Design of Competitive Learning Model in Engineering Education

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Abstract–**Competitiveness has always been misunderstood and misinterpreted in the education industry for long now. A sincere attempt has been made by the authors to propose a competitive based and activity based learning program in Engineering Education that can enable today's students to learn in a way that will reduce their incubation period as a fresher and an employee during the early days of their employment.The authors are from the Information Science Department and therefore the example used in this paper will be relevant to the subjects they handle.**

Keywords –Activity based learning, Competitive based activity learning, Class room techniques, Learning Programmatic Languages.

I. INTRODUCTION

Engineering education is going through an evolution at a tremendous pace in the current decade, thanks to the competitive industry standards. The job opportunities for fresh engineering graduates in the form of campus recruitments though abundant till now has been going through a roller coaster ride given the unstable global economic conditions. The onus is now on providing the best quality education possible to enable our students to occupy the top rung in the available job opportunities no matter how fewer they are. This can only be achieved by bringing out the best quality graduates into the market that can get the attention of the cream brands in the industry to come to our campus for recruiting our grads. The emphasis therefore is more on the education mechanism as to how unique and effective can one be to make the student the best in the industry.

It has become a global phenomenon to improve the quality of teaching and learning in engineering educational institutions Higher education teaching is becoming more professionalized with some countries setting up accreditation bodies to ensure competencies [1]. At the same time companies in the global market are going through severe competition from all corners of the world. Companies have to be both flexible and adaptive at a pace that is as rapid as the evolution of technology that has almost exploded in the recent past. Constant innovation is the key to success and sustenance in both the existing and the emerging markets alike. And for constant innovation, there is a need of regular supply of quality resources who can make that happen. It is therefore necessary and also the need of the hour to stress on innovative means of teaching and learning at the education level. The quality of student learning is directly although not exclusively related to the quality of teaching [2]. Therefore, The quality of student learning is directly not exclusively related to the quality of teaching but the first and most promising way to improve learning is to improve teaching writes [3].

Activity based learning is considered as one of the best approaches towards improving the quality of teaching and learning in engineering educational institutions. It is also receiving considerable attention globally over the past few years and growing. Activity based teaching and learning in simple words describes a range of pedagogical approaches to teaching. Its core premises include the requirement that learning should be based on doing some hands-on experiments and activities. We can find plenty of research work available on activity based learning for engineering education and most also become obsolete with time. Change is constant and everywhere [4] modern society is characterized by a rapidly expanding base of knowledge and expertise, such that many students cannot be expected to be cognizant of all of the knowledge in their chosen area of learning, [5]. Whilst trying to incorporate more "human" skills into their knowledge base and professional practice, today's engineers must also cope with continual technological and organizational change in the workplace. In addition they must also cope with the commercial realities of industrial practice in the modern world, as well as the legal consequences of every professional decision they make [6].

The challenge of preparing engineering graduates for a fast changing work environment calls for the development of thinking programs [7] that are dynamic and versatile at the same time. The programs have to be more market oriented and be realistic to what the students learn and what the Industry demands. There are plenty of activity based learning mechanisms that many faculty members follow but nothing beats the competitive based activities that is based on and designed for the competitive market that the students have to get into one day eventually.

II. CLASSIFICATION OF ACTIVITY BASED TEACHING

The purpose of activity-based teaching is for an educator to engage students directly, drawing them into a lesson so that they become a participant in their own learning. Some traditional forms of education often relied upon the educator as a knowledgeable expert who simply provided information to students [8].It is clear that there is a need for activity based teaching alongside the traditional mechanism to coexist in cohesion to make the teaching more effective to and desirable by the student community. The activities thus used can be either individual or group based but the outcome is to ensure that the students are learning in an effective manner such that they understand and use the learnt methods to good use when needed. The Activity Based teaching can therefore be broadly classified under three major categories [9].

- Exploratory
- Constructive
- Expressional

Exploratory activities are those where the students are encouraged to gather knowledge through exploring new concepts and skills in a way that will help them enhance their knowledge base to the level that the market needs. The current environment where the information is available in abundance by the press of the button – click of a button to be more precise has made it a lot more easier for the student community to explore and gather more information about the topic they study within their class rooms. This activity has exponential benefits to sync the students with the latest technologies that is actually being used within the companies that one day the students might be a part of.

Constructional activities are those where the students are encouraged to build a functional mechanism that is fully functional and is relevant to both the topic at discussion and a real life instance that the mechanism can be put into use. This though is the primary objective of the students during their dissertation project in the final semester of the curriculum is necessary at the subject level at a lesser magnitude based on the topic and the magnitude of its importance in the actual industry.

Expressional activities are the most commonly used ones by the faculty members in the form of presentations. There are again various forms of presentations such as the actual power point presentation, chalk and talk activities, seminars, debates and so on. The list can go on and on but what matters the most is the effectiveness of the activity on the student learning. There is a saying, "You do not know how much you have learned until you start teaching." So, the most effective method of learning is "Students teaching other students." There is a wealth of evidence showing that students of different levels and personalities can learn effectively through peer teaching in a wide range of goals and content [10]. Expressional activities however are labelled as time consuming and non-effective broadly due to the lack of enthusiasm from the participants.

III. EFFECTIVENESS OF ACTIVITY BASED LEARNING

Activity-based teaching is an approach to education focusing on the idea that students should be engaged through actions. This is in contrast to some traditional forms of teaching in which an educator lectures or otherwise relays information to students who are expected to absorb what they are told [9].Irrespective of the type of the activity, what is more important is the participation levels of the participants (both teacher and the students) to make an activity more effective or least effective. It is therefore necessary to design and drive the activity in such a way that it does not lose its charm during and post the activity and will continue to encourage the participants in keeping their enthusiasm at the highest possible levels.

The goal of activity based learning is for learners to construct mental models that allow for higher-order performance such as applied problem solving and transfer of information and skills. New information and communication technologies make it possible to develop and deliver multimedia learning objects for activity based learning [11]. Mental Models are more than declarative or procedural knowledge, they are advanced knowledge representations [12]. Given the kind of distraction our student community is facing today, keeping the students engaged in classroom activities has become a horrendous job for the faculty members no doubt. In such cases, expecting them to engage themselves in the activity based learning actively and with enthusiasm is a great deal to ask for. The answer for this lies in the basis of our education rating system itself, the competition within the students to be the best in class. Our education system in India until recently used to follow the ranking system that has produced brilliant people who have contributed to the world that we know today. The same system of competitiveness when used in activity based learning should give good and long lasting results that will instill both enthusiasm and attitude to know and learn more within the young minds of students effectively.

IV. COMPETITIVENESS IN ACTIVITY BASED LEARNING

Edward Bellamy (March 26, 1850 – May 22, 1898) an American author and socialist once said „Competition, which is the instinct of selfishness, is another word for dissipation of energy, while combination is the secret of efficient production'. It has long been debated over and over that competition in education is not the right way and most of the western world follow this and yet we Indians have always followed this principle in our

education system for a long time now. Many universities and institutions are now looking at embracing a grading system to avoid discrimination within the students by ranking them as individuals. However grading system is yet again a reformed way of creating competition in a way through creating a group of students under a performance based grading mechanism collectively. There are people who oppose even this and are proposing a pass / fail mechanism but then how would you rate the best among the lot when needed. There is also a need to instill the competitive attitude at a younger age if we have to enable the student to stand apart and be recognized in the society for being unique.

There are many papers published within activity based learning on comparing cooperative learning versus competitive learning. Most of these papers shed more light on the need for competitiveness but yet fall short of distinctively coming out with a proper activity model. There are a few papers that compliments the debate with good logical reasoning and with some supporting examples making the reader understand the pros and cons of each. The most popular ones being from Ms. Sangeeta Chauhan [13] and Marlow Ediger [14] in which they debate that both cooperative learning and competitive learning have their own pros and cons and therefore cannot be distinctively go with one than the other.

There is a need to understand what they are and also the pros and cons of both Cooperative Learning and Competitive Learning in brief [15].

a. Cooperative Learning

Students are usually divided into small groups and encouraged to work together to maximize their own learning as well as that of each student in the group.

Pros of Cooperative Learning

- Students learn important cooperative social skills that they will need later in their working lives.
- Students can actually learn better when they also help teach other students.
- Children who might be left behind in a more competitive environment can be brought up to speed by their peers.

Cons of Cooperative Learning

- It can be hard for a teacher to accurately evaluate the progress of individual students.
- Students may not be motivated to excel if they know their classmates will do whatever work is needed on a project.
- Students can become frustrated when their individual efforts go unrecognized.

b. Competitive Learning

Sometimes called individualistic learning, the competitive classroom is the more traditional form of learning. Student study alone and complete their own assignments while trying to learn the presented subject matter.

Pros of Competitive Learning

- Children face the real-world challenge of competition.
- Students are encouraged to do their very best.
- Independent thinking and effort are encouraged and rewarded.
- Children can still work in teams, but compete against other teams: It can be a great way to "enliven the classroom environment."

Cons of Competitive Learning

- Some students may become frustrated and even apathetic if they fall too far behind the rest of their classmates.
- Earning high grades and teacher approval may come to be seen as more important than actual learning.
- Getting along with others is de-emphasized.

V. COMPETITIVE BASED ACTIVITY FOR LEARNING PROGRAMMING LANGUAGE

We being faculty members of the department of Information Science we have been teaching programming languages such as Unix, C++, C-Sharp, Java, Data Structures, etc., to our students.The IT boom has exponentially increased the job opportunities and has opened the doors of major corporations like never before. The software development market even after a couple of downfalls and recessions is going strong and is believed to strengthen in the years to come. The younger generation is aware of the growth prospects in the software industry and are therefore very keen in enrolling themselves on to the engineering stream of education. Over the semesters we have noticed a variation in the interest for learning programming language in the classroom sessions.

Observation in this regard suggests that majority of the students treat class room learning of programming language as theory learning and the lab learning of the same as practical learning. We have identified a need to make the students learn the programming language with more enthusiasm and vigor within the classroom session as they do in the lab sessions. In order to make the classroom sessions more interesting,a survey among a sample size of 50 students across semesters was conducted wherein the student could identify any four areas of making the classroom teaching more interesting. Based on the feedback from the students, the gaps identified are mentioned below:

- 53% of students believed classroom sessions are monotonous in nature with just the black board being used most of the time.

- The subject being a programming language that was taught, 62% of the students wanted to see more visuals than the chalk and talk activity.
- 71% of the students felt that they are taught basic fundamentals within the class room which is not what is being actually used in the industry that they would be a part of one day.
- 41% of the students wanted to try out new concepts that are being discussed in programming language forums on the internet but lacked knowledge or support in that matter.

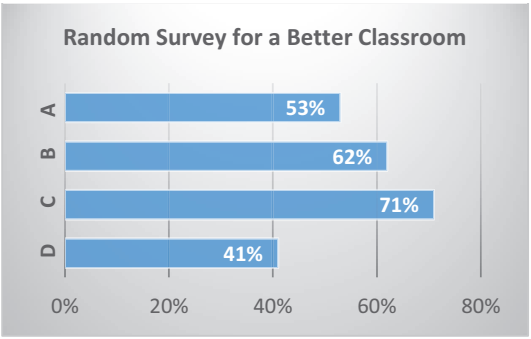

Figure 1: Survey results for making classroom sessions more interesting.

The results were also graphically represented as shown in bar chart above Figure 1. We then devised a model that addressed all of the identified gaps and increase the engagement level of students to the higher level eventually.

Through this paper we propose an activity which is a combination of both cooperative learning as well as competitive learning that is more industry focused so that the students are moreinclined towards active participation, contribution and involvement. Below is an example tounderstand how it would matter within a class of Information Science students learning C-Sharp as a part of their regular curriculum.

Programming is something that can only improve with more and more practice and a student's ability should evolve as and when they apply their knowledge in real life examples. It is therefore necessary that we provide opportunities within the classroom sessions to work towards learning the programming languages in a way that they will remember and excel at the same time. It is necessary that we divide the class into multiple groups thereby addressing the individuality concern and creating a cooperative environment within the teams. For example, a class of 50 can be divided into 5 groups of 10 each. The team members will be picked randomly using token or chit system. The teacher will have the last say to balance out the team strength based on the abilities of the students in every group if necessary. These groups can choose to represent themselvesas software companies who will develop a software and bid for a requirement that the teacher will identify thus participating in a competitive environment just like real life market scenario. The teacher has to identify a project that has real life implications such as building a cost analysis software for a division of the state road transport corporation. It is necessary that the project has to be a small one that should not consume more than two weeks longeffort collectively by the team, else this activity will lose its charm by students claiming the lack of quality time to be contributed towards the project.

The groups will have to first build a proposal to bid for the project with a write up that captures the timeframe and specifications of the software. The best specification among all the groups will be selected by the teacher and the rest of the teams will have to work for that particular timeframe and specifications decided by the teacher. The flow chart of the process of bidding and execution should be as shown in the Figure 2 below.

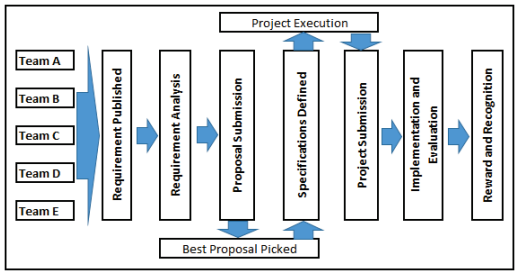

Figure 2: Process flow chart for the Project Bidding Exercise

Each of the team will comprise of a team leader and the remaining members should contribute to the cause as a team. The program has to be based on the concepts that the teacher is teaching as a part of their regular curriculum and therefore must illustrate the creativity and the usefulness of the language being taught in the real life scenario.The competitiveness within and between the groups will encourage the students to be creative and think different in order to be considered the best among the class.

VI. BENEFITS OF COMPETITIVE BASED ACTIVITY LEARNING MODEL

The above mentioned competitive based activity learning sessions will enlighten the students in learning the programming language in a fun filled and competitive atmosphere where they compete between their own class mates and also work with each other in terms of coming up with the best for others to learn as well. It is well known that there is no better way than challenging one's ability themselves. Also, It has long been debated that the syllabus that the students learn as a part of their curriculum is very basic when compared to the actual industry practice and the same students when they come out of the have to undergo a lot of industry relevant training in order to make themselves familiar with the industry and then contribute.Therefore, it becomes very necessary that we synchronize the classroom learning to the industry practices so that the students feel at ease when they go out of the as graduates into the

industry as job aspirants.Enabling competitive based activity sessions as mentioned above, the issue of alienating the students from the industry is also eradicated.

VII. CONCLUSION

An attempt has been made to identify the gaps in making the classroom teaching sessions more attractive and engaging for the students learning engineering programs. A survey was conducted in order to identify and understand the gaps and then build an activity based learning model that will address the issue at hand. Post identifying the gaps, a competitive based activity model has been designed and proposed for implementation for learning programming languages in the engineering stream. It is therefore concluded that there is a need for a competitive based activity learning model for the students to get a first-hand experience to be in a real life scenario and enjoy being a part of it and learn at the same time.

VIII. SCOPE OF FUTURE RESEARCH

The work presented in this paper is just a proposal of identifying the need, defining and designing a competitive based activity learning model for learning programming languages in engineering education stream. The proposed model can be readily implemented and the outcome can be evaluated thereby fine tuning the model. There is tremendous scope for future research in this area as this model reduces the gap between class room learning and a real life scenario as per the industry standards.

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