JEET

Personality Mapping Of Entry Level Engineering Students For Assessment Of Engineering Competencies

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Abstract - In transforming students into competent engineer the role of engineering educators have become crucial. Because of increased number of engineering institutes all over India all competent and incompetent students are getting admission to the institutes. The entry level merit of students also varies from student to student because of policies of state and central government. Because of this all graduating students are not acquiring desired skills and competencies and hence many of them could not get job in the industry.

The present study focuses on identification of the personality factors of fresh engineering student which is required for successful completing the course. The personality factors such as verbal, non-verbal and general intelligence, numerical, spatial ability, form and clerical perception was assessed and students are guided to attain desired level of academic and personal attainments. The findings of the study show that the test and individual counseling has helped students to align the academic efforts towards a career path.

Keywords—Competency mapping; personlity test; engineering aptitude; employability;

I. Introduction

The British started engineering education in India by setting up four engineering colleges in the four corners of India i.e. Roorkee, Sibpur, Guindy and Poona to train the engineers needed for the civil and other engineering activities [1]. The enrolment for these four engineering colleges was 608 students per year during 1884–85. Each had a glorious record, having produced some of the outstanding engineers of India. After this two other prominent institutions were set up nearly 100 years ago one was Indian Institute of Science by the House of TATA and Banaras Hindu University (BHU) by Pandit Madan Mohan Malaviya, who grew as to become institutions of national importance. After independence, there were only 24 engineering degree colleges with a total intake capacity of 2570 students. Around 1950 t0 1960 five IITs were established as institutions of national importance by an Act of Parliament. After a gap of over three decades, the sixth IIT was established at Guwahati and the Engineering College at

Roorkee was first made an University and then seven IITs in 2001. In 2008, four more IITs were established at Patna,

Jodhpur, Hyderabad and Gandhinagar followed in 2009 by four more at Ropar, Bhubaneswar, Mandi and Indore, making a total of 15 IITs. The Institute of Technology at BHU has been elevated as an IIT; thus there are 16 IITs now.

In the next tier institutions, there are 20 RECs which were recently renamed National Institutes of Technology with Central Government funding and greater autonomy. There are total of 30 NITs in India with an intake capacity of 9297 UG and

4569 PG. Then, there are a large number of State Government Engineering Colleges, often affiliated to a University and having a limited or no autonomy about curriculum, examinations, degree granting, etc. The great demand for engineering and technical education has forced the central and state government to design a policy to open engineering education sector private unaided engineering colleges in India. Some of the state governments have taken initiative and promoted to public trusts and education societies to start private unaided engineering colleges, hence many trusts and education societies have started engineering college with a noble cause of engineering education. However in latter stage large number of private engineering colleges has started by politicians or as money-making ventures which lead to mushrooming of the engineering institutes. Currently there is total intake capacity at diploma, degree and PG levels are 3034540 students per year. There are 3393 engineering colleges are in India (2011-12) and shortly the number will reach to 5000 and the share of institutes in engineering education by public institutes is just 9% and private institutes have 91%. Almost every year almost 30,00,000 students are graduating every year from IITs, NITs and private engineering colleges. Out of these graduating students how many possesses requisite skills, knowledge and competencies required by the recruiters is a big question.

II. Status Of Employability Of Engineering Graduates In India

Every year almost in all institutes campus interviews, pool campuses are conducted by many recruiters. Their methodology of selection is as follows; they initially scrutinize students on the basis of the academic performance and these shortlisted students will appear for aptitude test, group discussions for filtering and finally they face a personal interview. The number of students' clear all stages of selection and get short listed are not more than 10-20% of students appearing for the process. This figure may vary from institute to institute but average remains same. Many professional and social organizations have also conducted surveys of employability of engineering graduates, their survey shows that maximum 20% of engineering graduates are employable[3]. According to the National Association of Software and Services Companies (NASSCOM), only 15-18 of the graduate engineers are employable. The National Employability Index of 2013 also shows that only 18.33% of engineering graduates are employable and 10.03% get jobs. Aspiring Minds[2] has conducted India's employability study of technical graduates based on the results of a standardized computer-based test called AMCAT conducted for more than 40,000 engineering students across the country. They covered all objective parameters for adjudging employability including English ccommunication, quantitative skills, problem-solving skills and computing and programming skills. The findings of the study are summarized as average 17.84% employability of engineering graduates in the specific sector however with regard to IT product companies is as low as 4.22% (amongst computer/electronics related branches). KPOs find only 9.47% technical graduates employable and employability with regard to BPOs and Technical Support Jobs (TSJ) is 38.23% and 25.88% respectively. This leaves a total of 61.77% students who require training in both soft-skills and problem-solving skills to be eligible for any job in the industry.

III. Competencies Required For Engineering Graduates To Get Employed

There is a distinction between competencies and knowledge, skills, and abilities (KSA). Knowledge refers to a body of information about the theoretical and practical understanding of a subject, acquired by a person through experience or education. Skills refer to the application of data or information with manual, verbal, or mental proficiency. Skills can be tested to measure quantity and quality of performance, usually within an established time limit. Examples of skills include typing and computation using

decimals. Ability means the sufficiency of strength to accomplish something, especially the physical and mental quality to perform activities. Examples include planning and implementation. KSAs are fundamental aspects of competencies, but competencies are more behavior-based rather than skill-based. In brief, each competency requires several KSAs. While KSAs may underlie competencies just as personal traits may underlie competencies, the KSAs are not the exact competencies [4].

Wood and Payne [5] proposed 12 items as basic criteria for competency-based recruitment and selection as communication, flexibility, achievement orientation, developing others, customer orientation, problem solving, teamwork, analytical thinking, leadership, relationship building, planning skills and organizational skills. In 2001, the European Union identified eight key competencies as the development of indicators which can be used to monitor and evaluate education and training progress across the European Union (a) language proficiency; (b) foreign language proficiency; (c) ability to apply basic math and science; (d) ability to learn function; (e) ability to learn skills such as time-management, problem-solving, information seeking and applying; (f) social commitment; (g) entrepreneurship such as creativity, planning, achievement motivation; and (h) ability to appreciate culture such as art, music and literature

Industry is looking for the graduates who will have to be following qualities. He must have sound knowledge in his or her core discipline with good numerical and logical ability. This will be able to build candidates self-confidence, focused on the assigned work and will be able to deliver results. He must have positive attitude towards responsibilities and must be emotionally managed to work well in team culture. He must have good communication skills, English proficiency. He also must be equipped with computing tools in the specific domain.

The recruitment procedure for recruiting fresh engineers starts with the initial scrutiny on the basis for the 10th, 12th , and 1st to 6th or 7th semester academic performance. Many oganisations scrutinize candidates on the basis of 1st class at all above levels and then they conduct an aptitude test followed by either group discussions or personal interview. Many candidates fail to complete first two steps i. e. throughout first class and aptitude test and hence they lose opportunity of placement. We tried to find out the reasons of their poor performance and came to know that there is a big gap between industry expectations and the competency of the student. This gap analysis has revealed the need of understanding the basis competencies of the student at entry level and planning to inculcate the requisite skills in four year engineering curriculum that at the end of fourth year he/she will be able to get placed in his desired type of company.

IV Components Of Personality Test

Cattell's 16 PF is a well researched, reliable and valid test which measures 16 primary source factors of a person which is being used for the present study. These 16 primary factors are again combined to give eight secondary or global factors. MBTI learning styles by comparison, the Myers-Briggs Type Indicator (MBTI) has been widely used and validated in the education domain [6] and has long been considered an important instrument by educational psychologists. Consequently, questionnaire-based identification processes have been compiled by many observations and interviews [7], [8]. The MBTI questionnaire examines personality traits in four distinct spectrums: Observation and Concept Formation, Spatial Awareness, Observation and Spatial Transformation, Abstract Reasoning, Memory Recall, Visualization, Numerical Ability, Management, Technical, Computational, Business & Commercial, Scientific, Mechanical, Persuasive, Adventurous, Outdoor and Social Services.

The MBTI type theory has two basic assumptions. First, that equal development of all four functions is not desirable and the dominant spectrum should be the most developed. Second, people are not capable of developing concurrent interests in both traits in a spectrum i.e. both what is happening (S) and in

possibilities (N) at the same time. This tends to lead to one preference being dominant, and subsequently used more, trusted more and being more developed, in a cumulative and spiral process [9]. Hence, the general picture in normal-type development is each person gradually discovering what they are best at their talents, gift and central motives and then spending more time and energy on what they are best and necessarily less on other things.

More importantly following major areas were selected to assess the students.

1) Verbal Intelligence: Verbal intelligence tells about reasoning, logic and analytical ability in problem solving based on understanding of English. At academic level, it tells about persons' ability to understand what he study. This ability impacts across all subjects with theory with or without calculations.

2) Non-Verbal Intelligence: Non-verbal intelligence tells about reasoning, logic and analytical skills in graphics and designs. This is a must intelligence for every professional engineer. At corporate level, this is termed as critical thinking ability. An ability that lets to find out patterns and apply individuals learning to work out a solution using his acquired knowledge in various subjects.

3) General Intelligence: This tells you about reading habits as well as your awareness of how things work based on common sense. This ability directly contributes to academic as well as professional success.

4) Verbal Aptitude: A direct measure of command over English vocabulary. A low score on this directly impacts examination answer reproduction as well as communication skills.

5) Numerical ability: Along-with mental maths, this is problem solving ability by understanding the mathematical question put in to word form. Individual may know how to calculate, but if he does not understand what to calculate, then he will be faced with a problem in every subject that asks to solve problems using mathematics. This ability impacts performance in all subjects which have calculations as a part of learning.

6) Spatial Ability: A key ability of understanding two and three dimensional figures. A must have ability for every Mechanical, Civil or Automobile Engineer. Throughout professional life, engineers are going to come across engineering drawings which demand understanding.

7) Form Perception: A must have ability for every Engineer which helps in understanding the minute details in graphics & drawings. This ability impacts understanding of detailing in diagrams, flow-charts, across all subjects.

8) Clerical Perception: An ability which allow understanding the details in theory. This is the ability which helps as one read pages after pages of theory where no calculations are involved.

V. PROCEDURE

The 443 first year engineering students covering 326 boys and 117 girls were appeared for the diagnostic test. All students in a group of 60 were counseled for test by mentioning the purpose and methodology of the test. The entire process was conducted online by Dheya Career Mentors (India) Pvt. Ltd. Dheya Career Mentors (India) Pvt. Ltd. is a professional registered organization involved in psychometric mapping and analysis.

Following were the objectives of the study

- Identify the personality factors of fresh engineering student which are required for successful completing the course.
- Assessment of personality factors of fresh engineering student
- Identify the gap between the perception of students about engineering and demands of industry.
- Guide students in a group or individual to attain desired level of academic and personal attainments.

The students were further instructed to read the instructions printed on the questionnaire and were asked to give the responses that come to their mind. Any doubts raised by the students were clarified by the support team before they started answering the questionnaire. After the students answered the

questionnaire, the same was collected and subjected for scoring and interpretation. The scores were calculated for personality and ability testing. The individual reports about their performance with analysis by experts with recommendations were given to individual student.

VI. Results And Discussions

The total 443 students were appeared for the test and the gender distribution was 117 girls and 326 boys. Fig. 1 shows the program wise distribution of the boys and girls. In core engineering programs the girls percentage is in the range of 9.5% to 25%, however in soft branches the girl percentage lies betwween 45% to 65% with overall percentage is 35.9%. The results of the test are compiled and presented in the form average of personality and abilities of the students. The personality factors such as conscietiousness, behaviour, ethusiasm, energy level, self assurance, emotional stability relationship, assertiveness and relax nature are assessed.

The fig. 2 shows the the average index of students and their levels. The conscietiousness, control over behavior, ethusiaum, energy and tough mindedness are obsered as strengths of students. The following personality factors such as assertiveness, emotional stability and self assurance is found to be below expectations.

Fig. 3 shows mental abilities of the students. The all abilities under test such as concept, reasoning and logical abilities, visual, memory, numerical observations and visualisation abilities are found to be better. The figures are average of the data hence there may be some students below expectations however the overall understanding shows that the students pussesses sufficient abilities required to complete the engineering program.

Interpretation of the test results shows in fig. 4 that the students career interests are social, adventurous, technical, administrative and management. There is less liking towards scientific, musical, literary, clerical, computational and business. This means that they are suitable for administrative, managerial
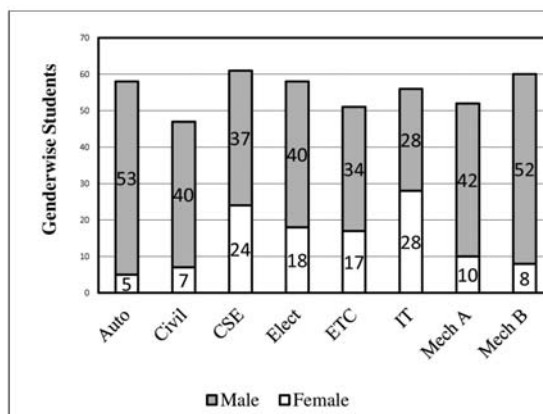

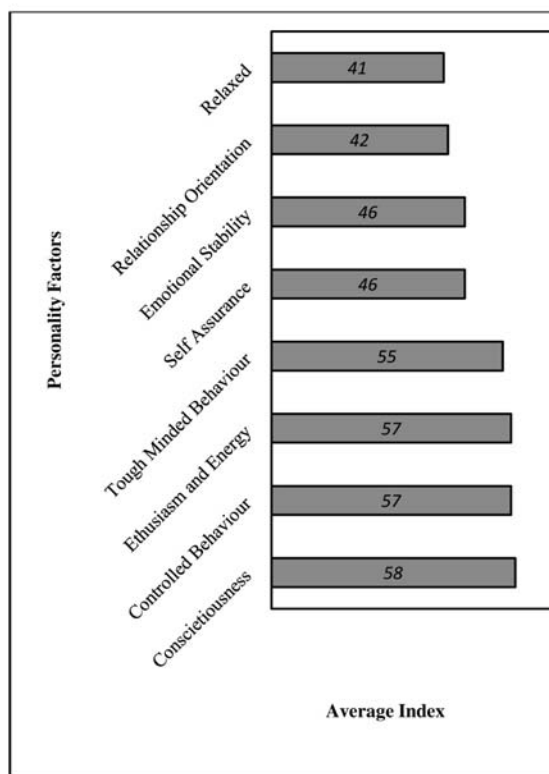Fig. 1: Genderwise details of students appeareed for test
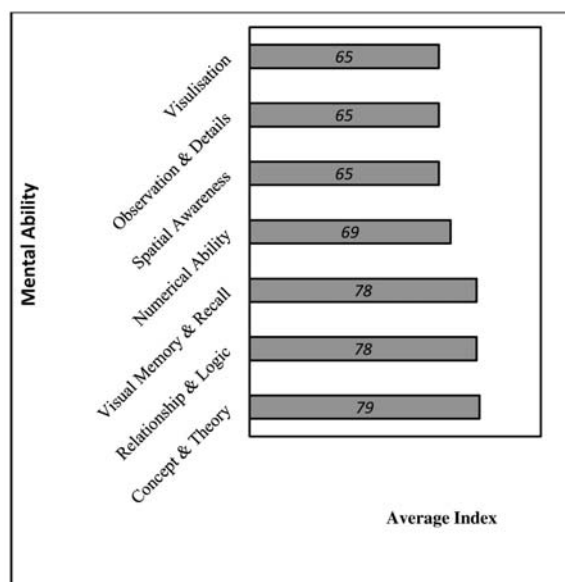

Fig. 2: Average of Personality Factors

Fig. 3: Mental Abilities – Facors that affect
learning and Performance

job in comparison with scientific, computational and research jobs.

The lead factor combination shows that the 61% students are diligence and systematic and 21% students found to be people oriented. 14% of total students are students are stable and only 3% students are result oriented and assertive. Less number of studenta are result oriented and this is an alarming situation.

The fig. 6 indicates the career profile integration for students under test. With bigger number of perfectionists and objective thinkers, we could look at developing engineers who are knowledge driven. However a fair number of students with people skills are always an advantage.

The important outcomes of the test results are identification of the students who could not have desired level of abilities and intelligence. The total 443 students undergone test and out of which following percentage of students have observed their level below expected level. The fig. 7 shows that
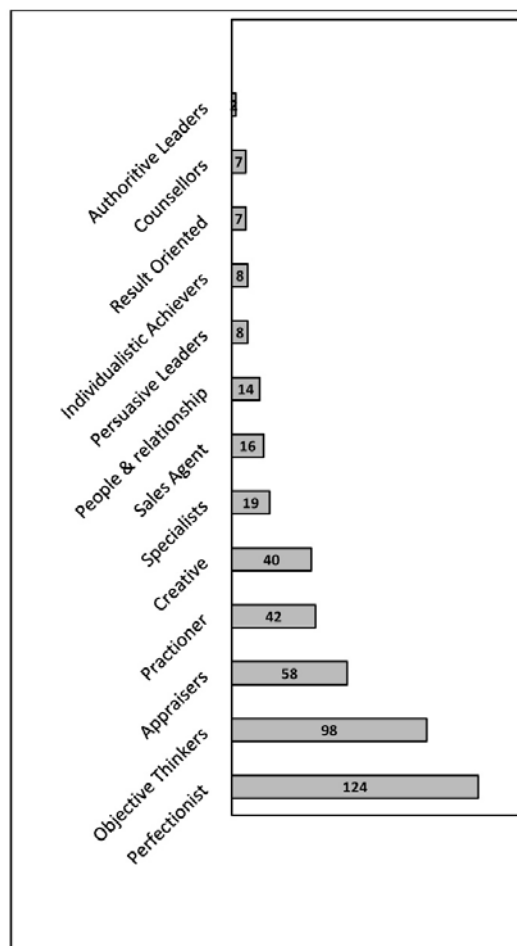

Fig. 4: Career interst of Students – Activitiy level interest
that student would like to work upon

numerical abilities, verbal aptitude, spatial ability and clerical peception are the serious concern.

VII. Conclusions

Ultimate purpose of education is to get the student ready for an occupation and a career. A normal student spends almost 18 years of life in educating self to get the next 40 years of work life right. A planned development approach customized to the individual needs works well in building a long
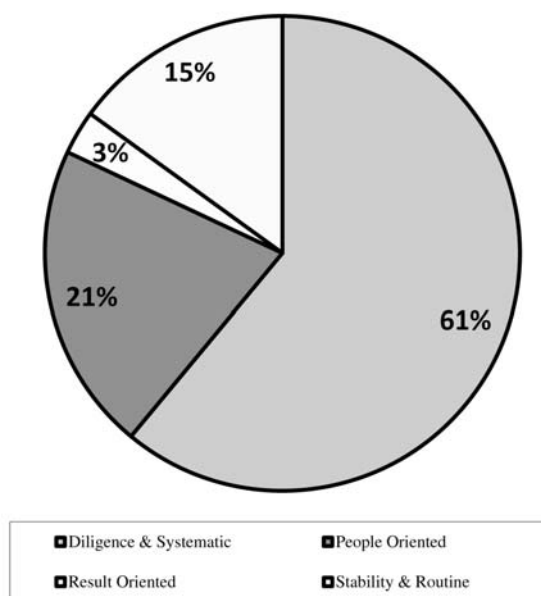
Fig. 5: Lead Factor Combination

Fig. 6: Career profile integration

tern career and not just an entry into jobs. The major objective of the institute (RIT) is helping and guiding our students to achieve greater heights in academics and to maintain consistently strong academic achievements throughout academic career. By an individualized approach and giving a feedback at an earlier stage, it would help students in achieving good academic record.

A competency is a cluster of related knowledge, skills, and attitudes that affects a major part of one's job role or responsibility. The KSA correlates with individuals performance on the job and this is measured by well-accepted standards and these KSA of students can be improved via training and development.

The test areas in which students were observed with low level are identified, communicated to them personaly with parents and counselled by professionals. The desires training and coaching areas are identified and training is provided to students in groups. Clearer is the career path faster is the growth and better is the performance.
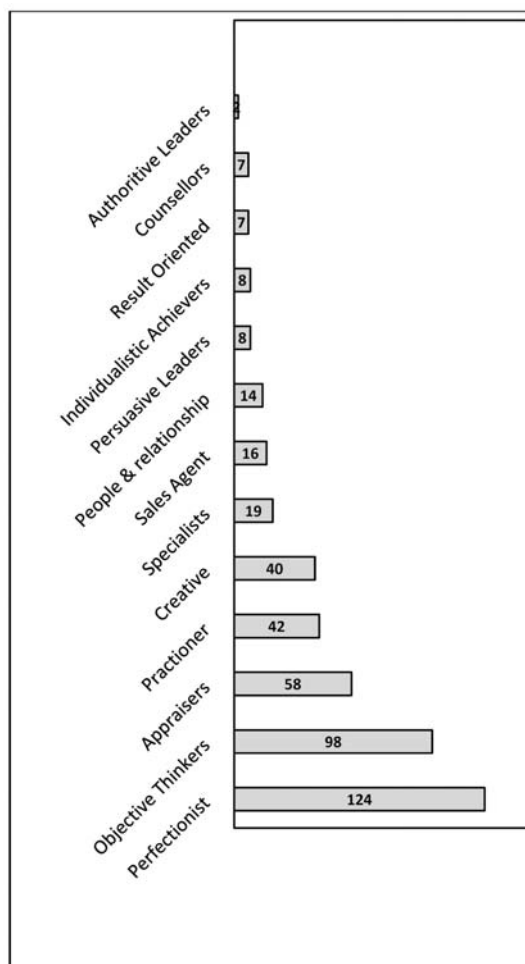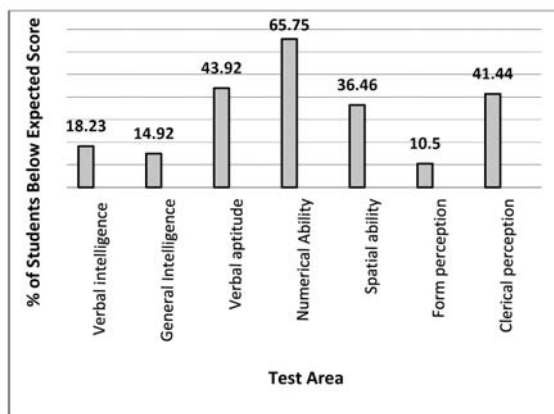
Fig. 7: Percentage of students below expected score in intelligence and abilities.

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