LIMITING THE DIFFERENCE BETWEEN CLASSROOM TEACHING-LEARNING AND CONSTRUCTION SITE

Tashi Choden, Assistant Lecturer, Jigme Namgyal Engineering College.

Abstract

Teaching engineering requires different strategies to deliver quality of classroom teaching-learning pedagogy, which the student can connect it to the site works. Thus, this paper intends to study the gap between classroom teaching-learning and construction site works. It also discusses the difference between the traditional teaching-learning methods. Therefore, the study employed on desk research to determine research objectives. The study provides various strategies, which can be adopted to improve teaching-learning pedagogy. These includes the importance of teaching communication skills, broadening the students' perspective with the ethical issues of engineering and implementing the inductive instruction technique as an effective approach of teaching. Moreover, it also provides some of the suggestion to narrow down the gap between classroom teaching-learning and site practice through an observations made by fresh engineers who recently graduated from two of the colleges of RUB. Some of the suggestions given by the graduates of two engineering college in RUB to bridge a gap between classroom learning and construction site is taken into account.

Key words: *Teaching-Learning, Engineering*

Introduction

According to the Accreditation Board of Engineering and Technology (ABET), "Engineering is the profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind."

Engineering and construction go hand in hand. If there is no engineering then there will be no constructions. Therefore, it's important to study the nature of teaching-learning pedagogy in engineering colleges and its application in the field. A survey study of engineers of two RUB colleges revealed the presence of breach between classroom teaching-learning and the construction site which is gradually crammed with experience gained at the construction site. The survey study found that the classroom teaching-learning is kept at basic while in field students required to deliver full potential. Moreover, incomplete module development in the Definitive

Programme Document has left out some important modules like Structure Design and Highway Engineering.

There have been many journals which have given some solutions to bridge the gap between classroom learning and site practices. Engineering is not an easy subject to teach. As noted by The International Journal of Engineering Education, topics cover a range of teaching issues, including developments in educational method in technology, case studies, laboratory applications, new theoretical approaches, and educational policy. Based on the volumes of literature dedicated to effective teaching strategies in engineering, teaching engineering has become an important task. (Elshorbagy, 2002, p.295).

Teaching engineering is important tasks as we are grooming the future of a nation who will be directly helping the country to strengthen the economy and beautify with magnificent architecture. But the main issue is how to provide quality education for the increasing number of student intake. Reducing the intake of student is not the solution for quality education as the colleges are run by the fees paid by the students. Now let's state an example of engineering colleges where one tutor has to look about more than 70 students in a class. It's hard for a tutor to make every individual student to understand the lecture provided by the tutor. Due to large number of student tutors tends to give lectures which only makes student fill with boredom. Classroom learning is one of the most important knowledge which the students will carry in the site. How can we improve it is the issues which has been raised now and then.

Even though a variety of innovative teaching techniques are available to engineering lecturers, the education of engineers in many colleges and universities still follows the traditional lecture format. The traditional teaching technique involves only the text book knowledge where a lecturer delivers what is already in a textbook without any additional information. Regardless of the reasons, more organized attention should be directed toward the teaching and learning processes of engineers. There is a gap which exists between the present education of engineers and expectations of their roles in the site. Many engineering graduates have difficulty making the transition from school to employment. The roles expected in the workforce are often alien to many recently graduated engineers.

Since classroom learning are mainly involves lectures and practical classes, the main problem is to make connections between the theoretical knowledge given to them and the fieldwork they have to do at the site. If the civil engineering students study about basic materials used in construction like bricks, stones, rods etc., then what the lecturer says holds true about these building materials. The student should

have an idea about how bricks will look like and in which type of construction it can be used. Therefore, to bridge the gap between classroom learning and practical knowledge, the teaching technique must be improved. The lecturer or tutor should follow the Feynman technique of teaching where they can explain the concepts of subjects in simple language which students can connect with it and prepare their own notes with their understandings.

Kolb Theory of Teaching Engineering Students

Apart from the traditional teaching method, Kolb's learning styles and Bloom's Cognitive taxonomy can be used to develop the theoretical framework as it can relates to developing critical skills that are significant to engineer's workplace. As learning is a continuous process, the ultimate goal of the classroom learning is to stimulate desire in the students to learn and discover new ideas to help solve the endless flow of incoming problems of modern life (Kolb, 1998). If such purpose is not fulfilled by the university then the education system has failed in training the engineers. To induce such desire in engineering students, Kolb's learning style needs to be introduced. According to Kolb (1984), the learning cycle consists of four principles which include "Why", "What", "How", and "What if". Kolbe's theory has been developed for the purpose of teaching engineering and has been successfully applied to various engineering teaching students

The purpose of the first principle of Kolb's theory is the "Why?" question which establishes a 'feel' for the subject and its significance. It provides the basic information about engineering concepts which are taught in classroom presentations. In this first principle the lecturers or tutor have to grab students' attention and give motivation to student for learning the basic concepts of the lesson. In order to accomplish this goal, lecturers are encouraged to generate enthusiasm for new material by modeling it during the presentation. According to many researchers, students learn better when they see an image form rather than reading a write up. If the tutor is teaching the module of building materials and construction, he or she can show how the bricks or sand or aggregate looks like and what are the properties so that students will have clear visual about it. Or tutor can relate the new concept to the existing real-world problem. For instance, there is lecture on the significance of strength of steel is introduced by a 30 second highlight from the movie Titanic. Why disaster? By doing so, the lecturer's role is as motivator who personalizes the material, bridging a connection between theoretical and practical. Therefore it will inspire the students to build interest in learning the subject.

With second principle of Kolb's theory, students find the answer to question "What?" At this stage, the students are given a chance to be acquainted themselves with

the facts. The lecturer will primarily focus on giving information to the students, organizing and integrating new materials, and also providing them to have time to think and reflect about their findings. Referring back to Titanic example, lecturer can initiate Kolbe's second principle by enquiring students to guess about the composition of the steel used in the Titanic and to compare it to the steel used in current ship manufacturing. This will lead to the question, what caused the demise of the Titanic?

The third principle of Kolb's theory is to find the answers to the question "How?" Students will assemble the information and apply it to find the answer to the question, How does it work? The main objective of this principle is to acquire experience with the lesson being taught in the classroom. Students can conduct test on different types of steel to find the strength of the steels that can be used in Titanic ship and replicate the Titanic structure with the different types of steel. Specific objective of this principle is to provide opportunities for students to apply new information, helping them to develop problem solving routines and elimination the fear of failure by reassuring them to try trial and error method to the new ideas generated which is essential part of learning process. (Palmer, 1998). Usually in traditional teaching method the tutor tend to discourage effort of student to do trial and error process by giving low grades for wrong methods. That's the reason why there isn't any progress in student's creative thinking. Therefore a lecturer should be encouraging students to accept their mistake, and correct their mistake so that they can improve and learn in a process.

The fourth principle of Kolb's Theory is the question "What if?" Borrowing from computer science, this part of the learning sequence could be re-labeled the 'post processing' phase. Here the more importance is given to self-discovery, where students will seek to apply the materials and the acquired 'tools' to their lives and to real-life situations. Using examples of Titanic, the students would have the opportunity to create new composites of steel and test them against the composite structure of steel used on the Titanic. Students could transfer their findings to new problems associated with the strength of steel, as are frequently found in current news stories around the world. The same process of self discovery can also be used in the failure of Tacoma suspension Bridge which was built in 1940 in United State. A natural progression from Kolb's self-discovery phase is the process of sharing the findings with other (Kolb, 1984). Providing an opportunity for students to share their self-discoveries with others can potentially lead to further excitement in the process of learning. This process will not only excites the student who is presenting but also encourage other students too. It will be one of the effective methods to dismiss students' fear of being wrong and will encourage them to go through trial and error stage and developed their own version of materials that they have

acquired. Moreover, with this method the students can retain their knowledge longer than the lectures given by the tutors and they can apply it to different cases and different situations. This is the ideal method for teaching engineering.

Teaching and Learning Strategies

A variety of teaching techniques are used in the engineering classroom. These include the traditional lecture or deductive instruction, discussion or facilitative instruction, and the reverse lecture or inductive instruction. All of these techniques will have an impact on students learning which will automatically affect their capability to learn the lesson.

Deductive Instruction

It is the traditional method of lecturing where the lecturer or tutor is the one who imparts the knowledge without students' involvement. It is often effective method for large number of students for communicating knowledge but it's a least effective for learning of students. According to research, students tend to remember 70% of first 10 minutes of content, but only 20% of the last 10 minutes (Colbeck, 2001, p.175). Although the lecturer has control over course delivery during class period, this method results in the lowest retention of content material in comparison to the other methods of learning. Students are not as likely to be actively engaged in this type of learning, given the one-way flow of information, and are therefore less likely to benefit.

Facilitative Instruction

Facilitative instruction requires the lecturer to become "the guide on the side". The lecturer facilitates the discussion while the students generate the content. Students are more engaged in this process and tend to feel more ownership of their learning. Although this method is very effective but it is more challenging to adapt for engineering classes. Engineering educations requires the learning of significant amounts of technical information, which often precludes the use of discussion technique. However this technique could be used in few situations to generate interaction between students in the class and to help them express their understanding of a subject. For the lecturer, this technique reveals the different capabilities and oral communication skills of the students.

Inductive Instruction

The third type of teaching technique, inductive instruction, is highly suitable for teaching engineering. Grounded in the theory of constructivism, the learner is at the center of the learning process, developing his/her own understanding of the

way the world works. The lecturer assumes a facilitating role, assisting students in learning how to obtain knowledge, while students assume responsibility for their own learning. The focus of classroom learning is on concept development through understanding, and construction of active learner reformation (Brooks, 1990, p.68) For example the module strength of material can be taught using this method where lecturer can give concepts of stress and strain or where the moment of inertia acts in different types of body using some models. This will help them to get the image of the distribution of stress and strain. Then students can further discover the stress and strain distribution in different type of structure and will be able to calculate it with the guidance of their tutor. Likewise tutor can begin with simple examples that students can understand and discuss. The students are encouraged to build or develop the theory or the concept that is being taught gradually. Once students understand the abstract concept, the lecturer can precede deductive instruction. This practical way of combining deductive and inductive instruction techniques has the potential to be efficient way of teaching engineering.

Bloom's cognitive taxonomy is one of the assessment method adapted in the new teaching method where student are being assessed on the understanding level of the module. Bloom provides one way to develop assignments, quizzes, projects, and exams that provide the lecturer with means of assessing varying levels of learning (Bloom, 1984). According to Bloom (1984), cognitive development spans across a continuum, beginning with the acquisition of new information or knowledge and ending with the evaluation of complex thought. Blooms cognitive taxonomy has six stages of learning. Students tend to grasp the basic concepts of engineering in the beginning of first year. As they proceed with the following years they end up acquiring the abstract ideas of the engineering. Bloom's taxonomy has designed in such a way that it reflects the developmental stages in the engineering course.

Suggestions by Engineering Graduates

According to the interview carried out on 10 fresh graduates, they said the subjects were vast in the engineering modules where some of the topics aren't relevant to the construction site. They suggested if the module could consist of the topics which can be directly applied to the field and excludes the one which are not much of relevant to the site. And they also advised to have a lecturer who is well qualified with theoretical knowledge as well as practical knowledge. As the lecturer becomes the main source of information center for the students, he or she at least have some of the work experience in field so that they can relate the topics with the field work while giving the concepts to the students . Another suggestion is to give examples relating to practical field and not only the textbook questions. For example, if a tutor teaches the module of estimation and costing, he or she just solves the problem of

textbook questions which are the basic concepts of how to calculate B.O.Q of the any structure but it will be useful for students if the tutor assign students to find the estimate of whole building by giving the architectural drawing. In this way the students will be acquiring practical knowledge and they don't have to wait till they graduate to have field experience. And also assess the student basic understanding of concept of the module using Bloom Taxonomy cognitive theorem where students are assessed through quizzes, assignments, term projects and exams with different level of questions which can identify the understanding levels of students.

Conclusion

A number of important features of engineering education have been reviewed and presented in this paper. Kolb's cycle of learning, along with the major questions that need to be addressed during the education process, have been discussed. Two important aspects of effective engineering education have been mentioned. Firstly, the inductive instruction (reverse lecture) technique has been highlighted in this paper as an effective method of teaching undergraduate engineering students. Secondly, the performance of engineering students should be carefully assessed in different ways taking into consideration Bloom's cognitive taxonomy to provide information about different levels of learning that the students have achieved. By applying each of these ideas, engineering education can successfully bridge the gap between classroom learning and the engineering profession. Some of the suggestions from the fresh graduates are also being discussed for further improvement in teaching learning process.

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Author's Profile

Tashi Choden has done the schooling from Phuentsholing Higher Secondary School and completed her bachelor of engineering in civil engineering from College of Science and Technology. During her final semester, she did a research project on the topic "Impact of air pollution in Pasakha area". After completing her graduation, she worked as a site engineer for three months in a private company at Samrang under Samdrup Jongkhar Dzongkhag. Then in July 2016 she joined as the assistant lecturer in Civil Engineering and Surveying Department at Jigme Namgyel Engineering College under Samdrup Jongkhar Dzongkhag. Currently she is teaching strength of material to the first year students and been occupied with research works carried out for Annual University Research Grant on the topic "Assessment on Impacts of Mining and Transportation Activities on Ambient Air Quality of Dewathang".