,644) = 0.119
Cooperative Learning	F(2,1041) = 1.125	F(3,644) = 1.113
Problem Based Enquiry	F(2,1041) = 1.037	F(3,644) = 2.104
Academic Games	F(2,1041) = 1.273	F(3,644) = 0.576
Brainstorming	F(2,1041) = 0.641	F(3,644) = 1.021
Debates	F(2,1041) = 0.901	F(3,644) = 0.740
Drill and Practice	F(2,1041) = 1.960	F(3,644) = 0.853
Independent Study	F(2,1041) = 0.615	F(3,644) = 1.124
Projects	F(2,1041) = 0.817	F(3,644) = 0.573

Table 3
ANOVA Results for Assement Techniques (Cadre and Programme Wise)

Assessment	*Cadre*	*Programmes*
Comprehensive Examination	F(2,1041) = 0.511	F(3,644) = 1.026
Capstone Projects	F(2,1041) = 0.725	F(3,644) = 0.263
Course Embedded Assignments	F(2,1041) = 0.661	F(3,644) = 0.302
Viva Voce	F(2,1041) = 1.432	F(3,644) = 1.114
Internship Evaluations	F(2,1041) = 0.748	F(3,644) = 0.691
Scoring Rubrics	F(2,1041) = 1.006	F(3,644) = 0.737
Thesis	F(2,1041) = 0.934	F(3,644) = 1.468
Alumni Surveys	F(2,1041) = 0.627	F(3,644) = 1.035
Employer Surveys	F(2,1041) = 0.634	F(3,644) = 0.217
Exit Interviews	F(2,1041) = 1.125	F(3,644) = 0.477
External Reviewers	F(2,1041) = 0.932	F(3,644) = 1.182
Focus Group	F(2,1041) = 0.6218	F(3,644) = 0.514

Tables 1-3 show the F-value for course types, pedagogy and assessment. P-values for almost all the factors is greater than 0.05.

The course type, instructional pedagogy and assessment methods which have been rated as highly important by most of therespondents are taken as the most appropriate ones in the table 4.

Table 4
An Attribute Development Framework

Graduate Attributes	*Course Type*	*Pedagogical techniques*	*Assessment Tools*	
			Direct Method	*Indirect Method*
Engineering Knowledge	Core and specialisation elective Courses	Lecture, Lecture with Discussion	Comprehensive Examination, Capstone Projects, Internship Evaluations, Thesis, Course Embedded Assignments	Alumni Surveys, Employer Surveys, External Reviewers, Focus Groups
Problem Analysis	Core Courses	Drill and Practice, Simulation, Case Studies, Problem based Enquity		
Design and Development	Research based projects	Simulation, Projects, Problem based Enquity		
Investigation of Complex Problems	Research based projects	Case Studies, Problem based enuqiry, Projects		
Modern Tool Usage	Allied Courses	Lab-Practical Hands on, Projects	Capstone Projects, Thesis	Employers Survey, External Reviewers, Focus Group
Engineer and Society	Allied Courses	Lecture, Lecture with discussion, role plays	Comprehensive Examination, Capstone Projects, Internship Evaluation, Thesis	
Environment and Sustainability	Allied Courses	Lecture, Lecture with discussion, role plays		
Ethics	Allied Courses	Projects		Employers Survey, External Reviewers, Focus Group, Alumni Surveys
Individual and Team Work	Value Added Courses	Collaborative learning, Cooperative learning, Independent Study, Projects	Capstone Projects, Course Embedded Assignements, Internship Evaluations, Thesis	Employers Survey, Exit Interviews, External Reviewers, Focus Group, Alumni Surveys
Communication	Value Added Courses	Debates, Role Play	Capstone Projects, Internship Evaluations, Thesis	
Lifelong Learning	Skill enhance-ment courses, Interdisciplinary Courses	Independent Study, Projects	Internship Evaluations, Thesis	Alumni Surveys, Exit Interviews, External Reviewers
Project Management and Finance	Resesrach based Courses	Independent Study, Projects		Alumni Surveys, Employer Survey, Exit Interviews, External Reviewers

Table A
Descriptive Statistics for Course Type

Course Types	*Core Course*		*Specialization Elective Courses*		*Allied Courses*		*Value Addition Courses*		*Research based Project*		*Inter disciplinary courses*		*Skill Enhancement courses*	
Graduate Attribute	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Engineering Knowledge	4.85	0.36	4.71	0.507	3	0.889	2.37	1.071	4.53	0.65	3.65	0.808	3.32	0.725
Problem Analysis	4.74	0.39	4.42	0.784	2.12	0.756	1.08	0.97	4.62	0.82	3.98	0.586	3.75	0.981
Design and Development	4.27	0.52	4.31	0.65	1.91	0.451	1.79	0.78	4.71	0.71	2.51	0.951	3.19	0.8`1
Investigation of Complex Problems	4.31	0.4	4.57	0.82	1.82	0.59	1.1	0.92	4.8	0.9	3.67	0.691	2.53	0.793
Modern Tool Usage	2.78	0.75	2.96	0.632	4.32	0.981	1.96	0.871	4.31	1.094	2.38	0.882	2.79	0.861
Engineer and Society	1.98	0.97	1.68	0.96	4.81	0.74	1.85	0.96	2.31	0.64	1.77	0.634	3.37	1.061
Environment and Sustainability	1.75	0.89	1.26	1.04	4.73	0.798	1.74	1.1	2.85	0.78	1.69	0.672	3.75	0.78
Ethics	1.63	1.08	1.18	1.109	4.58	0.87	1.43	0.635	4.27	0.68	1.58	0.908	1.58	0.91
Individual and Team Work	1.84	0.72	1.39	1.89	2.14	0.94	4.78	0.79	3.56	0.71	1.14	0.812	1.64	0.89
Communication	1.72	0.9	1.34	1.03	2.26	0.85	4.36	0.85	2.16	0.97	2.09	0.85	1.79	0.73
Lifelong Learning	1.31	0.53	1.79	0.987	2.81	0.745	2.98	0.95	2.53	0.735	3.94	0.673	3.74	0.68
Project Management and Finance	1.16	0.75	1.12	0.671	1.84	1.16	1.79	1.08	3.98	1.07	1.71	0.631	2.98	0.667

Table B
Mean Values for Different Pedagogical Techniques

	Lecture	*Lecture with Discussions*	*Lab – Practical Hands on*	*Simulation*	*Role Play*	*Case Studies*	*Demonstrations*	*Collaborative learning*	*Cooperative learning*	*Problem based and inquiry learning*	*Academic games/ competition*	*Brainstorming*	*Debates*	*Drill and Practice*	*Independent study*	*Projects*
Engineering Knowledge	5.00	5.00	4.26	4.37	0.80	4.39	3.67	3.94	3.46	4.11	3.27	2.63	0.25	4.36	4.17	4.87
Problem Analysis	4.53	4.32	4.17	4.71	0.36	4.71	3.97	4,16	3.98	4.72	2.98	2.81	1.35	4.85	4.46	4.63
Design and Development	4.72	4.16	4.15	4.86	1.02	4.47	3.84	3.02	3.51	4.73	3.18	1.99	1.03	4.27	4.42	4.91
Investigation of Complex Problems	4.26	4.42	4.46	4.17	0.34	4.93	3.41	4.04	4.68	4.93	3.05	2.74	0.98	4.24	4.57	4.53
Modern Tool Usage	3.59	2.96	4.03	3.78	0.12	2.10	2.14	1.73	1.39	2.13	2.68	0.95	0.25	3.03	3.97	4.45
Engineer and Society	4.18	4.41	2.61	1.92	4.27	3.26	2.48	1.95	1.13	1.73	1.95	1.34	1.93	3.28	3.02	3.89
Environment and Sustainability	4.26	4.14	2.57	1.39	4.16	3.35	1.36	2.16	1.28	1.93	1.53	1.27	1.36	2.96	3.17	3.63
Ethics	3.14	3.68	1.98	1.48	3.62	3.08	2.04	1.85	0.80	1.48	1.72	2.07	1.42	1.89	3.27	3.92
Individual and Team Work	3.24	3.19	1.53	1.07	3.23	3.79	2.13	4.84	4.27	3.94	1.26	1.94	2.61	1.41	4.70	4.92
Communication	3.58	3.93	1.24	1.25	4.75	2.96	2.58	3.73	4.03	3.27	1.91	2.07	4.71	1.24	4.62	3.97
Lifelong Learning	2.97	2.16	1.90	1.16	1.58	1.94	1.01	2.17	1.05	2.96	1.26	1.03	3.74	1.05	4.93	3.85
Project Management and Finance	2.41	2.69	2.76	1.33	1.27	2.18	0.69	2.37	1.17	1.94	0.78	1.05	1.15	0.97	4.27	4.17

Table C
Descriptive Statistics for Assesment Techniques (Direct Method)

	Comprehensive Exam		*Capstone Projects*		*Course Embedded Assignments*		*Viva Voce*		*Internship Evaluations*		*Scoring Rubrics*		*Thesis*	
Graduate Attribute	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Engineering Knowledge	4.57	0.315	4.98	0.416	4.56	0.082	3.95	0.418	4.16	0.621	3..62	1.13	4.13	0.913
Problem Analysis	4.14	0.83	4.37	0.571	4.63	0.219	3.41	0.98	4.31	1.063	3.51	1.25	4.73	0.935
Design and Development	4.05	0.519	4.74	0.418	4.17	0.632	3.16	1.35	4.83	0.901	3.83	1.41	4.62	0.74
Investigation of Complex Problems	4.11	0.905	4.83	0.482	4.73	0.328	2.96	1.721	4.02	0.912	3.26	1.04	4.21	0.82
Modern Tool Usage	3.01	0.931	4.17	0.837	2.13	0.91	1.38	1.931	3.96	1.12	2.86	1.15	4.73	0.613
Engineer and Society	3.52	1.031	3.96	1.021	2.58	0.943	2.96	1.82	3.15	1.35	2.35	1.31	3.96	1.53
Environment and Sustainability	3.48	1.731	3.92	1.032	2.96	0.87	2.47	1.64	3.21	1.38	2.17	1.42	3.59	1.42
Ethics	3.17	1.31	3.37	0.851	2.91	1.13	1.64	1.84	3.81	1.51	2.24	1.51	3.73	1.62
Individual and Team Work	2.13	0.952	3.97	0.909	3.71	0.932	1.06	1.81	3.52	1.46	2.75	1.73	3.52	1.14
Communication	2.07	0.843	3.62	0.947	2.95	1.13	1.47	1.93	3.94	1.83	2.63	1.52	3.72	1.26
Lifelong Learning	1.94	1.849	2.41	1.12	1.09	1.04	0.47	1.16	4.17	1.33	2.01	1.81	4.38	1.52
Project Management and Finance	2.69	0.741	2.68	0.659	1.86	0.94	0.91	1.11	4.53	1.52	2.14	1.1	4.33	0.91

Table D
Descriptive Statistics for Assessment Techniques (Indirect Method)

	Alumni Surveys		*Employer Surveys*		*Exit Interviews*		*External Reviewers*		*Focus Group*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Engineering Knowledge	4.21	0.952	4.39	0.421	3.91	1.14	4.62	0.901	4.62	1.02
Problem Analysis	4.52	0.946	4.32	0.528	4.02	1.09	4.28	0.853	4.28	1.14
Design and Development	4.13	0.924	4.83	0.87	4.01	1.311	4.41	0.931	4.33	1.04
Investigation of Complex Problems	4.62	0.995	4.68	0.57	4.12	1.98	4.62	0.925	4.32	1.313
Modern Tool Usage	4.01	1.31	4.51	0.61	4.01	1.32	4.15	1.4	4.11	1.462
Engineer and Society	4.15	1.23	4.81	1.1	4.08	1.01	4.22	1.13	4.24	1.673
Environment and Sustainability	4.63	1.094	4.23	1.42	4.11	1.36	4.51	1.35	4.47	1.531
Ethics	4.37	1.53	4.31	1.53	4.17	1.21	4.15	1.74	4.15	1.854
Individual and Team Work	3.91	1.73	3.41	1.27	3.94	1.53	3.72	1.42	3.41	1.642
Communication	3.65	1.31	3.28	1.25	3.49	1.73	3.75	1.36	3.69	1.683
Lifelong Learning	3.18	1.03	3.01	1.5	3.18	1.632	3.25	1.632	2.18	1.743
Project Management and Finance	3.51	1.45	3.28	1.31	3.52	1.73	3.28	1.646	2.97	1.96

6. CONCLUSION

Unemployabiltiy of the graduates is a major concern for any nation. Recent surveys indicate that the graduates lack essential skills and hence do not get the jobs in their area of specialization. Therefore, it becomes inevitable for the higher educational institutions to provide the right mix of three educational pillars – Course content, delivery and assessment. The attribute development framework can be referd by thhe higher education institutions as it provides the right set of courses, pedagogies and assessment techniques essential to imbibe graduate attributes among the students.

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