Target based education: a simple guide

Satesh NAMASIVAYAM
KDU University College
Kuala Lumpur, Malaysia
satesh@kdu.edu.my

ABSTRACT

This guide intends to provide a simple explanation on how to implement Target Based Education (TBE) for Engineering Schools. TBE aims at engaging students in real life discussions and problems, thus encouraging concentrated learning (centered and focused learning) between themselves. TBE also aims at building the knowledge of the students through the application of design and practical skills, working together in a team or as an individual. This guide's ultimate goal is to provide insight into the TBE methodology enabling successful administration. It should be noted that the guide is non-exhaustive and any attempt to add to the body of knowledge contained in the guide is highly encouraged. TBE is meant to supplement the initiatives of Outcome Based Education and Problem Based Learning.

Keywords: *Education, Target, Problem, Goal*

1.0 INTRODUCTION

University teaching environments have changed significantly over the last 10 years. Universities now encourage teaching which generates better understanding to many of engineering's abstract concepts, employing real world engineering issues and problems to the seemingly infinite diagrams, illustrations and mathematical models.

Most, if not all of us seem to view lectures as information dissemination rather than learning. As such many students seems to adopt a rather unresponsive role during lectures, but in some cases, if a learning experience can be generated, a more active sense of participation can be shown. Such scenarios may develop confidence and creative skills, stimulating students to embrace learning not to just accept it.

With the addition of specific learning outcomes (LO) as well as the more macro – program outcomes (PO), all of which are geared towards developing a pool of

undergraduates equipped with independent learning skills[1]. As such, there now exists a need to ensure that the prescribed LOs and POs are still met without the traditional method of information dissemination by lecturers.

Lecturers are required to adopt the transition from the role of solely transmitting information to facilitating student involvement in their own learning process resulting in richer learning experiences for their students.

Ingleton et al. (2000) states that the responsibility of the academic staff in ensuring that the learning outcomes are greater. This is to ensure the focus on student learning and responsibility thus supporting the students as independent learners.

Dhanasekar and Devenish (2008) implied that assessment strategies must demonstrate student achievement of specific LOs. The authors go on to state that the introduction of such initiatives can help to demonstrate this, highlighting and enhancing problem solving, communication, learning and technical skills.

This change is result of echoes of cries from the engineering industry, demanding for graduates who aren't subject specific but those who possess a broader range of interpersonal and soft skills with the ability of thinking outside the box, increasing their employability. In addition, the industry also demands graduates which are capable of explaining why a particular solution should be implemented for a particular problem, in addition to highlighting the relevant codes of design during the problem solving process.

As we are all well aware, the pressure on universities in ensuring that such outcomes are produced is monitored closely by the local accreditation councils, emphasizing skill development in the core course structure. Johnson (1996) correctly states that accrediting bodies worldwide requires that graduates from engineering programs are to be able to demonstrate that they have acquired the skills necessary for practice in a complex environment.

TBE attempts in guiding the students to come up with a suitable solution to an engineering problem, the solution of which can be found by employing the usage of the existing or acquired resources. In the process of finding the solution the entire process is highly thought and intellectually provoking as there is the addition of a time constraint which aims at maximizing the intellectual output of the students. TBE aims at supporting the body of knowledge instilled through the application of Outcome Based Education and Problem Based Learning initiatives.

It should be noted that ultimately, these cases provide the students to see theory in practice. It is generally assumed that the students would need to make some effort in defining the problem, identifying the resources required to assist in providing

[1] LOs are normally described as the achievements of the student upon successful completion of a particular subject while POs describe the knowledge and capabilities a student would possess upon graduating from a specific undergraduate program.

solutions to the problem, applying the associated analytical tools to obtain the required data and finally drawing conclusions from the findings and thus recommending a solution to the problem.

Such an initiative is a welcomed challenge as engineering schools are now looking for an opportunity to demonstrate their students' ability in attaining their learning outcomes - Maddocks (2008). Schank et al. (1993/1994) asserts that such initiatives also encourage learning in service of achieving definable goals (solutions to problems in the domain of the program or course content). The authors also state that such tasks – learning by doing, requires an environment that is organized around the pursuit of the goal, allowing the students to acquire the necessary skill to achieve it. Schank et al. (1993/1994) also rightly point out that a key area of focus in this learning process is in encountering failures in the pursuit of such goals.

2.0 TEACHING METHODS

Target Based Education encompasses two aspects. In an engineering school, TBE covers the familiar Problem or Project Based Learning (PBL) and the less familiar Goal Based Learning (GBL). PBL involves students in designing, building, testing and implementing a thought out design solution to an engineering problem. In many cases, PBL is run in a common subject for all disciplines. In such a subject the ultimate goal is designing an actual product (or device) which is functional and meets the desired and defined objectives. GBL involves the students in solving real-world engineering examples without fabricating a product (or device). The main aim would be to provide a solution to a defined problem through the usage of various existing equipment made available by the school and to highlight the relevant codes of design in solving the problem. PBL can be run as part of a common subject for all disciplines, while GBL can be run in a shorter time span, and in any single subject. The more rigorous time constraint is necessary as the fabrication time required to build and test the product is not required and the flexibility of GBL in being able to apply itself to any subject in an engineering programme is also advantageous.

The role of the lecturer in TBE is to encourage interaction between the students and the identified problem. As such the role of the lecturer would simply be to help the students in defining the problem and perhaps in some cases to provide the background to the problem. It is recommended that the lecturer guides the students in such a way so as to ensure that the following questions are posed to them.

- What is the problem?
- Why do we need a solution?
- When do we need it by?
- Where is going to be implemented?
- Who would be affected by the outcome of the solution?
- How would we go about obtaining the solution?

It is recommended that the lecturer makes an effort to pose the above "5W 1H" model to the students to structure the discussions and analytical fact finding mission. However care should be taken as not to cross over from the relevant role as played by the lecturer. The lecturer could also insinuate to point out important sections during discussions and perhaps to recommend further questions.

2.1 Points to Consider

TBE requires a clear definition of 4 key areas in order to be implemented smoothly.

- Goals

  The lecturer must be able to assess that the students have clearly identified the problem and have a clear idea on how to go about providing solutions to the problem (the goal).

- Timing

  The lecturer must make the relevant time constraint clear.

- Preparation

  The lecturer in charge should have sound knowledge in what the outcome of the case should be[2].

- Commitment

  The lecturer should see to it that all students get involved[3].

In summary, TBE solves and tackles problems head-on, finding a viable and implementable solution for it, thus encouraging the "learning by doing" pedagogy. TBE aims at providing a highly charged learning environment where the students themselves are able to identify what needs to be learnt by providing a solution to the problem. In essence the tool in providing the students knowledge and skills is the problem.

TBE would aid in developing:

- Management skills
- Team-working skills
- Decision making skills

[2] Where it is required, lecturers would need to ensure that adequate resources are available.
[3] The lecturer would need adequate skills and training in facilitating teamwork and cooperative learning.

- Problem solving skills
- Communication skills
- Practical application skills
- Life long learning skills

Figure 1: TBE.

In very simple terms, students would need to develop skills of **P**roblem identification, **S**olution identification, **S**olution implementation and **P**roblem review – the **PSSP** methodology highlighted in Figure 2 below. Each step clearly ensures that the students are learning as they progress along. This process "PSSP" aims as coaxing students to think for working and practical solutions to a problem.

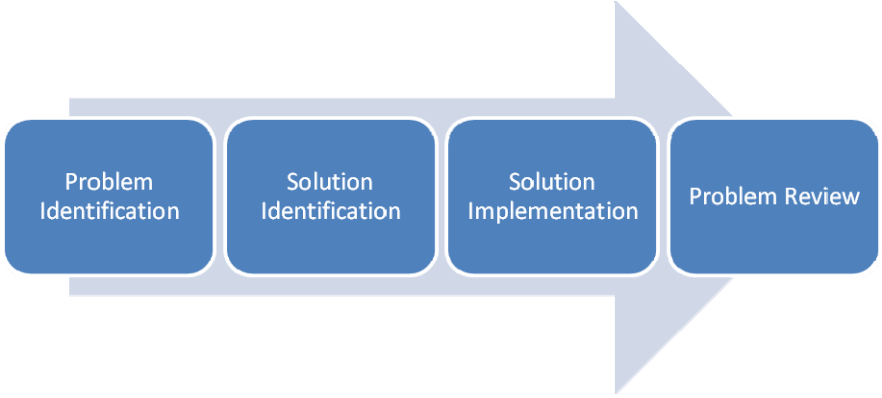

Figure 2: The PSSP Methodology.

2.2 TBE Development

When incorporating TBE into a subject, it is imperative to note that the problem (or project) must be defined to ensure that the students are the key in obtaining the

information required to solve it. The lecturer acts as the facilitator (or supervisor). The problem aims at developing the learning outcomes of a particular task. Ideally, it would seem logical to follow a thought out route in solving a TBE-based problem, thus employing the PSSP methodology.

Problem Definition

A 1st stage discussion between the supervisor and the student team to ascertain the background of the problem.

Solution Identification

Brainstorming – solution identification, conceptual designs

Solution Implementation

Here a 3rd stage of testing the viability of the identified solutions, clearly looking for loopholes as well as additional inconveniences that can occur by implementing a particular solution.

Problem Review

The final stage, looking at the complete picture, after choosing an appropriate solution, the team would review the problem and ascertain on whether the problem objective has been answered.

In summary when incorporating TBE the learning outcomes always prevail, as it seems an utter waste of time and resources in designing a case which does not lead to produce a specified outcome! The other key point in the development is to ensure that the students have access to the necessary information and resources they would require to aid them in solving the case.

CONCLUSION

This guide has discussed the need, rationale, processes, and benefits of TBE in Engineering Education. Much more work is needed to successfully implement it to achieve all its stated aims and objectives. An ongoing learning process is expected as staff makes the transition from their traditional role to a new and for some a radically different role from that which they are used to. A staff support/discussion group would be helpful in this regard.

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