Survey of an Effective Outcome Based Teaching Learning Taxonomy in Professional Undergraduate Courses

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Abstract. This paper is mainly focused and has been survived for All Teaching and Learning Activities in Higher Education Institutions (HEIs) that should be planned and conducted to facilitate the students to attain well defined and measurable Outcomes (OBE) for one’s own career. Since 2015, while in India, Outcome Based Education (OBE) became the foci of higher education. This paper is designed to enhance all the teachers in engineering programs to facilitate their students to become good graduate technical engineers. The OBE program configuration viably joins the curriculum, instructional prominence, and the appraisal procedure to accomplish a well-organized package for compelling teaching and learning. The OBE also provide mechanisms for the progress of a faculty community around the goal of outcomes assessment. At the end of this survey, this paper reveals the nature of Outcome Based Education (OBE) with framework and their levels of impact in advanced education (Teaching and Learning) for professional learners. It also depicts the improvement of OBE over traditional lecture or Theory based learning in recent and future learning-teaching.

Keywords- Higher Education Institutions (HEIs); Outcome Based Education (OBE); Traditional lecture or Theory Based Education(TBE); Program Outcomes(Pos).

1. INTRODUCTION

Engineers are required to operate and behave as per well-defined professional and ethical standards. The Groups of engineers and non-engineers to solve socially relevant complex technical problems. Engineers provide services using technological products. The Characteristics of a good engineer are ability to solve well defined and ill-defined problems, should have sound knowledge of engineering sciences and technologies, Willingness and ability to learn on the job effectively [1]. As We all are know about the nature of Higher education formal programs are of two to four years duration and Offered as two semesters per year. It has well defined curricular components, predefined methods of grading and to Carry predefined credit load.
2. ORIGINS OF OUTCOME BASED EDUCATION (OBE)

Policy makers and stakeholders in several countries have been emphasizing since 1970s on the need to create instruments to acquire comparable and equivalent information about students learning methodology can be realize across schools and Higher Education Institutions (HEIs) [2]. The term Outcome Based Education was first introduced by William Spady in 1994 through his book “Outcome–Based Education: Critical Issues and Answers”, American Association of School Administrators. ABET, in 1997, in Fig 1. Engineering education adopted for Engineering Criteria 2000 (EC2000) which moved the concentrate away from the source of information (what material is instructed) to the outcomes (what students observed). William G. Spady expressed that Outcome-Based Education implies clearly focusing and organizing everything in an instructive framework around what is necessary for all students to be option to do successfully and effectively at the end of their learning encounters. This implies beginning with a clear picture of what is significant for students to be option to do, and then plan the curriculum, instruction, and assessment to make sure this adapting and learning ultimately happens.

2.1 Features of an Outcome Statement

- Should unambiguously state what the student should be able to do/perform.
- What the students do or perform are observable and measurable.
- Students should be able to understand what it means (comprehensible).
- Should be able to provide guidance to students in planning their learning.

3. PHILOSOPHY OF EDUCATION TAXONOMY- TEACHING AND LEARNING

Education, in its broad sense, alludes to any demonstration or experience that has formative impact on the mind, character or physical capacity of an individual. In this sense never closes; we genuinely learn from experiences through our lives. In its technical sense, is the process by which society, through high schools, colleges, universities and other Multi institutions, intentionally transmits its social legacy – its gathered knowledge, values and special skill – from one generation to next another. Education, in our context, is concerned with intentional learning like in schools, colleges and universities.
To educate people wisely we must know what we educate them to become. To know this it is necessary to ask what can be the purpose of life and what sort life it should be. This leads to the necessity to consider education philosophically. Educational philosophy involves the application of formal philosophy to education [3]. One can look at education from the view of any of following philosophies: Idealism, Realism, Pragmatism Existentialism, Analysis. This is one convenient classification of philosophies.

Higher Education includes

1. Formal programs
2. Aims of higher education cannot be and are not that universal.
3. Universities/Colleges offering higher education general programs will identify the aims, called Program Outcomes.
4. In case of professional courses like engineering the concerned Accrediting agency will identify the Program Outcomes with some freedom to add some more given to the Department offering the program.

3.1 Teaching

Teaching is the way toward helping other people to obtain valuable knowledge, quality skills and values or information. Teaching is the way towards attending to people’s needs, experiences and emotions, and intervening with the goal so that they learn specific things. (Mark K Smith)[4]. Interventions regularly appear as the form of questioning or addressing, listening, sharing information, clarifying some phenomenon, showing a quality skill or process, testing ones own understanding with their capacity and encouraging learning good activities or exercises (such as note making, group discussion, tak composing, assignment writing, reenactments, simulations)

Models of Teaching

• May help teachers to create conducive environment for learning.
• May help teachers to plan learning centered educational experiences.
• May stimulate development of new and better forms and opportunities for education.

In Glasser Model of Teaching, William Glasser (1962) belongs to the Personal family of Models of Teaching

1. Instructional goals or objectives
2. Behaviour of students
3. Instructional steps or procedures
4. Analysis of Performance assessments

The success of this model depends upon the competency and ability of the teacher in terms of skills like the formulation of objectives, use of proper strategies, and techniques of evaluation.

3.2 OUTCOMES OF LEARNING
Learning is getting new knowledge ability, behaviors, quality skills, valuable information, preferences or understanding [5]. As we learn, our conceptions of marvels change, and we see the world in an unexpected way. Possession of valuable information is not synonymous with learning. Learning is most stabilizing, through repeated use, certain suitable and desirable neural connections in the mind (Leamnson R, Biologist, 1999). In Fig 2 attributed to in the literature of writing as Outcomes, Outcomes of Learning, Intended Learning Outcomes, Instructional Goals, Educational and Behavioral Objectives, Performance and Terminal Objectives, General Instructional Objectives with Specific Learning Outcomes, Subordinate Skills and Objectives, and Competencies.

![Figure 2. Taxonomy of Learning](image)

*Learning Theories Three important theories of learning:*

1. Behaviorism (J. Watson)
Learning is the obtaining of a new kind of behavior through conditioning.

2. Cognitivism (Jean Piaget)
Humans learn by generating valuable knowledge and significance through successive development of their cognitive or psychological capacities including acknowledgement, recollection, investigation, reflection, application, creation, understanding, and evaluation. [6]

3. Social Constructivism (John Dewey 1933, Bruner1990, Piaget1972 and Vygotsky1978)
Considers that learning happens within a context that it is part of what is learned, knowing and doing cannot be isolated, and learning is a procedure that is reached out after some time. Exposing new ideas, hands-on experiential, collaborative, project-based, and task-based learning are based on constructivism. Assessment is a proportion of performance.

Evaluation is a translation of appraisal. Our appraisal apparatus mention to students what we consider to be significant, educators guide students to learn through their appraisals [7]. It is an adhere that interfaces the segments of a course - it’s part of content, instructional strategies, and quality skills development.
Assessment drives student learning. Assessment should be in alignment with stated outcomes of education.

3.3 Assessment

3.3.1 Types of Assessment

• Formative Assessment (Assessment for Learning or Educative Assessment)
• Summative Assessment (Assessment of Learning)

3.3.2 Instruction

Purpose of instruction is to help people learn effectively and develop it accordingly. Learning and development can be:

• Cognitive
• Affective
• Psychomotor
• Spiritual

Learning can certainly occur without instruction. Principles of learning can be applied by Instructional designers for design of emerging external events we call instruction. It is a set of events adhered in purposeful activities that facilitate to learning effectively.

3.3.3 Events can be

• Learning externally (printed pages, an educator’s oration, or the activities for gathering of students)
• Mental occasions internally (coordinating consideration, practicing, reflecting, and checking progress)

Instructional System Design - ISD

ISD model provides a way of educator or instructional designer can use to design, plan and prepare for guidance [8]. Different Instruction Design hypotheses vary in the process used to apply those hypotheses to specific situations. Instances of ISD models incorporate ADDIE or its variations.

4. OUTCOME BASED EDUCATION

Outcome-based education is one kind of approach to deal with education where choices about the educational program, guidance and appraisal are derived by the egress learning outcomes that the students ought to show toward the end of a course or the program. In Fig 3, outcome of an education is what the student should be able to demonstrate at the end of a course, program, or instructional unit. It gives the premise to a viable interact among stakeholders. In outcome-based education, “product defines process”. It is contrary to input-based education where the accentuation is on the educating and the framework is glad to acknowledge whatever is the outcome [9]. According to OBE ‘Students Learn Well’ when they are clear about what they ought to do at the end of a program. Appraisal is in alignment with what they are relied upon to do. Instructional activities are planned and led to encourage them to gain what they are relied upon to accomplish.
Framework of Outcome Based Education:

Undergraduate Engineering Programs are required to grant valuable Knowledge, quality Skills and Attitudes. Engineering Programs in India are offered according to the guidelines of All India Council for Technical Education (AICTE) by Tier 1 (Academically Autonomous) and Tier 2 (Academically Non-autonomous) Institutions.
At present over 90% of engineering colleges are scholastically non self-governing, i.e., Tier 2 organizations. In Fig 4 represent the framework of OBE, India turned into a perpetual individual from the Washington Accord in 2014.[10] It perceives the significant equivalence of courses authorize by signatory nations and prescribes that graduates of programs certify by any of the signatory bodies be perceived by different bodies as having met the academic requirements for entry to the practice of engineering. Since 2015, needs that engineering programs are led in the framework of Outcome Based Education.

4.1 Advantages of OBE

Clarity: An unequivocal explanation, of what the instructive procedure expects to accomplish, explains the educational program for the two understudies and educators, and gives a concentration to instructing and learning.

Provision of a Framework: Outcome-based education come up with powerful system for curriculum integration.

Guide for Assessment: The outcomes furnish the system for student assessments.

Facilitates Curriculum Evaluation: The outcomes bear the criterion against which the educational plan can be judged.

4.2 Reservations about OBE

• It is against the spirit of education
• It is a straightjacket
• Documentation overload

5. LEVELS OF OUTCOMES

An outcome is what the learner will be able to do/perform as an outcome of some learning experience in the context of formal education. An outcome is what the student should be able to do at the end of a program [11]. Outcomes come with up premise to a powerful association among stakeholders. The Level of outcomes are,

Program Educational Objectives: PEOs are wide articulations that depict the vocation and expert achievements in four to five years after graduation that the program is planning graduates to accomplish.

Program Outcomes: POs are proclamations that portray what the information, abilities and perspectives learners ought to have the option to show at the time of graduation from an expert program. POs (12 in number) are recognized by NBA and are pertinent to all Professional Undergraduate programs. They address both disciplinary and expert skills.

Program Specific Outcomes: PSOs are articulations that portray what the alumni of a specific Professional program ought to have the option to do at the time of graduation. It describe the explicitness of the (Professional Core courses) of a program. PSOs of Professional program must be two to four in number.

Course Outcomes: COs are articulations that portray what learners ought to have the option to do toward the end of a course. COs ought to be recognizable or observable and measurable. A course outcome tends to a subset of POs and PSOs.

6. STUDY ANALYSIS
The instructions are provided by the full scale level educational program which is planned dependent on OBE, however resources use to convey the substance at small scale level. Advance Pedagogy is the stage to create miniaturized scale level showing state in India, National Institute of Technical Teachers Training and Research (NITTTR) is such sort of stage. Following some speculation based on OBE structure of educations are:
1. promotes high prospect and superior learning for all students as well as teaching for all teachers,
2. Prepares students for lifelong learning and cope up with recent trend,
3. Fosters more authentic forms of assessment and acquires meta-cognitive knowledge
4. Encourages decision-making at all levels including: Curriculum, Teaching methods, Institution structure and Management also.

6.1 Adaptation Of Learners In Obe Enactment
In Fig. 5 shows the rate recurrence of the degree of concurrence to Statement 1: Adaptation of learners on OBE enactment. In Fig. 5. Rate recurrence of the degree of concurrence an adaptation of learners on OBE enactment. The outcomes show that a most of learners (over 70%) concurred that they had the option to adjust their learning style towards the OBE enactment. Notwithstanding, the outcomes additionally show about 24.2% who were as yet impotent to adapt the OBE approach.

**Figure 5.** Rate recurrence of the degree of concurrence an adaptation of learners on OBE enactment.

Fig.6 shows the various levels of percentage for Outcome Based Learning and Theory Based Learning of different countries with data monitor to progress toward the Sustainable Development Goals for learning for over a period of certain years. Further this could help to analyze the education system among other countries.

**Figure 6.** Percentage of countries with data monitor to progress toward the Sustainable Development Goals for learning

7. OUTCOME BASED EDUCATION LEARNERS IN 2013
Among OBE Framework nations, the normal pace of degree accomplishment among learner is 44% (a figure that compasses above half in nine states members, including Canada, Japan and the United Kingdom).[12] The International Association of Universities gauges there are presently 18,000 degree-conceding organizations in 180 nations around the world. Looking across member countries, the OBE ventures this extending field of colleges and Universities will graduate a capricious learners by the end of the upcoming decades. All the more explicitly, the quantity of professional learners with a college degree is estimate to develop from 137 million starting at 2013 to 300 million by 2030. The accompanying graph features this extension alongside the moving appropriation of degree achievement by nation. Inside that base of 137 million professional outcome based education learners in 2013 which represent in Fig 7, for instance, 17% were in China, 14% in the US, and 14% in India.

**Figure 7.** Outcome based education learners in 2013

### 8. OUTCOME BASED EDUCATION LEARNERS IN 2020

In 2000, there were 51 million professional learners with advanced education degrees in OBE framework nations, and 39 million in non-OBE framework nations. Over the previous decade, however this crevice has nearly shut, in enormous part due to surprising development of advanced education in this latter gathering of nations. For instance, in 2010 there were an expected 66 million professional learners with advanced education degree in OBE framework nations, contrasted with 64 million in non-OBE framework nations.[13] In Fig 8, represent the event that this pattern proceeds, the quantity of professional learners from Argentina, Brazil, China, India, Indonesia, the Russian Federation, Saudi Arabia and South Africa with an advanced education degree will be practically 40% higher than the number from all OBE Framework nations constantly 2020.
Figure 9. Professional Outcome based education learners in 2030

9. IMPROVEMENT OF OBE OVER TRADITIONAL BASED EDUCATION

Twelve percent originated from the Russian Federation, and about 10% each were from Japan and India. In 2010, China was at the leader of the pack, as per OBE framework gauges, representing 18% of professional learners with Outcome based education. The United States followed with 14%, the Russian Federation and India each had 11%, and Japan had 7%. These patterns are probably going to increase further in the years ahead. As per OBE framework projections, there will be in excess of 200 million professional learners with advanced education degrees over all OBE and non OBE framework continuously 2020 – and 40% of them will be from China and India alone.[15]

According to investigation the accompanying fig.10 portrays the improvement of OBE over traditional lecture or Theory based learning. On the other hand, the United States and the European Union nations are relied upon to represent a little more than a fourth of youngsters with provisional degrees in OBE and non OBE framework countries. In reality, these figures may underrate the future development of the worldwide ability pool, because the fact behind that various nations – prominently China, the European Union nations, and the U.S. – are pursuing activities to increase advanced education accomplishment rates even further.

Figure 10. Improvement of OBE over traditional lecture or Theory based learning.
10. CONCLUSION

Creating measurable learning objective is important to set forth course improvement plan. Taxonomy of educational objectives help instructor to re-design or improve one’s own course curriculum. Increased retention of knowledge is targeted by using active learning strategies rather than traditional learning environment. Even each learning style has its own definition, most of the time those are interchangeable in the literature such as; active learning, cooperative learning and problem-based learning. Course outcomes shall support program outcomes – not all but partially – to be part of the entire engineering education. Writing measurable learning outcomes is possible by using some action verbs that some of them belong to high level cognitive domain. Creating a course plan to achieve specified outcomes requires effort in three domains as; learning objectives, instruction and assessment. In order to document a previously developed course curriculum based on problem-based learning, an existing course blueprint is selected to use as an ideal template.

In this paper, the authors have introduced road-map of OBE and Engineering Pedagogy as an advance impact of OBE which is designed for professional learners.

This was aligned with the concept of soft skill, technical education focused on graduate qualifications, OBE structure and advanced engineering pedagogy. The blow of soft-skill and advance pedagogy reflect prospect of OBE framework by professional learners. The impact of advanced education is speculated as a plus point of OBE for the recent and future learning-teaching.

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