

Learning by engagement and empowerment - a pragmatic approach to enhance student engagement in a service course and developing relevance of such a course to their own majors

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Abstract

New pedagogical approaches are developed and implemented in a service course in order to enhance the engagement of students in the learning process. Service courses are often perceived to be non-relevant and lame by majority of engineering students. The new approaches bring a climate where students are provided with opportunities to take charge and explore. The idea behind the new approach is built around a good mix of technology with old tools of the trade so as to create a system of challenge and reward. Trials based on this approach indicate that such a system of reward helps enhance classroom engagement and helps students discover the connection between the service course and their chosen field.

Key words: Pedagogical approach, service course, technology in class, challenges and reward, innovation in learning

Introduction

Majority of engineering students are unmotivated to study courses outside of their major, in part, because of the lack of engagement and in part due to a perception of lack of relevance. They don't find compelling reasons for them to be engaged and involved in those courses because they feel the courses are not related to them. To their eyes, the time and resources spent on those courses do not bring any reward. Actually, most of them perceive such courses as unnecessary or rather unneeded burden which they will happily do without. A lack of engagement in the learning process coupled with a failure to see relevance have given in to this apathy.

At present, various undergraduate engineering departments in our university and elsewhere in other institutions within US or abroad [1] are required to take "Electrical Circuits" course to meet their departmental requirement for graduation. At Missouri S&T, this course is named "EE281 – Electrical Circuits" This author has been teaching this particular course for more than a decade. The common wisdom behind such a requirement is perhaps an aspiration among educators to see our engineering graduates having a basic knowledge and knowhow of electric circuits – a reasonable desire given the realities of our modern world. This perspective is, however, lost among students when they realize that they are compelled to take this course if they wish to graduate. They feel being pushed and rather punished for no reason. This situation begs for a change. The remedy is to alter the situation all together.

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Rationale for engagement

We will be doing disservice to our students if we just require them to take a course and deny the joys of engagement or the so called fruits of labor. So, this author introduced some new pedagogical approaches that involved the students quite actively in the teaching - learning process. These approaches provided them with rewards for their initiatives and involvement. Students need to feel the pressure of a challenge in any given course but they also need to find a venue where a genuine conversation takes place and where they could see the connecting dots of their endeavor to their desired goals. A carefully planned strategy can deliver such a climate.

The issue raised in this article addresses an important S&T teaching and learning issue that could go beyond the boundaries of this campus, many universities struggle in like manner in its attempt to capture its students' mind to study service courses [1]. A disconnect between the aspirations surrounding a given course and the perception of irrelevance of such a course among the students is at the root of this struggle.

Methodology

1. Calibrated peer-instruction

The methodology surrounds the idea that students tend to learn more when they have to teach others what they have learned. The three factors: knowledge, articulation, and implementation complete a full circle of learning process. So, the methodology consists of activities where the students are required to articulate ideas among their peers and take charge in problem solving sessions.

The student population is divided into teams of 3 or 4 people. Each member of a team is required to take turn in articulating and solving a problem. Emphasis is made to seek out various types of solutions to a given problem. Traditional teaching methods tend to focus on problems with one type of solution, despite the possibility of multiple solution methods. Our methodology shifts the focus to more realistic engineering application by way of seeking out various viable alternate methods to bring in the culture of problem-based learning (PBL) [2] into our circuit education. When we use questions and problems that allow multiple strategies to reach a successful outcome, we give students the opportunity to make choices and then compare their approaches. This strategy challenges them to operate at a higher level of thinking than otherwise.

These peer-instruction sessions are watched and scored. In this manner, a significant portion of the usual homework/quiz assignments is augmented/replaced by such activities that focus on peer-instruction. To start off, students are handed pre-assigned list of problems or tasks. A schedule is made where each member of the team will articulate the solution and the teams will take turn.

2. Wikis on the go

Majority of the students in our classroom today are from face-book, linked, twitter, and four-square generation. These venues of social media are comfort zones for the bulk of our students. This is not necessarily a bad thing. We could actually use this techno-savvy culture to increase the engagement of our student body effectively in our class room. In EE281, the students are asked to post assigned topic as a wiki post within the “Blackboard” where their peers are encouraged to comment on each other’s work. All of these interactions intrigue them and lead them to have more discussion and engagement. The return of this activity is an enhanced exchange of ideas not just vertically between a student and a professor but more so horizontally across the peers. Getting them do the tasks that they are socially more comfortable doing is the key here. Students do better when they feel emotionally and intellectually safe. This gets everyone on the bus. A pseudo face-book environment such as a wiki post within the “Blackboard” can help produce such a climate. This author has experienced such an effect in his class. When we have a good mix of modern technology with old tools of the trade, we can really hit home.

The wikis have become a place where the students can really show off and they like it. They are encouraged to add graphics, audio/video clips, to enhance their presentation where appropriate. This encouragement instills a sense of being tech-savvy among the students. They gain the sense of being at the edge of modern technology and helps build their confidence.

In EE281, the students are assigned to build case studies where they investigate how the circuit theory they are learning in the class is applied to solve a problem in their respective fields. These endeavors carry points. However, the most important return of this activity is to help them see how the “Electrical Circuits” course can be not only relevant to their majors but also be a great tool to solve some of their own problems. Some of the examples for wiki posting are “Using resistance to measure strain”, “energy storage for electrical vehicles” etc. where they really see the application side of circuit theory.

To add more flavors to this activity, specialists are invited to present case studies when appropriate and when they are accessible. These specialists could be other faculty members from other departments or engineers from industry, alumni, etc. Students receive points for attending these events. The pizzas help too. These events show them how circuit analysis is useful in various types of engineering disciplines. The ideas sell on the spot.

3. Learning by playing

An occasional “Jeopardy-like” game playing can provide additional intensity in the engagement process. Students feel more energized in the face of the idea of a game.

Actually, for many of us, the mere word “study” sounds burdensome and tiring while the words “game” or “playing” bring out all of the positive emotions. The trick is to translate a study session into a game-like activity without losing its core values. When we could do so, learning occurs without having to carry a burden of chore.

4. Old tools of the trade

The other side of this methodology is to combine new technology with old tools of the trade. Regular exams and a final exam are our old tools which have their roles to play. The new methodology retains them as well but less in number. Another problem in a service course is a decline in attendance as the semester continues. To encourage class participation and attendance, 50 points are allotted for it. However, the focus is placed on the positive side. The notion that ‘Just showing up to the class brings some points’ does a good trick. However, a sense of perspective is kept. This portion of 50 points is out of a bag containing a total of 700 points in all less, than 8% at the end of the day.

5. Striking a Balance

A good balance is the key to success. In EE281, the overall grade distribution is spread over various parts of the methodology to keep a good balance. The distribution is shown below. Out of a total of 700 points, the various pieces carry the following points

Peer-instruction/group activity based problem solving – 100 points
 Wiki posting – 100 points
 Class participation/attendance – 50 points
 Exam 1 – 100 points
 Exam 2 – 100 points
 Final comprehensive – 250 points

Pragmatic approach

The methodology is good as long as it could be implemented. The question surrounds the narrative if the approach is pragmatic. As is well accepted, the best engineering teaching methods involve the application of heuristics to achieve the best outcome within the available resources [3]. Articulation among peers, earning credit for peer instruction, and case study exploration dominate the spectrum of grade composition in our methodology. Traditionally, EE281 consists of weekly homework assignments, several quizzes, typically 4 one-hour long exams and a comprehensive final. Many students drag their feet through these activities with a sense of indifference and even with a hint of contempt. To make the matters worse, quite frequently, the solution to the homework assignments may be simply lifted from some files, as no one will be asked to articulate the solutions before an audience. In contrast, in an environment where one has to articulate the solution before a team, the student will have to understand the solution, at the very least. In such a classroom setting, involvement and engagement will be the central theme to earn points.

The main area of focus in this methodology is to promote active learning and improve attainment of learning outcomes.

In the new methodology, the traditional home-works are augmented/replaced by peer-instruction activity, wiki posts. The number of regular exams is reduced to 2 from 4 one-hour long exams. The final exam is kept as usual.

Learning outcomes

The results of this methodology are measurable improvements in the quality of instructions. It provides a metric that measures or reflects the degree of active learning that has taken place in the course. Along with this, many of the challenges in teaching service course, or any course for that matter, share certain commonalities. For instance, the lack of student engagement is often a common problem in many courses, service or not. So, the return of this methodology generalizes to other courses as well. This methodology is based on the conviction that students when trusted and allowed to explore tend to engage in the learning process more. So, a carefully crafted strategy where students are encouraged to venture into such explorations brings enthusiasm in a learning process. In this regard, the outcome of this methodology has the potential to be transformational in nature.

Conclusion

The evaluation of the approaches is made by measuring the success of the students in the new methodology as compared to those from previous ways. The students were asked to answer questionnaire and fill out surveys. This provided qualitative or semi-quantitative analysis which led to the conclusion – the new methodology is pragmatic, it enhances student engagement in a service course and it helps them see a degree of relevance of such a course to their own majors

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Biographical Information

Bijaya Shrestha was born to Prof. Kalidas Shrestha and Mrs. Kamala Maiya Joshi in Kathmandu, Nepal. He earned a Ph.D. degree in 1995 from the University of Missouri-Rolla (UMR) for developing a Monte Carlo algorithm to model Photon Transport in a semiconductor. His research interests include particle transport, pattern recognition, feature extraction and identification, Medical applications.