
Outcome based Education at SSN College of Engineering

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Abstract: Outcome based Education is a process of defining and setting expected goals and outcomes in the form of competencies that the students should display as a result of undergoing a learning experience. This learning experience can be a short term course or a graduate program.

SSN College of Engineering has converted this process into an institution wide philosophy to establish itself as a world class engineering institution. With a well defined vision statement encompassing the chief objectives of the founders, specific initiatives have been designed. Each objective is broken down into a set of actionable steps towards achieving the outcome of producing employable engineers. The metrics are defined to measure the success of the activities. These initiatives have led to establishing itself as a premier engineering institution within a short period of 19 years and having successful alumni in diverse walks of life.

This process can be used by new private engineering colleges to link management and academic objectives to produce world class technical institutions.

Keywords: SSN College of Engineering, Outcome Based Education, Research Excellence, 360 degree learning, Bridging Urban-Rural divide

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1. Introduction

There has been an influx of engineering colleges in recent years. Every year around six lakh engineers graduate out of Indian engineering colleges and universities. However, of these, less than 20% are employable for IT jobs and less than 7.5% are employable for core jobs¹. Employability consists in not just technical knowledge but also the knowledge of practical applications, research methods and above else soft skills.

The need of the hour for engineering colleges is to produce more than just theoretically sound engineers. They should also be well rounded personalities able to appreciate their larger roles in developing the country and society. They should be team players able to collaborate effectively to solve the challenges facing the nation. The primary outcome for engineering education at SSN College of Engineering is to produce such engineers from diverse backgrounds. This paper explores the process through which this outcome is achieved.

1. Overview of Outcome Based Learning

The institute follows a top down process to ensure that all academic, co-curricular and extra-curricular activities are aligned towards achieving the primary outcome. The Vision Statement serves as the guiding force in this process. The three pronged vision statement is broken down into measurable goals/objectives. Specific initiatives/interventions have been designed and executed around these goals with an expected outcome mapped to these initiatives. Various metrics are used to measure the expected outcomes. Fig. 1 shows the flowchart of the process beginning with the vision statement and measurable results as the final outcome.

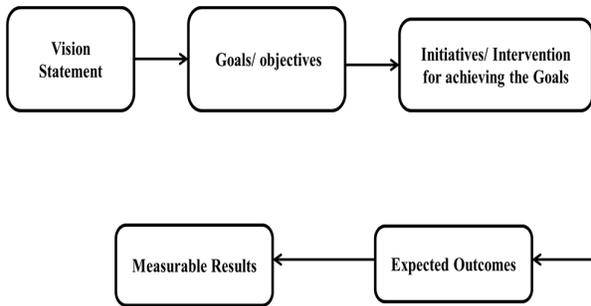


Fig 1: Outcome Based Learning Process

2.1 Overview of Outcome Based Learning in individual departments

The institute offers 8 B.E./B.Tech. degree programs in Electrical & Electronics Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Information Technology, Mechanical Engineering, Chemical Engineering, Biomedical Engineering and Civil Engineering, 11 M.E./M.Tech degree programs in Power Electronics & Drives, Communications Systems, VLSI design, Applied Electronics, Computer Science & Engineering, Software Engineering, Information Technology, Manufacturing Engineering, Energy Engineering, Medical Electronics and Environmental Science & Technology. Every department has a separate vision and mission statement from which the Program Educational Objectives (PEOs) are developed. These are developed primarily in consultation with industry, alumni and faculty about the future trends in engineering education. Based on the attributes defined for engineering graduates, the Program Objectives (POs) are derived. The Program Outcomes are derived from the Program Educational Objectives and Course Outcomes are derived from Program Outcomes. The whole process at the department level is captured in Fig. 2. Being an affiliated institute, the whole process is guided by Anna University.

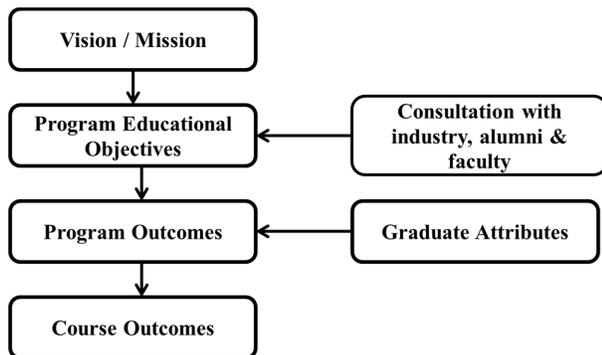


Fig 2: Outcome Based Learning at individual departments

2. Outcome Based Learning – Process Description

3.1 SSN Vision Statement

The Vision statement serves as the guiding principles for all its outcomes. The three pronged statements in the vision are:

- I: Be a global technology-led research Institute.
- II: Serve society by providing life changing opportunities to academically bright but economically challenged students.
- III: Create model citizens who contribute professionally and socially to the nation.

This paper is now divided into three sections with each section describing the goals, objectives, expected outcomes and measured results of individual statements.

Section I

This Section pertains to Vision Statement I: To pursue the vision of being a global technology led Research Institute.

Goals/Objectives

A. Academic Excellence in Engineering Education

A Governing Council consisting of eminent people from all walks of life has been set up to translate the vision of being a global technology institute through concrete initiatives and guidelines.

Initiatives to achieve the objective:

- i. *Technology led Learning:* SSN is amongst the first institutions to use technology extensively in engineering education. The campus is fully Wi-Fi enabled. Learning material is updated in a central repository enabling students to learn at their own pace. Both students and faculty use the intranet extensively to post notes, evaluate assignment, clear doubts etc. All the classrooms are equipped with learning aids such as LCD projectors and laptops, and lectures are delivered through this medium. Faculty go the extra distance to prepare e-lectures and notes accessible to the students from the comfort of their rooms even after class hours.
- ii. *Best in Class Faculty:* The best faculty are recruited through a stringent selection process. The institute not only stresses on high qualifications and ability but also seeks out individuals who share the values and support the mission of transformational education. To attract and retain competent faculty, the management offers many incentive schemes such as for paper publications, travel grants, reimbursement of registration fee for presenting paper in India and abroad. Other facilities include group mediclaim, incentives for filing patents, subsidised laptop, sponsoring for higher studies, and subsidy on

housing loan, tuition fee waiver for wards and host of other benefits. As shown in figure 3, the current faculty strength is 260, of which 60% are Ph.D. holders and another 35% are in the process of obtaining their PhDs². About 70 textbooks authored by the faculty have been published across all disciplines.

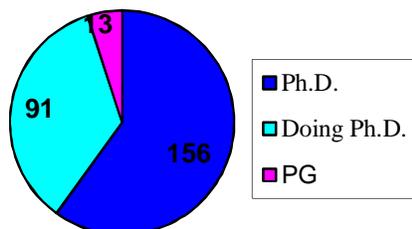


Fig 3: Qualification-wise break up of faculty

- iii. *State of the Art Infrastructure:* The fully Wi-Fi equipped campus is spread over 250 acres located off Chennai city with over 1.7 million sq. ft. of built up space. There are 12 hostels for boys and girls where around 65% of students are accommodated. All Post Graduate programs are fully residential in order to enable the students to evince a high focus on studies and research. Accommodation is also provided to faculty and staff on campus ensuring a vibrant community which is active in academics, research and other learning activities way beyond the official college hours. There is a modern well stocked central library with access to over 84,000³ volumes with 32,000 titles and various national and international journals and e-journals. Fully equipped, modern laboratories are available apart from an independent Research Centre involved in practical research solving social problems.

Expected Outcome: The expected outcomes from the above initiatives and interventions is to create graduates who have strong technical skills and can compete for the best positions and best opportunities in higher education in their fields.

Metrics: The metrics which can measure the success of these initiatives would include the pass percentage, number of toppers, students receiving offers from reputed technical organisations, students being accepted in top global universities for higher education, students clearing the top entrance examinations.

Results: Students have shown excellent performance across all these criteria. The UG pass percentage has been

consistently above 90 over the last five years ending 2014-15⁴. In 2014, three students were university toppers in their branches with 20 students within the first five ranks. A total of 148 students were rank holders in the Anna University examinations⁵.

Students have received offers from top technical organisations over the last five year period. Organisations include Amazon, Microsoft, Flipkart, Dell India, Samsung, L&T, Ford Motors, Danfoss, ITC, Saint Gobain, LatentView, MuSigma etc. Students have also received internships from Indian Institute of Science, Reliance Communications, Tata Elextsi, ISRO, BOSCH, National Brain Research Center, IIT Madras, IGCAR etc. Many students are offered internships in leading institutions abroad.

Every year, over a hundred and fifty students get admissions for their Master's programs in leading universities in US and Europe some with full financial assistance. Many students have done well in CAT and have been admitted to the IIMs. Students have also done well in GATE examinations.

B. Research Excellence

Initiatives to achieve the objective:

- i. *Constitution of a Research Advisory Council:*
A Research Advisory Council (RAC) comprising of eminent international researchers from their field has been constituted to promote external and internal research. RAC meets twice a year and reviews and sets the guidelines for research at SSN.
- ii. *Centres of Excellence to promote interdepartmental research:*
To promote interdepartmental Research, Centres of Excellence have been created in following areas:
 - Energy
 - Materials
 - Speech technology
 - Health care technology
 - Smart technology
 - Machine Learning

All the departments periodically organize and conduct international and national level conferences, workshops, seminars, faculty development programs and short term training programs.
- iii. *Management Funding to promising projects of both faculty and students:* Management funding also known as Internal Funding Scheme is being implemented. It fuels the research activities of

various departments with the funds allocated by the management. Over the last four years, student projects worth of Rs. 44 lakh have been funded and a total of Rs. 2.87 crore worth of faculty projects have been funded⁶. The internal funding scheme is categorized into ‘Faculty Project Proposal’ and ‘Student Project Proposal’. Under ‘Faculty Project Proposal’, an individual or a team of faculty members can submit a proposal and quote the amount required to create a prototype or create hardware/software setup for a lab, thereby leading to a standard publication in a conference, journal or arrive at a patentable solution. ‘Student Project Proposal’ promotes either an individual or a group of students to apply for the funding scheme under a guidance of a faculty, to do research leading to student publications, thereby exposing them to arrive at solutions for complex problems.

The process involved with the ‘Internal Funding Scheme’ is shown in Fig. 4.

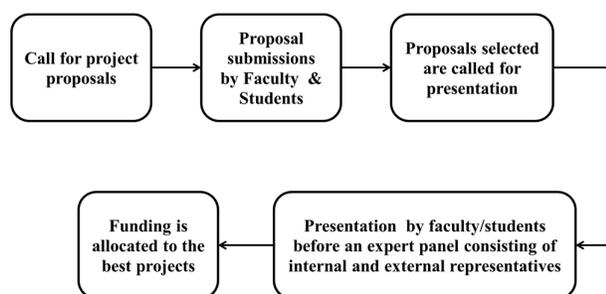


Fig 4: Flowchart of Internal Funding Scheme

iv. *Setting up of Innovation Labs and Technical Business Incubation Centres*

As a next step to internal funding, Innovation Labs and Technical Incubation Centres have been set up to ensure development of ideas generated from projects. Idea can be refined in an innovation centre which has all the basic tools in one dedicated space and can be used by both faculty and students. Mentors are assigned to the projects in innovation centre. Promising projects are further encouraged via a seed funding through the technical incubators. Both these initiatives have commenced in the academic year 2015-16 and will bear fruit in the coming years.

Expected Outcome: The initiatives and interventions are expected to significantly improve the high

quality research output, innovative projects and path breaking work on complex research problems.

Metrics: The expected outcome for this goal can be measured by the number of research publications in reputed international journals, external funding provided to researchers, award winning projects, patents & innovations etc.

Results achieved: The Research output has increased manifold. Referring to fig 5, the faculty published over 352 papers in the year 2014 in reputed refereed international journals with high impact factor⁷.

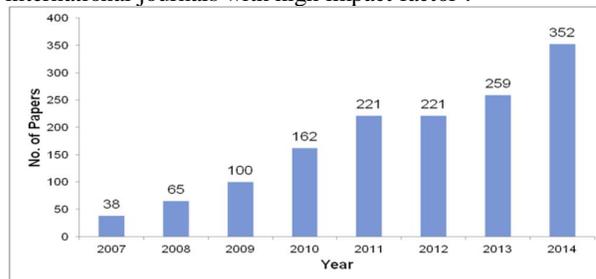


Fig 5: Publications by faculty in refereed international journals over the years

Since the inception of research activities at the institute in the year 2007, a total grant of Rs. 15.75 crore has been received in external funding for 54 projects⁸. All the major national research agencies have funded projects including MNRE, AICTE, DAE – BRNS, NIOT, DST, DRDO, UGC, DIT, IGCAR, NRB.

Students are also active in publications and both UG and PG students publish papers in refereed international journals. A total of 135 UG students have published 49 papers in refereed international journals and 55 PG students have 55 international publications to their credit in year 2014. Faculty have obtained 8 patents and have filed for another 12 patents.

Section II

This section pertains to Vision Statement II: Serve society by providing life changing opportunities to academically bright but economically challenged students.

Goals/Objectives

A. Bridge the Urban Rural Divide

Initiatives to achieve the objective:

- i. *Reaching out to Rural areas and increasing awareness about higher education*

The institute has pioneered a unique initiative known as Vidiyal to reach out to school students in rural areas and increase awareness regarding higher education in general and the available opportunities in higher education for rural students. Volunteers from faculty and students visit schools

in rural areas and spend time with students in the form of seminars and information sessions. Schools are identified beforehand in consultation with Chief Education Officers of the districts. The flyers, brochures and pamphlets are sent beforehand. Students are made aware of various schemes available to them and encouraged to pursue higher education by showcasing the examples of other students from their community or villages that have completed higher education.

ii. Rural Scholarship Scheme

Twenty five students from rural areas are selected every year for free education. These students are from the pool of toppers in Class 12th from government schools in rural areas to ensure that the high potential exhibited by them is not wasted due to lack of resources. If not selected for this scholarship, they would discontinue their studies and join the workforce. The average annual family income of these students is around Rs. 35,000. Hostel fees are waived for these students and they are given a book allowance. Fig 6 depicts the methodology of selection of students for this scheme.

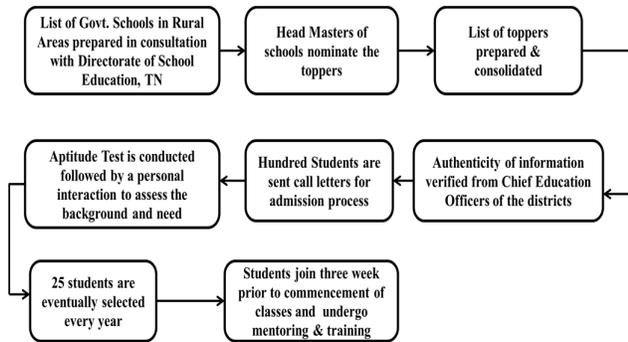


Fig 6. Methodology of Student selection for Rural Scholarship scheme

iii. Training and Mentoring of Rural Students, lateral entry students and first generation learners

Students from rural areas face a plethora of challenges after joining the institute. Culture shock and the experience of visiting a metro city for the first time lead to diffidence. Further with their vernacular backgrounds, they find it difficult to comprehend the lessons in English and communicate with their teachers and peers. To help the students to overcome these difficulties, special training and mentoring programs are arranged for these students. An orientation program is organised exclusively for rural students for three weeks before to the commencement of the academic session wherein they are taught communication skills in English, sessions on basic etiquettes and team work. A special mentor is assigned to the students who monitors them closely and addresses their difficulties. Evening classes are conducted for them in various subjects for extra attention. Special placement trainings are organised to polish their soft skills.

Expected Outcomes: Increase in student from rural areas at campus. More students, who are first in their families to undergo graduation. Higher number of students from rural areas gets employed by recruiting organisations.

Metrics: The percentage of first generation learners, number of rural students being placed, rural student participation in various events during their stay at campus.

Results achieved: 20% of the students are first generation learners⁵. Over the years, % of placement of rural students is higher than the average placement percentage at the institute. A significant number of rural students has been placed at salaries close to their average annual family income. Rural students are competing with their urban counterparts for job offers at top organisations with some receiving more than 4 job offers⁹. The head of IEEE chapter in 2014 and Saral Tamil Mandram have been rural students.

B. Scholarships Distributed to Students

Scholarship scheme was started in the year 1999 to ensure inclusive education and to provide access to high quality affordable education to all strata of society.

Initiatives and Interventions:

- i. **Merit Scholarships:**
SSN recognizes top performers through this scholarship to encourage excellence in academics.
- ii. **Merit Cum Means Scholarships:**
Offered to students based on academic performance and economic need.
- iii. **Sports Scholarships:**
Offered to students who have excelled in sports and also achieved standard performance in academics.
- iv. **Walk in walk out Scholarships:**
The top ten rank holders of any State or Central Board Examination at the Plus Two or equivalent level are provided free education for the undergraduate degree.

Expected Outcomes: Financial Assistance to the needy students, diversity, meritocracy, excellence in sports.

Key Metrics: Amount of scholarships disbursed, students from diverse backgrounds.

Results: Over Rs. 4 crore worth of scholarships are disbursed every year. A sum of Rs. 62 crore has been disbursed to over 6500 students over the last fifteen years¹⁰. Student community boasts of diverse students from different strata of society, from toppers of different state

boards, to international chess masters, to son of a daily wage earner.

Section III

This section pertains to Vision Statement III: Create model citizens who contribute professionally and socially to the nation.

A. 360 degree development of Students

Special focus is given to develop the graduates into well rounded citizens through various initiatives. Learning outside of classrooms is given equal importance.

Initiatives to achieve the objective:

i. Industry focussed training

Training programmes are organised for students to improve their soft skills and communication. Reputed trainers from external agencies train the students. Language training skills are provided in English, French, German, Spanish, and Japanese.

ii. Sports

Sports are integral part of the life in the campus. Sports instils in students a sense of discipline and team work and the sports complex at the institute boasts of world class sports facilities including an indoor stadium for Basketball, Badminton, Squash, Table tennis and Carom. It also consists of two modern gymnasiums. The outdoor fields consist of a Lawn Tennis court, Basket ball court, a foot ball ground and a track and field arena. There is also has an international standard cricket ground which hosts national level tournaments. The sporting facilities attract top sporting talent to pursue their education at the institute.

iii. Co-curricular activities

Students take part in various co-curricular activities. There are professional societies for IEEE, CSI, IETE, ACM etc. The IEEE student branch with the support of IEEE Madras section conducted IEEE international student congress in 2008. A total of 415 IEEE student members from twenty countries participated and the institute was awarded “Friend of IEEE” by IEEE global President. Students also hone their organisational and leadership skills by organising National Level Student Technical Symposia. Students of each department organise their own symposium with participation from all over the country.

iv. Entrepreneurship Cell

EDC, a 750 member strong student body works to develop the spirit of entrepreneurship by conducting series of

workshops, seminars and lectures by eminent entrepreneurs. PSYCON an annual event is a platform which brings together various entrepreneurs from various fields and people who have made a difference to their communities and society to share their experiences and inspire the student community. The institute has been awarded the “Entrepreneurship Week – India 2011 Championship Award.”

v. Extra-curricular activities

Students take part in various extra-curricular activities such as Model United Nations, which is a mock representation of the United Nations General Assembly. Students appear as delegates from across the countries and debate on global topics. Good Citizens forum is another platform where the faculty and students come together to debate on parameters of good citizenship and inculcate the same in their lives.

vi. Social Activities

The students are trained to be not just academically bright but also sensitive to the needs of the community. They engage in social service through NSS and Youth Red Cross. Institute has continuously received the ‘Best NSS unit award’ and the ‘Best NSS Volunteer Award’ from Anna University for the past 4 years¹¹ and has entered into the Limca Book of World Records for its social campaign on “No Smoking” in the campus in which a record 2026 students participated.

vii. Cultural Activities

Music, Dance, Dramatics, Literary & Debating clubs are very active at the institute. N2K, the dance team has won awards in all the national level fests they have participated. The Rock band actively participates in various culture fests across India and has won several awards. Saral Tamil Mandram and English Literary Clubs promote communication skills. Dramatics Club performs under the banner of ‘Lights Out Please’ and they have done several shows in Chennai city. INSTINCTS, the annual cultural festival, is fully organised by students with a participation of over 20000 students from all over India.

Expected Outcome: Graduates with multiple skills, professionally competent, socially aware, with an ability to be successful across a wide array of fields.

Metrics: Achievements by students and faculty in various fields, successful alumni in leadership positions in various fields such as industry, sports, civil services, culture, management etc. and consistently high placement percentage.

Results Observed: The percentage of students in the last three years has been in excess of 90%¹². Alumni have distinguished themselves in all walks of life including

engineering, management, civil services, cinemas, literature etc.. Sports persons from the institute have gone on to win Arjuna awards in their respective games. Some of the sample achievements of students and faculty are as follows:

- The Principal received the Bhartiya Vidya Bhavan National Award for Best Engineering College Principal for year 2011 from ISTE.
- A couple of faculty members received “Tata Rao Gold Medal” from Institutions of Engineers (India) and “SK Mitra award” from IETE for their publications.
- An Associate Professor received the IET CLN Sir CV Raman Research award 2014.
- Students of Mechanical Engineering won the Best Endurance, Best Driver & 4th overall place in Imperial Society of Innovative Engineers National level design and Karting competition.
- Students of Biomedical Engineering Department have won a cash prize of Rs. 3.15 lakhs in Innovation Challenge –Smart Living Contest for their project “Optimised Switch Control for elder and disabled patients using EEG.
- Several faculty and students have won Best Paper Awards in international and national journals.

3. Conclusion

Within a short span of 19 years, SSN College of Engineering has become a premier destination for aspiring engineering graduates. The high cut off marks for admissions for most branches in open category is around 95%. Reputed external agencies have ranked it among top ten private engineering institutions in India. A survey by Edu-Rand, commissioned by Rand corporation, USA has ranked the institute 7th among all Private Engineering Institutes in India. It has also been ranked among Asia’s Best Engineering College in Private Institutes Category for year 2013. Accreditations from NBA and NAAC with A grade for five years and all other achievements have been possible due to sustained focus on process based outcomes across key areas with the sole objective of enhancing employability through holistic development.

By following this framework of top down holistic development by linking the vision of the Institute and the Founder’s vision to individual activities and initiatives it is possible to create world class educational institution. As compared to conventional OBE concepts, this framework also acknowledges the importance of role of management leadership along with academic leadership in building world class institutions by linking the overall management vision with academic activities.

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