CHAPTER 5

SUMMARY AND CONCLUSIONS
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5.1 STATEMENT OF THE PROBLEM

5.1.1 Engineering Education in Tamilnadu

The engineering and the technological innovations determine the destiny of the modern world. Engineering education has given students a new outlook and a new dimension. Engineering education is one of the significant components of human resource development with great potential for national development. Engineering education is an instrument for developing and transforming the life of the people and improving the quality of life. Engineering Education is the development of intellectual skills and knowledge that will equip graduates to contribute to society through productive and satisfying engineering careers as innovators, decision makers and leaders in the global economy of the 21st century.

India, the largest democracy in the world, is very much proud of her rich traditional cultural heritage and technically skilled manpower. Recent Indian scientific, industrial and technological development, particularly in space, nuclear and missile technology, computer engineering and information science have earned India world recognition as an emerging global power.

During the past four years, there has been a phenomenal expansion of engineering education facilities in Tamilnadu. The Engineering Colleges are affiliated to the Anna University, which was established in the year 1978. Since December 2001, it has become a large, highly renowned affiliated University,
having brought into its fold about 225 Self-financing Engineering Colleges, six Government Colleges and three Government-aided Engineering colleges located in various parts of Tamilnadu State. It offers higher education in Engineering, Technology and allied Sciences relevant to the current and projected needs of the society. Besides promoting research and disseminating knowledge gained there from, it fosters cooperation between the academic and industrial communities. The affiliated Colleges offer degree courses in 46 areas of specialization with the annual admission of 60,000 students.

5.1.2 Non technical Competency

Non technical competence means fitness of ability which includes capability, efficiency, proficiency and skill. It is therefore a suitable word to describe such things as grasping, exploring, thinking, acting, manipulating and manifesting and changing the surroundings all of which promote an effective complete interaction with the environment. Non technical competencies are considered to be the window of the world.

The expertise of a candidate depends not only on his competency in the technical field but his efficiency in soft skills like interpersonal, communication, attitude and emotional maturity. Over the past several years, new concept of non technical competencies has come into being, that have increased productivity, enriched the work place and stimulated creativity and innovation. It is much easier to recognize and accept technical change than it is for manager to change the way of attitude they deal with the people.

The skills in the area of non technical competencies are required in students. Some of the non technical competencies include Attitude, Communication skill, Value, Emotional maturity, Decision making, Time management, Group discussion, Interpersonal skill, Professional values, Dignity of labour, Positive
thinking, Social mobility, Educational values, Environment Awareness, decision making, Time management and duty consciousness.

5.1.3 Need for the Study

Young people entering the work force are in need of a number of soft skills, which are essential for their success in life. They all need improved communications, linguistic and technological skills. Engineers are among the groups that need training in entrepreneurship and management. Abilities to innovate and to design are among the primary skills that engineers need now. Engineering is a well-defined profession, necessitating particular rules of professionalism and ethics. Instructing prospective engineers on these values and enticing deeper commitment to espousing them, is an important need.

One also wonders whether it is possible to achieve the required training in some of these skills, only by traditional academic instruction. Embedding some of these issues in existing courses can perhaps ease the pressure of the academic size of the programs, which is limited by many considerations. Training beyond the classroom is also an important concept that should be seriously explored.

In the era of information technology, engineering colleges need to produce graduates who are employable and trainable to face the competitive world. Apart from the engineering job competencies non technical competencies like attitudes, values, communication skill, and emotional maturity have to be inculcated among the students during their stay in engineering colleges.

The teaching and training of non technical competencies to the future generation can bring out useful products from the engineering institutions. So at this juncture it is very essential to introduce this non technical competencies in the curriculum of engineering colleges. Non technical competencies have not received the required attention. There has not been structured and organised curriculum for
these competencies. So at least new curriculum has to focus on some non technical competencies like attitudes, values, communication skill, and emotional maturity that are essential for the engineering graduates to make them sociable, employable and useful to the nation. With growth of scientific and technological knowledge in different fields of life the students should be trained to upgrade their skills and broaden their horizon of knowledge in the area of non technical competencies which are of greater values than intellectual accomplishments. Engineering education is viewed as an instrument for developing engineers who are the architects of the modern world. It is well accepted that the level of prosperity of a nation depends upon the quality of the engineering education imparted to the students.

So a need has arisen in this context to inculcate and strengthen a moral, social, ethical values in the students of engineering colleges. At this juncture there is a need to introduce non technical competencies to develop the skills, attitudes and knowledge essential for successful employment in the industry. A comprehensive study of non technical competencies must be suitably emphasized in the curriculum of engineering colleges. Hence the need for the study.

5.1.4 The Problem

Engineering education has been one of the essential education in the reconstruction of scientific advancement. The students should be taught to develop their skills and talents which are essential than intellectual development. White (1959) defines competence as fitness of ability and the suggested synonyms include capability efficiency, proficiency and scientific and technological advancement. Engineering education is essential as an instrument of developing employable engineers who are pillars of nation. It is well recognised that the prosperity of the nation depends upon the standard of the engineering education taught for the students. Engineering education is one of the areas in which not only
technical capabilities but also good values are inculcated. Engineering education in this regard should play a significant role in imparting, inculcating and educating the non technical competencies like attitudes, values, emotional maturity, communication skill etc. The engineering curriculum must be so designed to equip the students to face social problems. The development of technical components is the pride and prestige of Anna University, it should also strive to extend its curriculum frontiers to the domains of non technical competencies like attitudes, values, communication skill and emotional maturity. Though there is a vast improvement and development in the area of technical components, there is a decreasing symptom in the cultures and values of the education. Erosion of values and moral standard among students has been to some extent under estimated in the standard of engineering education. So a need has arisen at this juncture to develop and investigate the problems in the area of non technical competencies. Against this background an innovative idea has emerged as “DEVELOPMENT OF CURRICULUM FRAMEWORK IN THE AREA OF NON TECHNICAL COMPETENCIES IN THE ENGINEERING COLLEGES OF TAMILNADU”.

5.2 OBJECTIVES OF THE STUDY

The main objectives of the study are

1. To analyse the curriculum of engineering colleges of Tamil Nadu to elicit the non technical competencies.

2. To ascertain the non technical competencies required in employable engineering graduates as observed by the executives in the industry.

2.1 To list the non technical competencies required in engineering graduates.
2.2 To develop a tool to elicit the components of non technical competencies required by the industry from the engineering graduates.

2.3 To elicit the core non technical competencies from the data obtained from the industry executives.

3. To ascertain the non technical competency components needed in the employable engineering graduates from the data obtained from the teachers.

3.1 To list the non technical competencies required for employable engineering graduates.

3.2 To develop a tool to elicit the components of non technical competencies required in engineering graduates as observed by teachers.

3.3 To standardise the tool in terms of reliability and validity.

3.4 To elicit the core non technical competencies from the data obtained from the teachers.

4. To suggest a curriculum framework for the components of non technical competencies to be incorporated in the curriculum of engineering education based on study.

5.3 METHODOLOGY

5.3.1 Hypotheses

The hypothesis framed for the study based on the objectives are as follows:
5.3.1.1 Hypothesis Related To Industries

5.3.1.1.1 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries with respect to interpersonal skills as a non technical competency.

5.3.1.1.2 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to leadership as a non technical competency.

5.3.1.1.3 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries with respect to group discussions as a non technical competency.

5.3.1.1.4 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to values of professions as a non technical competency.

5.3.1.1.5 There is a significant difference in the responses of the executives from large scale, medium scale and small scale, with respect to dignity of labour as a non technical competency.

5.3.1.1.6 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to emotional maturity as a non technical competency.

5.3.1.1.7 There is a significant difference in the responses of the top executives from large scale, medium scale and small scale industries, with respect to positive thinking as a non technical competency.
5.3.1.1.8 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to social mobility as a non technical competency.

5.3.1.1.9 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to communication skill as a non technical competency.

5.3.1.1.10 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to values of education as a non technical competency.

5.3.1.1.11 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to leadership as a non technical competency.

5.3.1.1.12 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to awareness of environment as a non technical competency.

5.3.1.1.13 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to decision making as a non technical competency.

5.3.1.1.14 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to time management as a non technical competency.

5.3.1.1.15 There is a significant difference in the responses of the executives from large scale, medium scale and small scale industries, with respect to duty consciousness as a non technical competency.
5.3.1.2 Hypothesis Related to Teachers of Engineering Colleges

5.3.1.2.1 Hypothesis Related to Types of Institutions

5.3.1.2.1.1 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to communication skill as a non technical competency.

5.3.1.2.1.2 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to communication skill as a non technical competency.

5.3.1.2.1.3 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to values as a non technical competency.

5.3.1.2.1.4 There is a significant difference in the responses between the government, aided and private engineering colleges with respect to emotional maturity as a non technical competency.

5.3.1.2.1.5 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to decision making as a non technical competency.

5.3.1.2.1.6 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to time management as a non technical competency.

5.3.1.2.1.7 There is a significant difference in the responses between the government, the aided and the private engineering colleges with respect to group discussion as a non technical competency.
5.3.1.2.2 Hypothesis Related to Sex

5.3.1.2.2.1 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to attitude as a non technical competency.

5.3.1.2.2.2 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to communication skill a non technical competency.

5.3.1.2.2.3 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to values as a non technical competency.

5.3.1.2.2.4 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to emotional maturity as a non technical competency.

5.3.1.2.2.5 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to decision making as a non technical competency.

5.3.1.2.2.6 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to time management as a non technical competency.

5.3.1.2.2.7 There is a significant difference in the responses of the male and the female the teachers of the engineering colleges with respect to group discussion as a non technical competency.
5.3.1.2.3 Hypothesis Related To Marital Status

5.3.1.2.3.1 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to attitude as non technical competency.

5.3.1.2.3.2 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to communication skill as non technical competency.

5.3.1.2.3.3 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to values as non technical competency.

5.3.1.2.3.4 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to emotional maturity as non technical competency.

5.3.1.2.3.5 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to decision making as non technical competency.

5.3.1.2.3.6 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to time management as non technical competency.

5.3.1.2.3.7 There is a significant difference in the responses of the married and the unmarried teachers of the engineering colleges with respect to group discussion as non technical competency.
5.3.1.2.4 Hypothesis Related To Qualification

5.3.1.2.4.1 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to attitude as a non technical competency.

5.3.1.2.4.2 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to communication skill as a non technical competency.

5.3.1.2.4.3 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to values as a non technical competency.

5.3.1.2.4.4 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to emotional maturity as a non technical competency.

5.3.1.2.4.5 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to decision making as a non technical competency.

5.3.1.2.4.6 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to time management as a non technical competency.

5.3.1.2.4.7 There is a significant difference in responses of the engineering college teachers with different qualifications with respect to group discussion as a non technical competency.
5.3.1.2.5 Hypothesis Related To Different Levels of Designation

5.3.1.2.5.1 There is significant difference in the responses of the teachers of different levels of designation in the engineering colleges with respect to attitudes as non-technical competency.

5.3.1.2.5.2 There is significant difference in the responses of the teachers of different levels of designation in the engineering colleges with respect to communication skills as non-technical competency.

5.3.1.2.5.3 There is significant difference in the responses of the teachers of different levels of designation in the engineering colleges with respect to values as non-technical competency.

5.3.1.2.5.4 There is significant difference in the responses of the teachers of different levels of designation in the engineering colleges with respect to emotional maturity as non-technical competency.

5.3.1.2.5.5 There is significant difference in the responses of the teachers of different levels of designation in the engineering colleges with respect to decision making as non-technical competency.

5.3.1.2.5.6 There is significant difference in the responses of the teachers of different levels of designation in the engineering college teachers with respect to time management as non-technical competency.

5.3.1.2.5.7 There is significant difference in the responses of the teachers of different levels of designation in the engineering college teachers with respect to group discussion as non-technical competency.
5.3.1.2.6 Hypothesis Related To Experience

5.3.1.2.6.1 There is significant difference in the responses of respondents with various years of experience with respect to attitude as a non technical competency.

5.3.1.2.6.2 There is significant difference in the responses of respondents with various years of experience with respect to communication skill as a non technical competency.

5.3.1.2.6.3 There is significant difference in the responses of respondents with various years of experience with respect to values as a non technical competency.

5.3.1.2.6.4 There is significant difference in the responses of respondents with various years of experience with respect to emotional maturity as a non technical competency.

5.3.1.2.6.5 There is significant difference in the responses of respondents with various years of experience with respect to decision making as a non technical competency.

5.3.1.2.6.6 There is significant difference in the responses of respondents with various years of experience with respect to time management as a non technical competency.

5.3.1.2.6.7 There is significant difference in the responses of respondents with various years of experience with respect to group discussion as a non technical competency.
5.3.1.2.7 Hypothesis Related To Salary

5.3.1.2.7.1 There is significant difference in the responses of respondents of various levels of salary structure with respect to attitude as a non technical competency.

5.3.1.2.7.2 There is significant difference in the responses of respondents of various levels of salary structure with respect to communication skill as a non technical competency.

5.3.1.2.7.3 There is significant difference in the responses of respondents of various levels of salary structure with respect to values as a non technical competency.

5.3.1.2.7.4 There is significant difference in the responses of respondents of various levels of salary structure with respect to emotional maturity as a non technical competency.

5.3.1.2.7.5 There is significant difference in the responses of respondents of various levels of salary structure with respect to decision making as a non technical competency.

5.3.1.2.7.6 There is significant difference in the responses of respondents of various levels of salary structure with respect to time management as a non technical competency.

5.3.1.2.7.7 There is significant difference in the responses of respondents of various levels of salary structure with respect to group discussion as a non technical competency.
5.3.1.2.8 Hypothesis related to family status

5.3.1.2.8.1 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to attitude as non technical competency.

5.3.1.2.8.2 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to communication skill as non technical competency.

5.3.1.2.8.3 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to values as non technical competency.

5.3.1.2.8.4 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to emotional maturity as non technical competency.

5.3.1.2.8.5 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to decision making as non technical competency.

5.3.1.2.8.6 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to time management as non technical competency.

5.3.1.2.8.7 Hypothesis related to difference in response of nuclear and joint family teachers of the engineering colleges with respect to group discussion as non technical competency.
5.3.2 Sample

The population for the study comprises of the Engineering colleges and Industries in Tamilnadu.

A sample of 100 executives from 3 types of Industries viz. large scale, medium scale and small scale was used for the study. The data from these 100 executives was used to prioritise/rank the non technical competencies required by the Industry.

Therefore 25 industries in Tamilnadu were selected and earmarked for the purpose of conducting interview schedule with hundred executives. Care was taken to include 3 types of industries namely large scale, medium scale and small scale industries.

The sample for the main study consisting of 450 engineering college teachers. Out of 450 respondents, 25 respondents (5.5%) come from Aided Engineering Colleges, 25 respondents (5.6%) come from Government Engineering Colleges and 400 respondents (88.9%) from Private Engineering Colleges. Out of 450 respondents 245 respondents are (54.4%) male teachers and 205 respondents (45.6%) are female teachers. Out of 450 respondents 226 (50.2%) are married teachers and 224 (49.8%) are unmarried teachers. Out of 450 respondents, 170 (37.8%) respondents are teachers with B.E qualification, 161 (35.78) respondents are teachers with M.E. qualification, 104 (23.1%) respondents are with M.A/M.Sc., degree qualification and 15 (3.33) respondents are with Ph.D degree qualification. Out of 450 respondents 325 (72.22%) are lecturers, 44 (9.77%) respondents are Asst. professors, 43 (9.55%) are professors and 38 (8.44%) are H.O.Ds. Out of 450 respondents, 236 (52.4%) respondents are teachers who have less than two year of service, 153 (10.2%) respondents are teachers who have experience between 2 and 5 years, 46 (33%) respondents are teachers who have rendered service between 5 and 10 years and 15 respondents are teachers who have
completed more than 10 years of experience. Out of 450 respondents, 237 (52.7%) are teachers who are drawing salary between 5000 to 10,000, 183 (40.7%) respondents are teachers who are drawing salary between 10,000 to 15,000, 11 (2.4%) respondents are drawing salary between 15000 to 20000 and 19 (4.2%) respondents are drawing salary more than 20,000. Out of 450 respondents 294 (65.3%) respondents belong to nuclear family. 156 (34.7%) respondents belong to joint family.

5.3.3 Construction of Tools

The tools used for the data collection of the present study were interview schedule for executives and questionnaire for teachers.

5.3.3.1 Development of Interview Schedule for executives

As a prerequisite for the development of interview schedule, data related to the possible area of non technical competencies that are required in industry has to be collected and to be identified. So an attempt was made to draw a list of non technical competencies that are needed in industries to become an employable engineer. An exhaustive list of non technical competencies was collected from various sources namely literature, academicians, and industry executives. Then the competencies were assembled in a proper sequence. A list of 15 non technical competencies were selected to be included in the Interview schedule. The Interview schedule contains information such Name and address of the industry / company, Number of employees in the factory / organization, engineers are employed in the company, average number of engineering graduates per year, the average number of engineering graduates apprenticeship you they train per year, type of training given to engineers after recruitment, participation of newly recruited engineering students, what are their expectations from the fresh engineering graduates for recruitment in company / industry, priority of the competencies in
order, and any valuable suggestions. The executives were asked to prioritise/rank the components of non technical competencies from the following:

1. Interpersonal Skill
2. Leadership
3. Group Discussion
4. Values of Profession
5. Dignity of Labour
6. Emotional Maturity
7. Way of Positive Thinking
8. Social Mobility
9. Communication Skill
10. Value Education
11. Leadership
12. Awareness Of Environment
13. Decision making
14. Time Management
15. Duty Consciousness

The Interview Schedule is shown in Appendix

5.3.3.2 Development of Questionnaire for Teachers

A group of experts involving Faculty from Engineering colleges, Curriculum planners, Psychologists, Soft Skill trainers and researchers were interviewed by the Researcher to elicit the list of non technical competencies required by engineering students for placements. The rank of the non technical competencies as elicited by industry executives were also used in selecting the list of skills to be included in the questionnaire for teachers. The experts were involved in identifying the items needed for the development of questionnaire related to possible area of non
technical competencies that has to be incorporated in the curriculum of engineering colleges.

The questionnaire seeks information and opinion about non technical competencies that are required in the curriculum of engineering colleges. The items on the following non technical competencies like communication skill, attitudes, values emotional maturity etc were arranged in appropriate categories to ensure cozy and accurate responses. The items connected with non technical competencies are objective in nature. The terms and words that are given in that items are well defined and clear. Suitable grading categories are also provided. Likert method of summated ratings is extensively used in this research method. The actual Likert scale technique provides a 5 point scale and assigns each of the five positions of scale value.

| Strongly Agree | - | 5 |
| Agree          | - | 4 |
| Not sure       | - | 3 |
| Disagree       | - | 2 |
| Strongly disagree | - | 1 |

In the Questionnaire, there were 7 items in the Curriculum Development, 20 items on attitude, 15 items on Communication skill, 16 items on Values, 12 items on emotional maturity, 6 items on Decision making, 6 items on Time management and 6 items on Group Discussion. This questionnaire were administered to 450 teachers of Engineering colleges in Tamilnadu. The Questionnaire for teachers is shown in Appendix.
5.3.4 Administration of Tools

The investigator administered two tools for data collection. The first tool, interview schedule was administered to the industries and second tool, the questionnaire was administered to the teachers of Engineering colleges.

The investigator with the printed interview schedule went to 25 industries for data collection. The interview schedule was administered to 100 executives in 25 industries, which were classified as large, medium, and small scale industries. More than 25 days were spent for investigation and data collection through interview schedule. The list of Industries is shown in Appendix D.

Again the investigator with the questionnaire went to 25 Engineering colleges in Tamilnadu for data collection. The names of the Engineering colleges are given in Appendix E. The questionnaire was administered to 450 teachers of Engineering colleges. The teachers who were administered the questionnaire were clear about the aims and objectives of non technical competencies in the curriculum of the engineering colleges. Data collection through questionnaire took more than 90 days. In most of the engineering colleges the teachers were gentle and polite in giving their opinion.

5.3.5 Qualitative Analysis of the Curriculum of Engineering Education

Since the ultimate objective of the study is to suggest a curriculum framework involving non technical competencies, the content analysis of the existing undergraduate Engineering Education curriculum of Anna University was done. The content Analysis was done primarily to identify the presence of non technical competency components in the curricula. The curriculum components identified to be relevant for the study are presented in Appendix C. Qualitative analysis was done for analysing the contents of the curriculum.
5.3.6 Data Analysis Plan

To develop the research plan, processing and analysis of data is necessary. Quantitative and Qualitative method of analysis were used.

For the Industry data, Since there are more than two groups, one way ANOVA was computed and F-ratio was obtained. It was tested for significance using 0.05 level significant criteria.

The perception of Engineering college teachers were taken from different categories which were classified as type of institution, sex, marital status, experience, income and family status. The sum of the items in each components is treated as score for that component which includes frequency distribution, mean, S.D for the components of the questionnaire. The frequency distribution, mean and S.D were computed for each component score. This is done to understand the nature of the score distribution. For comparing various groups on their perception of various components mean, comparison statistics were used. Whenever there exists two groups, t-test was computed. The significant level of 0.05 was fixed to evaluate the statistical significance of difference. Whenever there are more than two groups, one-way ANOVA was computed and obtained F-ratio and it was tested for 0.05 level significance criteria.

5.4 MAJOR FINDINGS

5.4.1 Major Findings Related to Content Analysis of the Curriculum

1. A total of 14 undergraduate degree (B.E) programmes are offered.

2. Each degree programme has both theory and practical courses.

3. A certain number of core courses are compulsory. Sufficient number of elective courses are available that are opted by the student.
4. Every student should compulsorily involve in any one of character development programmes such as NCC/NSS/NSO/YRC. But there are no explicit indications of non technical competencies that will be developed.

5. A certain number of students are assigned to a faculty adviser.

6. Every student must undergo Industrial visit. Mostly the industrial visits are technical in nature.

7. Though different Language electives are available, English-I and English-II has scope and content for student to develop communication skills. But there are no practical sessions for these Electives.


9. Subject titled “Professional Ethics” is included. It covers only ethics and values of profession with a few case studies. There are no practical sessions for this subject.

10. All the Engineering branch contains a subject titled “Management”, Only in Mechanical Engineering “Management’ Syllabus, a few non technical components like Team work and time management are included in a Unit which is to be covered in 10 theory periods.
5.4.2 Major Findings Related to Industries

In the following paragraphs the major findings that emerged out of the analysis of the data obtained from the executives are presented.

1. There is no difference of opinion among the executives of large scale, medium scale and small scale industries with respect to the following non technical competencies

   1. Interpersonal skill
   2. Attitude
   3. Dignity of labour
   4. Positive thinking
   5. Social mobility
   6. Values of education
   7. Leadership

There is a difference of opinion among the executives of large scale, medium scale and small scale industries in following non technical competencies.

   1. Group discussion
   2. Values of profession
   3. Emotional maturity
   4. Awareness of environment
   5. Decision making
   6. Time management
   7. Communication skill
   8. Duty consciousness
5.4.3 Major Findings Related to Teachers of the Engineering colleges

5.4.3.1 Major Findings Related to Teachers of Colleges Pertaining to Type of Institution

1. There is a difference of opinion among The Govt., the Aided and the Private engineering college teachers with respect to following non technical competencies

   1. Attitude
   2. Emotional maturity

   The awareness about attitude of private colleges teachers is higher than that of Govt and aided engineering college.

2. There is no difference of opinion among the Govt., the Aided and the Private engineering college teachers with respect to the following non technical competencies

   1. Communication skill
   2. Values
   3. Decision making
   4. Time management
   5. Group discussion

3. It can be inferred that the teachers from all the three types of institutions are aware of the non technical competencies required. Type of institution does not matter regarding the level of awareness of non technical competencies.
5.4.3.2 Major Findings Related to Teachers of Colleges Pertaining to Sex

1. There is no difference of opinion between male and female teachers of the engineering colleges with respect to the following non technical competencies

   1. Attitudes
   2. Communication skill
   3. Values
   4. Emotional maturity
   5. Decision making
   6. Time management
   7. Group discussion

2. Teachers of both the gender are aware of all the non technical competencies.

5.4.3.3 Major Findings Related to Teachers of Colleges Pertaining to Marital Status

1. There is no difference of opinion among the married and the unmarried teachers of the engineering colleges with respect to the following non technical competencies

   1. Attitudes
   2. Communication skill
   3. Values
   4. Emotional maturity
   5. Decision making
   6. Time management
2. There is a difference among the married and unmarried teachers with respect to group discussion.

3. The marital status of the teachers does not play any role in the level of awareness/possession of non technical components.

5.4.3.4 Major Findings Related to Teachers of Colleges Pertaining to Qualification

1. There is no difference of opinion among the teachers of the engineering colleges with different qualification with respect to the following non technical competencies

   1. Communication skill
   2. Values
   3. Emotional maturity
   4. Decision making

2. There is a difference among the teachers of the engineering colleges with different qualification with respect to the following non technical competencies

   1. Attitude
   2. Time management
   3. Group discussion

It can be inferred that teachers with lesser qualification consider attitude, time management and group discussion as more important than the highly qualified teachers.
5.4.3.5 Major findings related to teachers of colleges pertaining to designation

1. There is a difference of opinion among the teachers at different levels of designation in engineering colleges with respect to decision making and group discussion. Professors give more importance to group Discussion and decision making.

2. There is no difference of opinion among the teachers at different levels of designation in the engineering colleges with respect to the following non technical competencies.
   
   1. Attitudes
   2. Communication skill
   3. Values
   4. Emotional maturity
   5. Time management

5.4.3.6 Major Findings Related to Teachers of the Engineering Colleges Pertaining to Experience

1. There is a difference among the teachers with various years of experience with respect to the following non technical competencies

   1. Communication skill
   2. Emotional maturity
   3. Time management

   Teachers with less than 5 years of experience possess and feel the requirement of the above 3 non technical competencies.
2. There is no difference among the teachers with various years of experience with respect to the following non technical competencies

1. Attitude
2. Values
3. Decision making
4. Group discussion

All the teachers irrespective of their experience, feel the requirement of the above 4 non technical competencies.

5.4.3.7 Major Findings Related to Teachers of the Engineering Colleges Pertaining to Salary

1. There is difference of opinion among the teachers of the engineering colleges at various levels of salary structure with respect to the following non technical competencies

1. Decision making
2. Time management
3. Group discussion

The higher the salary, the higher is the opinion of the above non technical competencies.

5.4.3.8 Major Findings Related to Teachers of the Engineering Colleges Pertaining to Family Status

1. There is a difference of opinion between the joint and the nuclear family teachers of the engineering colleges with respect to the following non technical competencies
1. Communication skill
2. Group discussion

2. There is no difference of opinion between the joint and the nuclear family teachers of the engineering colleges with respect to the following non technical competencies

1. Attitudes
2. Values
3. Emotional maturity
4. Decision making
5. Time management

5.5 RECOMMENDATIONS

On the basis of the observations the following initiatives are recommended for increasing the impact of non technical competencies in the curriculum of the engineering colleges and industry.

5.5.1 Curriculum Framework

In order to produce tremendous number of employable engineering graduates, a novel curriculum framework should be constructed in engineering colleges. In the present curriculum of the engineering colleges there are more branches for developing technical competencies, but less amount of importance is given to non technical competencies. All of these technical and non technical competencies have been debated by the professors, industries and the curriculum planners. Learning experience have to be put together to form some kind of coherent program in the area of non technical competencies. It is necessary to organise learning experience in the area of non technical competencies and
develop them. The curriculum planners should identify the components of the competencies that are needed in the area of technological world. Each engineering occupation needs specific knowledge and competency in the area of non technical competencies.

As Anna University is striving in the path of producing employable engineering graduates, the large gap between the inculcating of technical competencies and non technical competencies is to be identified. The curriculum planners may not be in a position to know their intricacy of the difference, hence the curriculum planners should be encouraged and advised to introduce the non technical competencies in the contents of curriculum of undergraduate engineering education. To assess the quality of education imparted in the Engineering colleges an investigation survey among the expert of industries and the teachers of the engineering colleges was conducted.

Future of the Engineering colleges will decide the future of the country. Building non technical competencies based curriculum is necessary today. In Tamil Nadu there are 250 Engineering colleges producing 60,000 fresh graduates every year. This has created a big crunch in the quality of the engineering graduates. While on one hand there are limited job opportunities in public and private sector, on the other hand there is a mismatch between what the industry needs and what these engineering colleges offer. So effective interactions between the curriculum planners and the industry is the need of the day. Acquisition of relevant competencies to carry out the jobs effectively is the need of the day rather than amassing just a wealth of information. The present industrial environment demands specific competencies based engineering graduates rather than knowledge worker.

- The study shows that teachers are aware of the requirement of core competencies like attitude, communication skill. etc.
• Teachers at the higher levels of designation and salary structure and experience recommend skills like. Decision making and group discussion.

• Teachers feel the inadequacy of non technical competency components in the curriculum of Engineering Education.

From the findings of the present study the following curriculum frame work is proposed:

1. **Communication Skill**

   Principles of Communication – Communicating with Superiors – Communicating with peer groups – Communicating with subordinates – Attending interviews – Importance of Communication.

2. **Attitude**

   Leadership – Functions of Attitude – Components of Attitudes – Attitude towards work – Attitude towards colleagues – Attitude towards Superiors – Attitude towards Innovation and Creativity.

3. **Values**


4. **Emotional Maturity**

5. **Time Management**

   Principles of Time Management - planning and scheduling of Time - Yardstick of Time Management.

6. **Participation in Group Discussion**


7. **Decision making**


   The proposed curriculum frame work can be integrated into the existing subjects of the different branches of Engineering or it can be offered as a separate subject. The proposed curriculum frame work should be implemented through class room lectures, practical sessions, case studies, group discussion, workshops, conferences, practical training and industrial in plant training. A curriculum frame work can also be evaluated through observable behavior and feed back from industry and alumni.

5.5.2 **Recommendations to curriculum planners of Anna University**

- The frame work suggested by the study can be taken as an input document to incorporate more non technical competency components in the curriculum.

- The no. of periods allotted for inculcating non technical competencies should be raised, particularly the sessions, as non technical competencies cannot be dealt in theory alone.
The non technical competency components be spread across the entire curriculum rather than restricting it to one semester.

Industrial training particularly in the of Social skills training should be made mandatory.

The University should insist on in service training in non technical competency for teachers of Engineering colleges.

Non technical competency components can be incorporated in the co-curricular and extra curricular activities also.

5.5.3 Recommendations to institutions

1. The engineering colleges should conduct debates and discussions in the area of non technical competencies.

2. Teachers should be trained in the area of non technical competencies.

3. Invited Lecturers / Discussion be arranged for students.

4. The engineering colleges can conduct need analysis of soft skills such as values, attitude and duty consciousness that are currently relevant to become employable engineer. Apart from seeking opinion from the experts in the industry, the engineering colleges can also get feedback from their alumni.

5. The engineering colleges can sign an agreement with major companies. Such an agreement can include counselling in the area of non technical competencies. There should be continuous inplant training for both the faculty and the students.
5.5.4 Recommendations to AICTE

1. AICTE can suggest curriculum planners to develop a curriculum framework for the components of non technical competencies to be incorporated in the curriculum of the engineering colleges.

2. AICTE can conduct a conference at national level to elicit the components to be include in the curriculum.

5.5.5 Recommendations to Industries

1. The industries should pave the way for better liaison and network with the engineering colleges for

   i) Exposure to duty consciousness in industry

   ii) Effective inplant training in the area of non technical competencies

   iii) Developing team work with an attitude for sharing

5.5.6 Recommendations to Parents

The parents can participate in the college day and other functions in order to know the values of non technical competencies that are needed to their wards.

5.5.7 Recommendations to Faculty Advisers

1. Social/Soft skills training should be made compulsory for faculty adviser as they are the direct counselors of the students.

2. The faculty adviser should spend considerable time in talking to students about the skills needed in them.

3. The faculty adviser should have information on what kind of training be offered to students both inside and outside the college.
4. The faculty adviser should try to maintain information on industries where training can be offered.

5.6 SUGGESTIONS FOR FURTHER RESEARCH

1. The present study in the area of non technical competencies has paved way for further several studies.

2. The present study has not been able to cover all the states of the country. A similar study can be conducted in other states and regions to cover the present status and significance of non technical competencies that are needed in the curriculum of the engineering colleges.

3. A separate study can be undertaken to find out core non technical competencies in the curriculum of civil engineering or mechanical engineering or electrical engineering faculties etc.

4. A study can be undertaken to investigate the significance of non technical competencies by providing co-curricular and extra curricular activities in the curriculum of the engineering colleges.

5. A study can be undertaken to find out the importance of non technical competencies in entrepreneurship development programs in the industry.

6. A study can be undertaken to find out the importance given to the non technical competencies by the teachers of the engineering colleges through in service training given to them. Such a study can get the feedback from the new pass-outs regarding skills needed, newer areas to be introduced in the in service training imparted to the teachers.
7. A separate study can be undertaken to explore the importance of non technical competencies that are needed in the curriculum of the engineering colleges as observed by the students of the engineering colleges.

5.7 CONCLUSION

The study has established the need for analyzing the non technical components required by the industry from Engineering graduates. The study enabled the qualitative analysis of curriculum of Undergraduate Engineering Education in Tamilnadu. The study facilitated the development of tools for Industry Executives and Teachers to assess the requirement of non technical competencies. The tools were administered to 100 executives from industries and 450 teachers of Engineering colleges.

The study clearly showed the less importance given to the development of non technical components and it also showed a mismatch between what industry needs and what teachers perceive as required in engineering students. The study enabled the researcher to develop a curricular framework which can be adopted by the Engineering Education in Tamilnadu. The study resulted in recommendations to Institutions, Industries, Directorate of Technical Education, AICTE, Parents and Faculty Advisors.

All the Objectives of the study has been fully achieved. A curriculum framework and a set of recommendations have been evolved out of the study. The study will help further researchers in pursuing their research in the area of non technical competencies.