Activity Based Learning: Overcoming problems in implementing OBE in Engineering Education during transition phase.

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Introduction:

The most integral and innovative future trend in engineering education is OBE i.e. outcome based education which requires thorough assessment and evaluation of the students individually, with special focus on the overall development of the students. OBE is based more on student's centric learning and less on the role of a faculty or the content part (taught) which requires grass root level modification and improvements in the University teaching learning scheme. It demands a transition of a lecturer in to a facilitator for these Digital Natives [3]. It also requires a paradigm shift in teaching learning process in engineering education system as OBE focuses more on development of all three learning domains, contradictory to traditional teaching learning process which is more focused on development of the cognitive and psychomotor domains only. The focus is on active learning rather than 'complete the course' through lecture approach. More than listening, the learners must read, write, discuss, or be engaged in solving problems. Most important, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Within this context, it is proposed that strategies promoting

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active learning be defined as instructional activities involving students in doing things and thinking about what they are doing.[1]The engagement of the learner in the process of learning will yield considerable outcomes and facilitate the alignment between the course outcomes and the deliverables as quintessential in OBE. To achieve this end, activity based learning is suggested as one of the most effective tool to overcome the challenges encountered in the implementation of OBE in Indian engineering education system.

1 NEED OF ACTIVITY BASED TEACHING:

1.1 Current Scenario in EE: The exponential rise in the intake of Undergraduate Engineering seats is apparent. In 2014, approx. 16, 34,596 students took admission in various engineering colleges (3384) in India.[2] As per the traditional education system,the number of students per class range from 60 (minimum) to 90 in every college. The classroom is teacher centred, content centred and discipline centred but not student centred. The schedule and the calendar control student learning and success.[4] Present scenario of engineering teaching learning scheme is having 3 or 4 hours of theory lectures and 2 hours of laboratory sessions.Chalk and talk approach to deliver the content and practical experiments in laboratory are two common methods for completing the syllabus. Unfortunately, not only the course curriculum but even the laboratory sessions offered in engineering courses do not cater to any application-based learning which is the crux of engineering education. Most of the time in labs is also used in delivering or re-delivering the information which the students may not have comprehended in their first attempt.The physical laboratory or simulation based laboratory,majorly focuses on content based learning which must be changed to Activity based learning to achieve OBE objectives and outcomes. [5] To validate the learning, assignments with deadlines are given, which the students generally copy from each other and submit. During exams, those scoring less are declared as poor learners. Thus, they rarely get a chance to process the gained knowledge, apply it to solve real-world problems, synthesize and evaluate its usage, eventually creating something new.Consequently, it develops their rote learning skills, killing their creativity and self-learning. This conventional method simply results in test-rig stuff which does not yield any practical knowledge or application-based mind set to the engineers whereas the engineers are intended to be application-oriented and process-oriented to solve the complex problems of daily life.

1.2 Issues in implementing OBE: Recently National Board of Accreditation, India has become the signatories of the Washington Accord adopting outcome based education guidelines in order to impart the quality education in engineering institutes [15].The OBE paradigm that shapes decision making and patterns of concrete action is the viewpoint that WHAT and WHETHER students learn successfully is more important than WHEN and HOW they learn something. To improve the teaching learning process, a new paradigm with utmost commitment towards learner-centric learning has been developedwhich requires grass root level modification and improvements in the University teaching learning scheme.Indian Education sector is confronting the challenge of implementation of OBE, especially engineering education. The realistic picture is embedded with so many obstacles and bottlenecks in the implementation of OBE. One of the major deadlocks is large class room which is pervasive, deeply felt and is of great concern. Implicit in OBE is the desire to have

all students emerge from the system as genuinely successful learners[4].Albeit OBE requires thorough assessment and evaluation of the students individually, with special focus on the overall development of the students. The voluminous research validates that learning process must be active, not passive which is the biggest challenge for the large class room.Another problem is that because of a huge number of students with varied learning styles in each class, personal attention is not possible. One common methodology of teaching i.e lecture is adopted for all. Several researches show that students prefer active-learning to traditional lectures.Further, some cognitive research has shown that a significant number of individuals have learning styles best served by pedagogical techniques other than lecturing. [1]To implement OBE in Indian Environment, dramatic changes are required. The another problem with implementation of OBE in a large class room is to map the course learning outcomes with programme outcomes achieved by all the learners through the proper assessment tools.In OBE, the outcomes are tangible and are measured by the demonstration of the skills which also includes soft skills. The grades are accumulated amalgamation of accomplishments, activities, assignments, attendance, attitudes, aptitudes, averages.The hallmark of the Information age workplace is adaptable, effective working teams that can collectively discover and solve significant problems and work successfully with others to get their potential solutions implemented.[4].Current curriculum of most of the universities in India don't have such courses which focus on such skill development, and hence to achieve the all the POs defined as per OBE guidelines, activity based teaching becomes essential.

1.3ABL for better implementation of OBE: Outcome-based systems focus on increasing students' learning and ultimate performance abilities to the highest possible levels before they leave school.[4]The four principles of outcome based education suggested by Spady(1994) are clarity of focus, designing down, high expectations and expanded opportunities. The third principle can be achieved through activity based teaching as this asserts that the teacher should strive to establish challenging standards of performance to encourage the learners to engage deeply in what they are learning supporting the idea that successful learning promotes more successful learning. This is based on the constructivist view of learning which suggests that each person 'constructs' his own learning process based on his previous knowledge and learning experiences called schema. The process is bettered when happens in collaboration with others. Activity based learning provides the best platform to the learner to be actively engaged to learn in pairs or groups in a fear-free, friendly environment enabling long lasting learning in a variety of situations with appropriate chances to assess. ABL also is in tune with fourth principle of expanded opportunity as it provides many opportunities to the learners to perform. Even slow learners get the chance to actively perform and participate.Activity based learning is also espoused in the new TAC of ABET criteria as one effective method of learning. [6]The Information Age demands long-term, sustainable performance and self-initiated and self-directed continuous learning capabilities, not just specific content and skills for specific tasks.[4]The application of this conceptual knowledge and moving from LOTS to HOTS is of utmost importance to make them 21st century industry-ready. Hence, this paper suggests an innovative framework offering a striking balance between the intended course outcomes and the activity outcomes in a large class. This paper proposes activity based learning or ABL as a solution to handle the issues of large classrooms, assessments and mapping of POs and CLOs while implementing OBE.

1.4 Advantages of Activity based learning: ABL is highly student-centred**.** Some researchers suggest that teaching strategies should move to a more student-centered approach. [7] ABL is conducive to self-learning, self-motivation and engagement amalgamated with confidence to demonstrate the learning which is inherent in OBE. Each learner individually or in group constructs some meaning by doing an activity on the basis of their schema or previous knowledge, making some mistakes, failing, re-doing, re-testing and finally succeeding. ABL involves the learner, so that he/she uses cognitive and sensory inputs and constructs the meaning on his/her own under the guidance of the mentor or teacher or with the help of peers. In ABL, the frequency and duration of learning opportunities also increase. The students' chances of learning and success are also not constrained. It also incorporates varied styles of learning. ABL supports continuous improvement, learning from mistakes, deep internalization of learning and is compatible to the philosophies like "all can learn and succeed," "creating the conditions for all to succeed," and "continuous improvement" implicit in OBE. ABL allows the learners to play ten life performances roles as espoused by Spady[4]

2. CASE STUDY ON ACTIVITY BASED LEARNING TO ACHIEVE OBE:

The hallmark of OBE is "success for all" i.e. everyone has potential to acquire the three Cs: content, confidence and competence but the key lies in the deep engagement of all the learners, which is the heart of the OBE, emphasizing over all development of all the students by giving opportunity to all to internalize learning by constant practice.
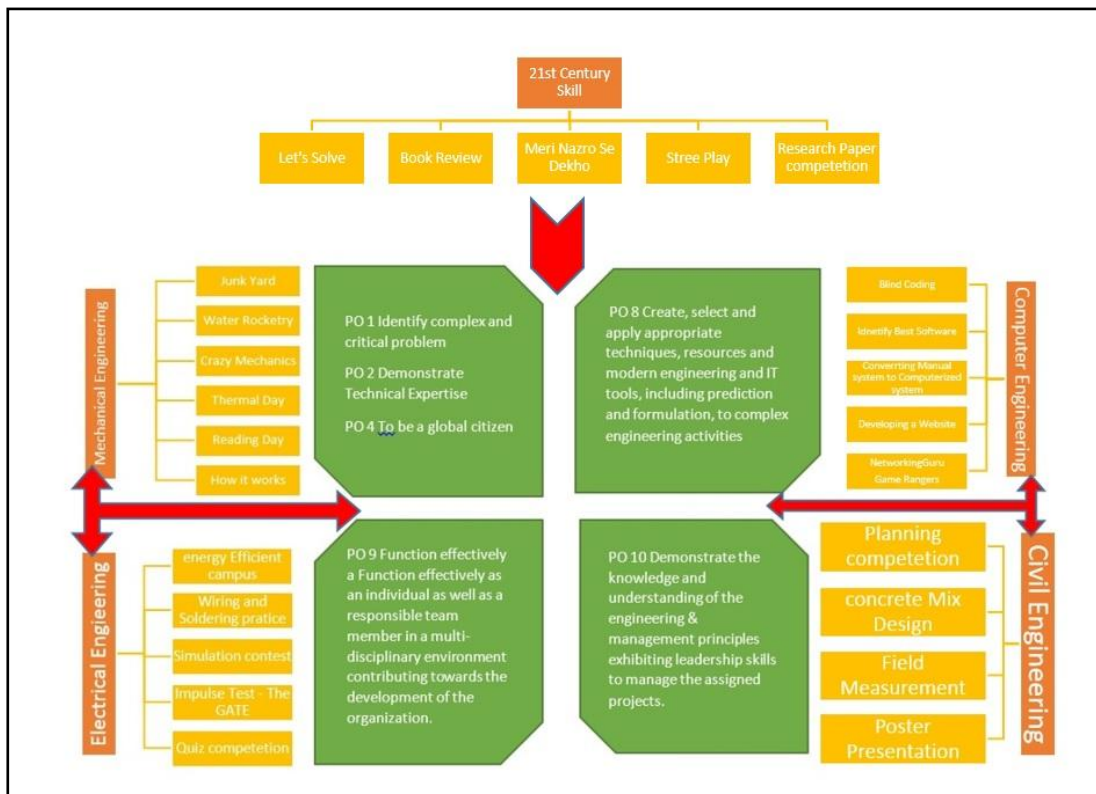

Fig 1 Activities to achieve POs

. Traditional lecture practice doesn't facilitate this. Rather, it mounts the attendance issues and several irrelevant actions taken by the faculties to make the students attend classes regularly by force or by choice. To overcome this as well as to cater to the taste of the mass, a pilot project namely, 'Stimulating Saturdays' was initiated by the authors of this paper incorporating activity based learning which excited the

learners to be involved in the learning process. More than 1500 students from the different programs were involved. The objective was to offer the varied opportunities to the learners to fuse technology with the thinking skills and soft skills in a real life environment or situations to gear them up to confront the realworld problems, eventually helping them to imbibe the 21[st]century skills .

2.1**Planning and Execution:** The normal teaching process was carried out five days a week and the 6th day i.e. Saturday was devoted to ABL.The planning, systematic organisation and execution was core responsibility of the voluntary students. The students were given the choices of 10 activities requiring multi-disciplinary approach. The standards, expectations and outcomes, execution dates, assessment criteria etc. were provided to the students at the onset of the semester. Students should be familiar with criteria used to assess whether they have achieved outcomes specified and the Assessment methods used**. [8]**This was the starting phase of OBE implementation which was a challenge for the faculties in the beginning but seeing the involvement of the students, became a learning experience for faculties too.

The driving force behind this unparalleled concept was to enable the students to navigate the complex life and work environments in this globally competitive information age as the current learner is going to play a vital role to identify the exact solution of some of the critical problems. One of such activity is "Junk Yard". The prime aim of this activity was tomanage the copious waste which is increasing every day in our society, from house hold to industrial waste. The details are:

1. Students have to design a useful product from junk given, showcasing their engineering skills with innovative idea.
2. Students have to apply the knowledge about how things work, the presence of mind to see how waste can be utilized to develop a new useful product from the junk.
3. All learnershave to think critically and organize their thinking to create useful product from the junk.

More than 100 teams, each team of 4 members, participated. The participants were provided with common junk. They were supposed to select any 6 junk items to make an innovative and useful product.This was a group activity. Total time given is 1 hour viz. 10 minutes for selecting the junk, 45 minutes for making the product and 5 minutes for presentation and queries.

The above enumerated points clearly indicate the Design down approach, where students had to show the ultimate outcome by designing the model with the available junk. This activity basically focused on the success of all the learners, as every individual made some model and discussion can be initiated by the facilitator on design aspect, mechanism aspect, aesthetic look and other features, which enhance learning.

2.2Assessment of the students in ABL: The assessment in OBE is done to determine whether learner has achieved the desired outcomes or not. Different assessment strategies are used to assess the learner: formative and summative, which could be used for selection, certification, instructional improvements etc. Albeit

as per OBE assessment is not once but constant. Following table shows the different parameters to select the best team among all.
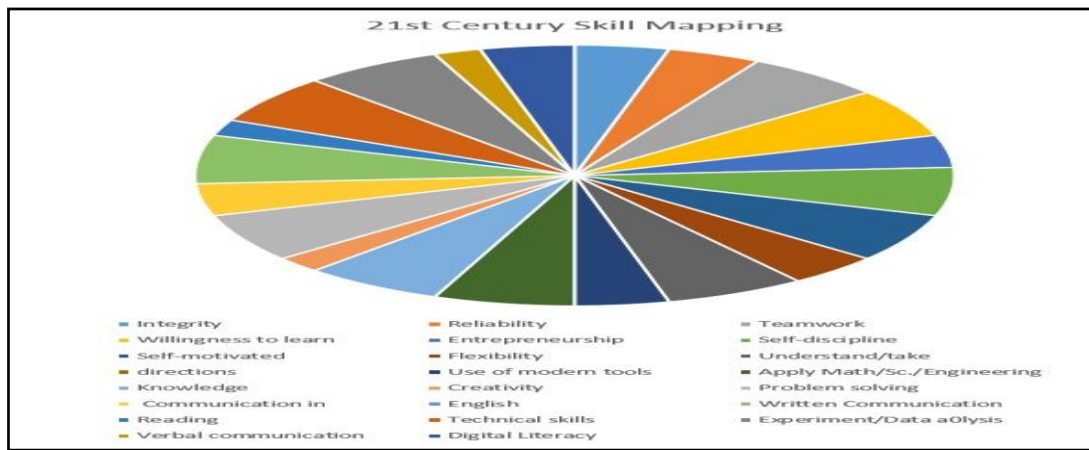
Table 1 Assessment Guidelines for Activity

Criteria\Level of Performance	Excellent	Good	Satisfactory	Needs improvement
Creativity	Best utilization of junk. Unique design and serves the purpose.	Utilization of junk and model shows some output.	Utilization of junk but no output.	Wastage of Junk.
Technical Acquaintance	Excellent knowledge about the core subjects. The design satisfies the fundamental laws.	Sound knowledge about the subjects.	Fundamental concepts are clear.	Fundamental concepts are partially clear.
Application to the society	Outstanding application of the product with effective strategy. Tranquil to use.	Appropriate application of the product.	Settled application of the product.	No application of the product.
Demonstration/Presentation skill	Participant can answer to questions easily with confidence.	Participant tries to answer to the questions.	Participant can partly answer to the questions.	Participant cannot answer to the questions.

2.3 Mapping of POs through ABL: Because of the limitation of the pages, the authors have selected B.E (Mech.) program where 8 activities were executed apart from regular teaching scheme. Out of 10 program outcomes formulated as per ABET rules, the sixPOs, shown in the table 2 have been achieved by implementing ABL where 1 means weakly achieved, 2 means averagely achieved and 3 means fully achieved. The pie-chart below reflects the mapping of 21st century skills with the activities intended outcomes.

Table 2 Mapping with POs

Sr.No	Activity Name	PO 1	PO 2	PO 4	PO 8	PO 9	PO 10
1	Reading Day	1	1	1	1	1	1
2	How Its Work	1	1	1	1	2	1
3	Junk Yard	2	2	1	2	1	1
4	Crazy Mechanics	2	2	1	2	1	1
5	Water Rocketry	3	2	2	2	1	2
6	Thermal Day	3	2	1	1	1	1

21st Century Skill Mapping

- Integrity
- Willingness to learn
- Self-motivated
- directions
- Knowledge
- Communication in
- Reading
- Verbal communication
- Reliability
- Entrepreneurship
- Flexibility
- Use of modern tools
- Creativity
- English
- Technical skills
- Digital Literacy
- Teamwork
- Self-discipline
- Understand/take
- Apply Math/Sc./Engineering
- Problem solving
- Written Communication
- Experiment/Data a0lysis

3 IMPLICATIONS AND DISCUSSIONS: By employing variety of activities, the students get more than one chance to demonstrate the outcomes and assure their success.It also provided a significant and visionary data basewith the indicators of effectiveness of this model which could be regularly updated to improve teaching-learning practices. It also yielded in increasing accountability of the students for their learning and self-directed learning. A unique learning platform was provided to the teachers through which they sieve their efforts and enabled them to clarify their roles as facilitators.It ensures quality-assured performance based assessment in line with OBE.OBE facilitates as assessment-to-a-standard approach in which what matters is the standards that students achieve and not the time they take to achieve this.[9]To bridge the gap between academe and industry, the judges were invited from the industries.

In this model of ABL, the activities designed and offered by and for the students were a mixture of individual and team activities which also provided them a platform to hone their multi-disciplinary and inter-personal skills.This is further supported by Spady who suggests ten categories of outcomes, based on "fundamental life performance roles". He also asserted that one way to prepare students for these life roles was to "continually engage students in both individual and team activities that explore important issues or phenomena, use multiple media and technologies, create products that embody the results of the students' explorations, and call the students to explain their work and products to adult and student audience. [4][10].ABL also encourages teachers to be well prepared and enable them to provide appropriate opportunities to the students to learn and demonstrate their learning. The learning time has not been divided into uniform periods enhancing the quality of learning. Time-and calendar-dominated programs would be quite sensible if all the students learned, developed and mastered same subjects at the same rate.[11]In this integrated approach, the common outcomes based on the knowledge, skills, dispositions and ways of thinking developed from various fundamental subjects are clustered to help learners to achieve the required outcomes. It can be argued, for example, that a key competency such as "collect, analyze, organize and critically evaluate information (in real life situations") is most likely to be achieved if it is approached from a multi-disciplinary perspective.[11]

Conclusions: Modern engineering students require acquiring technical skills, soft skills and life-long learning skills. According to World Bank, engineers must possess core employability skills, communication skills and professional skills.[12].It is often claimed that students learn best and retain when they learn engage actively in learning, when they are encouraged to reflect on their experiences, and when they

have opportunities to communicate with others about the things they are learning.[13]ABL provides the students varied chances to construct and reinforce their learning experiences without time constraints. Students learn important things when they use their knowledge and skills in relevant contexts.[11].The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET) in its new TC2K criteria identifies activity-based learning as one preferred feature of engineering technology programs in Criterion 6 on Assessment.[14]Hence it is anticipated to use ABL to overcome the hurdles like large classrooms while implementing OBE in Indian engineering education system. ABL empowers the learners to internalize the fundamental concepts, apply them inworld situations to solve complex problems, to learn from their mistakes and link their knowledge with their schema blended with improved communication, creativity, social skills and leadership skills.

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