

Implementation of Career Guidance System in Undergraduate Study for Smooth Transition to Future Prospects

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Abstract: In 2013, authors hypothesized that students would improve if motivated and mentored appropriately to pursue career in the chosen path. The primary goal is to facilitate students' successful transfer in the chosen path by maintaining healthy relevant learning environment. This study evaluates whether the implemented career guidance program in the electronics engineering department increases self-esteem, confidence and skill to pursue career in the chosen path by the student. Results indicate that students show higher levels of academic performance and achievements. In this paper, authors also propose curriculum scheme with choice based career guidance.

Keywords: Career guidance system, mentoring, curriculum development, skill development, informal learning

1. Introduction and Background

Mentoring and developing the students' as per their likings and future aspirations is a challenge particularly with diverse economic and social background of students. Recommendation systems are commonly used to guide customers to find the products or services to best fit with their personal preferences [1]. However no such vibrant cafeteria system exists in the present university education system. Due to poor career guidance services and development support in that direction, the transition of students after undergraduate degree is not smooth [2]. Many students choose their career path without receiving proper advice and training from suitable professional or institute services [3]. This may potentially cause mismatch between academic achievements, personality, interest and abilities of the students. The role of institutes is very significant in student's transition to professional world. If student is motivated as per his likings then during the undergraduate studies student will enthusiastic to learn and transition after studies could be smooth.

If student interest is to pursue an MBA after graduation then it is observed that he/she is least interested in technical activities. At the same time it is also observed that if student interest is in electronics hardware then he does not participate in extra-curricular activities. Also some of the students wish to join higher studies immediately after graduation and some of them would like to join an industry. Those who wish to join an industry they are least bothered about research oriented courses or the courses which does not offer them jobs in Indian industry. If teacher is not aware of student interest then these issues lead to conflicts and non-cooperation of students for some of the activities/courses. Hence it is important to first find out the interest of student through mentoring and/or SWOT analysis.

Career indecision refers to the phenomenon where individuals especially students are unable to make decisions about the careers they wish to pursue. Career decisions enable us to label students as being either 'decided' or 'undecided' on their career choices [4]. We have found that majority of the students fall under the category of 'decided' in second year. The decision to career choice is influenced by personal characteristics and circumstances; knowledge of self, options, and decision making; and prior experience with career interventions [5]. For 'undecided' students it is possible to assess the existence of these barriers using SWOT analysis. By identifying readiness barriers, teachers can help students to foster informed and careful career choices.

In this study, the active carrier guidance system and support to help students transferring to the professional world [6] is discussed which was implemented from 2013-14 in electronics engineering department and continued till date. The encouraging results of this system motivated authors to propose the curriculum which will have in-build career guidance system and support.

2. Survey/Feedback from Stakeholders

Discussions with all the relevant stakeholders were carried out about the development of the curriculum that inculcates employability and research.

A. Survey/Feedback from students: Feedback from the department students in year 2011-12 and 2012-13 indicated that there is a need for guiding and training students in their domain interests rather than teaching all the concepts. SWOT analysis in this regard was also carried out.

B. Survey/Feedback from academic experts: Panel discussion was organised to get the perspective on curriculum and identification of new relevant courses from the domain experts from other academic institutes. The panellists were two professors from autonomous institutes and Board of Studies chairman of Electronics, Computer and MCA departments. They have recommended new courses like consumer electronics. Also other autonomous institutes Walchand College of Engineering and Rajarambapu Institute of Technology were contacted. Feedback from all the academicians indicated that we need to revise curriculum which offers better employability.

C. Survey/Feedback from industry experts: Panel discussion on “Industry Institute Interaction” was organized. The eminent panelist (listed in acknowledgement section) from Electronics and Electrical Engineering related industries were present for the discussion. Panelists shared their views on various aspects of teaching learning process and industry collaboration. The panelist suggested to include industry aligned courses. It was also suggested to offer choice based course like system engineering or system design. Visit to Bengaluru was carried out to identify the semiconductor industry related employment oriented courses. One of the VLSI industries also shown interest in the revision of curriculum and was eager to provide the necessary support.

D. Survey/Feedback from alumni: The opinion of alumni was asked about the career guidance of students and revision in curriculum. Few of the alumni who actively discussed these issues are listed in the acknowledgement section. Alumni pointed out that autonomy calls for a more practical syllabus and introduction of project centric courses. In order for students to build a skill-set, projects are certainly more important than conducting several exams. Also, the courses have to be vastly modernized compared to the existing Mumbai University curriculum. There must be a course in the curriculum on 'Technical Innovation & Research Methods' to prepare students for technical start-ups and research for higher studies. It should comprise of survey of upcoming technologies, a study of new start-ups that have received attention in the technical arena and why they are technically superior. The course content should be more of technical analysis rather than business planning. The second part of this course will build upon the first part i.e. how does research fuel innovation that become successful start-ups. Again, the focus would be methodology of research, technical comparison and the importance of bench-marking different competing technologies. This could be a compulsory course, perhaps with inputs from the entrepreneurship team, but mostly technical and project (survey) based.

Alumni in general suggested several new courses. For example hardware security and cryptography can be a part of Electronics syllabus, as an elective or as a part of advanced digital circuit design. It is one of the very strong areas that are promising to be very important for the future. Alumni also suggested introducing blended learning course or making one course to be taken from CDEEP (IIT) compulsory.

E. Survey/Feedback from department Board of Studies: Board of studies members includes two professors from IITB, employer, alumni, present students and teachers from department. Members of board of studies said that industry related activities should be carried out to enhance the outcome of program. There can be provision for courses delivered by Industry, wherein 50 % contribution by internal faculty and 50 % by industry person. Allocate free session for studying and contact hours with students should not be more than six per day. More emphasis should be given on self learning activities or tutorial sessions so that student's creativity is encouraged. Members suggested having provision for floating of elective by an expert. The courses with contents like BJT, Moving coil, Moving iron Instruments and 8085 need to be revised. New elective based on Nonconventional energy sources should be added. Give motivation for earn value projects (i.e. include extra credit for better and original approaches made by the students). Emphasize on only semester based or short term based projects and not on yearly projects.

3. Implementation of Skill Development Program (SDP)

A. Conceptualization of SDP: Skill Development Program was conceptualized and implemented for electronics engineering students in year 2013-14. First of all SWOT analysis of second year students was carried out. Every student is asked to submit a plan about 'what they are going to do' after engineering or what is their area of interest or their goal in life. This SWOT analysis was very helpful in understanding student's perspective about their future. Depending on this various groups among students were formed and they have been allocated mentors/experts to achieve their goal. The groups were management, programming, hardware design, programming and simulations. The mentors for MBA group are from S. P. Jain institute of management and for Civil Services groups is Collector of Kochi who happens to be our alumni. Primary Outcome Emphasized was student will be able to acquire the value added skills and make themselves ready for the future endeavors. The targets/benefits of Skill Development Programme are:

- Enhanced focus for future endeavors
- Developments of soft skills, communication skills, presentation skills
- Skill set development in technology
- Motivation towards invention or innovation
- Ready for placement, research etc.
- Increase interaction with teachers
- Development of laboratories and their increased utilization
- Improvement in quality of Projects in Final Year

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B. Student Performance Enhancement Scheme (SPES):

It was found that there are limitations from laboratory aspects for implementing SDP. To enhance SDP activities a new scheme referred as 'Student Performance Enhancement Scheme' (SPES) was implemented. In this scheme, every student received hardware tools kit worth Rs. 3000/- to enhance their hardware debugging capabilities. One kit comprises soldering iron, multi-meter, Wire stripper, bread board, bundle of connecting wire, logic probe, soldering wire and flux. Students carry same kit during day to day practical, mini projects, final year projects and practical examinations. This scheme is found to be very useful for students for conducting self learning activities of their choice.

C. Activities carried out under SDP:

- All the groups regularly conducted experiments/ case studies in their domain during free time.
- Civil services groups finalized the subjects to be undertaken for UPSC/MPSC examinations after discussions with mentors
- MBA group started project with faculty of S. P. Jain Institute of Management
- Programming groups arranged extra classes by experts from computer department. Faculty and students from computer engineering department took extra classes in the evening on object oriented programming in the entire semester.
- 'SWOT Analysis' is carried out to identify barriers that limit outcomes of SDP, to decide on direction that will be most effective for SDP, to reveal possibilities and limitations for change in SDP, to decide plans for SDP and as a means for brainstorming and communicating
- One week knowledge exchange workshop is organized for all the student to share the knowledge they gained in the entire semester through SDP activities. The following activities are conducted in the workshop.
 - Introduction to Embedded Systems
 - Leadership in 21st century
 - Programming Microcontrollers
 - Programming with mBed Platform
 - Raspberry PI and project using Raspberry PI
 - TCAD programming
 - Emotional Intelligence and it's relevance in corporate life
 - Ngspice, Tina, OScad, Proteus
 - Labview Programming
 - Matlab and Scilab programming
 - Antenna Design and IE3D
 - Networking
 - Object Oriented Programming
 - Business and professional ethics
 - Preparing for UPSC/MPSC
 - Linux Programming

C. Observations and outcome of SDP: This scheme was implemented first time for second year students in 2013-14. Many activities mentioned above were carried out for them. When these students reached third year in 2014-15, we have observed their involvement and significant improvement in the mini-projects was found. In their final year of undergraduate studies also these students have shown improved academic performance. To state few examples, one of the project on bionic arm received First prize at Airbus sponsored Ingenium national level project contest.

Table I. Comparison of career choice with selected career

Student Name	Career Choice given in 2013	Status immediately after undergrad in 2016
JUGAL GALA	M.S.	Stanford University
AMIT DHAMNE	M.S.	Georgia Institute of Technology
ADITI TRIPATHI	M.S.	University of Minnesota
NIHARIKA SARODE	M.S.	University of Colorado Boulder
VIRAJ MALIA	M.S.	Rutger University
TANMAYA MISHRA	M.S.	Virginia Tech
AMOGH MORYE	M.S.	University of Colorado Boulder
GAURANG ALAT	M.S.	University of Michigan
SAGAR SHELKE	M.S.	Rutgers New Jersey
RAJ SHAH	M.S.	University of Houston
KARAN SHAH	M.S.	university of southern california
DEEP BHOJANI	M.S.	University of Pittsburgh
ANIKET PENDSE	M.S.	University of Minnesota
PRATHAMESH BHATKAR	M.S.	University of Colorado Boulder
VITEJ BARI	M.S.	Stevens Institute of Technology
ANURAG TULSIRAM	M.S.	University of Colorado
OMKAR PURANDARE	M.S.	University of Colorado Boulder
NAMRATA SUKHANI	MBA	ESSEC Business school France
SHASHANK RANE	MBA	S.P. Jain IMR
KRITIKA SABHARWAL	MBA	S.P. Jain IMR
SAMIKSHA GUPTA	MBA	Cognizant
SHERYL TUSCANO	MBA	Credit Suisse
VAIBHAV PULYANI	MBA	Indus Valley Partners
HARSHADA AMRAOTKAR	MBA	IIM
KALPIT NARVEKAR	MBA	Dolat Capital
UTSAV LOTIA	MBA	MuSigma
YASH DHANUKA	MBA	Cognizant
SAHIL KABDULE	Civil Service	UPSC Aspirant
RIDDHI CHABADIA	Civil Service	Northeastern University
HRISHIKESH TAWADE	Job (Core)	Rucha Engineers Pvt. Ltd.
PRASAD GAIKWAD	Job (Core)	Siemens
PRADNYA BHANGLE	Job (Core)	Larsen & Toubro
NITIN BARANWAL	Job (Core)	Seclore technology Pvt. Ltd.
AMIT KUMAR YADAV	Job (Core)	MU SIGMA
MADHURA VALVAIKAR	Job (Core)	KPMG INDIA
GAURI DALVI	Job (Any)	KPMG INDIA
ARCHITA GOYAL	Job (Core)	Deloitte
SANYOGEEETA DHULGUNDE	Job (Any)	Citius Tech
ADITYA SAWANT	Job (Any)	Ariston Capital
AMOL MARATHE	Job (Any)	Cognizant
PRATEEK KAVALE	Job (Any)	Cognizant
SHAMBHURAJE NALAWADE	Job (Any)	Citius Tech
RUCHIR MOHITE	Job (Programming)	Oracle
ASHISH MOHANAN	Job (Any)	MuSigma
ANIRUDH BHAT	Job (Core)	KPMG India
KARTIK CHAKOLE	Job (Any)	Fractal Analytics
ABHIJIT GOKHALE	Job (Core)	Accenture
HARSHAL PATIL	Job (Core)	Citius Tech
HARSHIT GANDHI	Job (Core)	Cognizant
SHRADDHA PATANKAR	Job (Core)	Citius Tech
SHRADDHA MANE	Job (Core)	Infosys
FALGUNI DOMADIYA	Job (Core)	Infosys
POOJA DHANAWADE	Job (Core)	Fractal
SNEHA GAJAKOSH	Job (Core)	Siemens
DEVENDRA SHINDE	Job (Core)	Cognizant
SAYALI MOHITE	Job (Core)	Siemens
HEENAL SHAH	Job (Core)	Infosys
JATIN SHINDE	Job (Core)	Citius Tech
MUGDHA VARTAK	Job (Any)	Indus Valley Partners
ADVAIT CHURI	Job (Any)	Cognizant
ALLAP GOPALKRISHNA	Job (Any)	Dolat Capital
PARESH PATEL	Job (Any)	Citius Tech
AMIT POOJARY	Job (Any)	Dolat Capital
NIDHI SHARMA	Job (Any)	Infosys
ASHISH JADHAV	Job (Any)	--
KANCHI PODAR	Job (Any)	--
RAJ LOKHANDE	Job (Any)	--
RAJ ASAWA	Job (Any)	--
APURVA MIRKE	Lawyer, Pursue LLB	--

Two projects received best project awards at other national level contests. There are three awards received for conference publications. One of the students Mr. Jugal Gala received admits from Stanford University, UC Berkley, Purdue, ETH Zurich and Columbia. His dream of joining the best universities in the world is fulfilled. In batch 2014-15, total 09 students went for higher studies while in 2015-16 total 20 students went. Students have been admitted in top ranking universities for 2015-16 passed batch.

There is significant improvement in the dream placements for 2015-16 passed batch as compared to 2014-15. The dream placements were 18 for 2014-15 while for 2015-16 it increased to 30. Table I shows the detail data for a batch of 69 students. From this table it has been found that students have selected/admitted to career of their choices and hence their interests are protected. The students of 2015-16 are selected in better career choices as compared to students of batch 2014-15. There are still few cases in which there is a diversion in the actual selected career choice. The discussion with students revealed that several personal factors affected their decision of a career choice.

4. Proposed Structure of Curriculum for Electronics Engineering Department

The purpose of this proposed curriculum is to inculcate the career guidance and choice based development of student into the system so that training is imparted for engineering under graduates to develop their employability before entering workforce or ability to do research before joining research institute for higher studies. The framework is developed by considering the present employability/research skill requirement and the requirement of accreditation of engineering programme. The feedback from all the stakeholders is also considered.

A. Salient Features of Proposed Curriculum:

- More tutorials and practical's are introduced
- Institute level 2 credit bridge course in fundamentals of mathematics for lateral entry students
- Domain specific FOUR tracks for electives
- Employment and research oriented optional skill development certification courses
- Activity based learning compulsory non-credit courses
- Optional Competitive Examinations Preparation courses
- All the programme outcomes are addressed
- Student engagement is min 28 hrs to 34 hrs per week
- Minimum credits student has to earn for award of B.Tech (ETRX) degree are 184.
- Student can earn maximum credits upto 194 by taking optional elective and certificate courses.

B. Open Electives: The institute level open electives are introduced. The open electives offered by electronics department are ASIC Design, Computer Applications in Healthcare, Consumer Electronics and Technology for Agriculture. Other open electives offered by other departments are Information Theory and Coding, Database Management Systems, Design and Analysis of Algorithms, Cloud Computing, Cyber Security and Digital Forensic and Optical Fiber Communication.

C. Bridge Course (BC): By looking towards the challenges faced by lateral entry second year students, a institute level compulsory bridge course on 'Fundamentals of Mathematics' with two credits is introduced.

D. Skill Development Certificate Programme (SDCP):

I. Salient Features of SDCP:

- SDCP is a 'tool to enhance career prospects and orient learners towards self learning'
- Introduced new courses of global demand
- Employability, Innovation and Research
- Develop self confidence and self reliance to provide greater opportunities for employment
- Alumni, Industry and other institute involvement from design to execution
- Method of establishing a network with outside world
- Unique Model with greater flexibility in the curriculum by giving more freedom of choice to learners to design their own combination of studies without compromising on fundamental courses.
- Adequate number of domains available to the students to choose from therefore 'flexibility in career' progression of students
- Unique feature of choice of opting for a domain from a total of six domains and from total of 36 employment/research oriented certificate courses
- Assisting learners to undertake employment/research in different disciplines
- Individual certification of a course which may be necessary as a pre-requisite for a specific task or a domain specialization
- Instructional delivery for SDCP will be as per ARCS model
- Cafeteria model with 'collaborative learning', 'blended learning' and project based learning (PBL)
- Better 'hands-on' experience leaning to employment and research
- Facilitation of 'peer learning' by formation of 'peer groups'
- Provides adequate learning opportunities for 'advanced' learners as well as 'slow' learners.
- Development of indigenous structured literature for training modules including audio-visual materials
- Interdisciplinary enrollment with registration at the start of the semester
- Confirmation of enrollment only after recommendation of course instructor
- Flexibility in course timings
- Flexibility for horizontal, vertical (UP/DOWN) mobility
- Certificate for each course
- Two extra credits to S.P.I.T. students (or students from other autonomous institutes if MoU exists) after completion of all courses in a particular module
- Maximum four extra credits can be earned through SDCP on completion of SEM-VIII
- Certificate courses open to other institute students

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II. Domains and courses under Skill Development

Certificate Program (SDCP):

1. Front End VLSI Design and Verification
2. Back End VLSI Design
3. Electronic Product Design
4. Advanced Instrumentation
5. DSP, Power Electronics and Control
6. Antennas and Networking

Table II shows all the courses arranged as per the domain.

E. Activity Based Learning (ABL):

I. Salient Features of ABL:

- Compulsory Non-credit activity
- Activities to be conducted are Field Visit, Seminar, Poster Presentation, Competition etc.
- ABL is a 'tool to impart knowledge in attitude aspect of POs'
- Responding to emerging needs and changing social realities
- Provide an experiential based learning environment for students to develop 'life skills' and generate confidence
- Personality development by value orientation, community orientation and self empowerment of students
- Making students to feel proud to become the designers and architects of social-re-engineering
- Creating responsible citizens of the country
- Establishment of wider network of services
- Development of outreach programs and services
- Playing a significant role in the formation of responsible civic society
- New approaches of social service delivery and strategies of intervention

II. ABL Courses:

- ABL01: Technical Presentation Skills
- ABL02: Safety and Legal Responsibilities of Engineer
- ABL03: Ethical Norms of Engineering Practice
- ABL04: Technical Paper and Patent Drafting
- ABL05: Engineering Solution for Environmental Problems
- ABL06: Financial Planning and Taxation Policies

F. Optional Competitive Examinations Preparation (OCEP):

I. Salient Features of OCEP:

- Motivation, mentoring and preparation of students to pursue higher education
- Modules as per national level technical competitive examinations GATE and IES
- Motivation, mentoring and preparation of students to join public sector
- Motivation, mentoring and preparation of students to join top ranking technical institutes in country like IISc and IIT.
- Module design as per the courses studies in that semester or prior semester by considering syllabus of competitive examinations
- Help to sharpen the problem solving skills of students and concerned teachers

II. OCEP Courses:

- OCEP-1: Introduction to CEP
- OCEP-2: Problem solving module-I
- OCEP-3: Problem solving module-II
- OCEP-4: Problem solving module –III
- OCEP-5: Problem solving module-IV
- OCEP-6: Problem solving module-V

D. Credit Distribution:

Figure 1 shows the credit representation for the entire scheme. Per semester credits are minimum 22 to maximum 25.

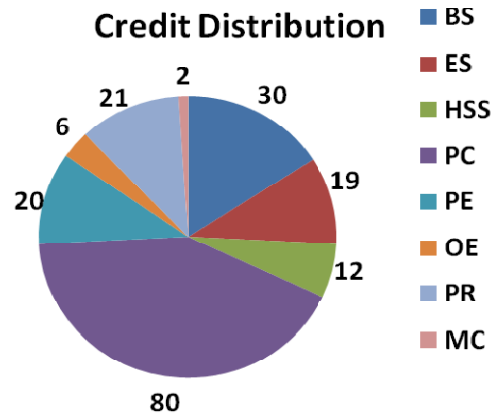


Fig. 1 Credit Distribution (BS=Basic Science; ES= Engineering Sciences; HSS= Humanities and Social Sciences; PC=Professional Core; PE=Professional Elective; OE=Open elective; PR=Project; MC= Mandatory Course)

5. Conclusion

The career guidance scheme implemented in electronics engineering department of Sardar Patel Institute of Technology is discussed. There are significant benefits observed in terms of academic performance of students. The scheme of curriculum by incorporating suggestions of relevant stakeholders is proposed. The major feature of the scheme is student interest is protected and he/she is trained as per his/her choice. If adopted then this scheme should benefit students and society.

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Alumni:

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Table II. Proposed SDCP Courses

SDCP01:Front End VLSI Design and Verification	SDCP02:Back End VLSI Design
SDCP013:Fundamentals of FPGA and CPLD SDCP014:FPGA based System Design SDCP015:Static Timing Analysis SDCP016:Soft Processors and SoC Programming SDCP017:Fundamentals of SystemVerilog SDCP018:SystemVerilog Assertions	SDCP023:Device simulation with TCAD SDCP024:SPICE programming SDCP025:MOSFET Modeling SDCP026:Low Power VLSI SDCP027:Mixed Signal VLSI SDCP028:Fundamentals of RFIC
SDCP03:Electronic Product Design	SDCP04:Advanced Instrumentation
SDCP033:PCB Design SDCP034:Pythan Programming for Single Board Computers SDCP035:Embedded System Design SDCP036:Protocols and Standards SDCP037:Embedded Linux SDCP038:RTOS Programming	SDCP043:Labview Programming-I SDCP044:Labview Programming-II SDCP045:Data Acquisition and Control-I SDCP046: Data Acquisition and Control-II SDCP047: PLC and SCADA Programming SDCP048: Development of Healthcare Platform
SDCP05:DSP, Power Electronics and Control	SDCP06:Antennas and Networking
SDCP053:MATLAB Programming SDCP054:Solar System Components SDCP055:Solar System Design SDCP056:Simulation tools for Power Electronics SDCP057:Applications of Digital Signal Processors SDCP058:Digital Control System	SDCP063:Fundamentals of Networking SDCP064:Network Simulation Tools SDCP065:Simulation of Radiating Elements SDCP066:Design, Implementation and Testing of Radiating Elements SDCP067: IP Subnetting and Supernating SDCP068:Wireless Network Security