Abstract— Software Engineering (SE) education intend to prepare students for their professional responsibility as software engineers. Software engineers are the individuals who are not only responsible of developing software from the beginning phase until its deployment but also describe about various phases involved in a software project. The increasing globalization of software development presents a unique challenge to Computer Engineering and Computer Science education. To better the computer students for this changing world, computer universities and instructors should develop and be able to formally evaluate pedagogy to teach software engineering course to address these challenges and to make students more competitive in today’s global environment. Nevertheless, SE education trends towards to be too theoretical using traditional methods. Therefore, Case Method (CM) is recognized necessary for SE education to improve practicality whereas the students can be exposed to real scenarios and learn to apply those theories through discovery. This paper presents a survey conducted to a set of students who employed CM in learning SE from the University of Computer Studies, Taunggyi. Moreover, this paper describes the empirical results of student perception and to determine the effectiveness of using CM approach.

Keywords— Software engineering education, Case Method Approach, Case Study Approach, Case Learning Approach, Traditional Approach.

I. INTRODUCTION

Software intensive systems have become essential to everyday activity and business in the global economy. Not only is public dependence on software increasing, but in addition the character of the software itself is changing – and with it the demands on the software developers. The growth in the use of software products has indirectly demanded reliable, efficient and knowledgeable software engineers. This requires the education system to produce better trained software engineers. In order to fulfill this expectation especially towards bridging the gap between experience and academics, the education system is continuously researching for the best technique to teach future software engineers who are nurturing essential knowledge, skills and attitude that are actually needed by the business. [1] Software engineering is concerned with theories, methods and tools for professional software development. It makes the students master the basic theory and method of software engineering, and use them to the analysis, design, coding, and testing activities of the software development. And train students the awareness of creativity and team spirit [11]. One of the driving issues in how software engineering is taught is current trends in industry software development practices. Another issue in software engineering education that has been addressed by several educators is how to motive students to appreciate the importance of software engineering. The current approach to SE education, CM, can fulfill the industry demand for high quality software engineering.

To date, there are not many studies discussed the use of case method in SE. Even if they do exit, the studies focused on the usage rather than the assessment. This paper discusses using case method (CM) in SE education to reform the traditional lecture based approach. The
discussion is based on the finding the survey conducted from the students of the University of Computer Studies, Taunggyi. The following section provides the related work on the subject matter. Section 3 briefly explains the problems of using traditional approach and the benefits of using case method. Section 4 presents using case method in SE whereas Section 5 discuss the implication. Finally, Section 6 concludes the paper and addresses some future work.

II. RELATED WORK

In recent years, quite a few colleges and universities have gradually abandoned the phase that students take in knowledge only by instructions of teachers in classes during the practice of teaching by software engineering. They are trying to a new teaching method that students learn their own. Learning theories are attempts to describe and understand the various ways in which people learn. They are an important resource for educational research, as they can both guide us in creating new educational approaches, and help to analyze and improve existing approaches.[9]

Software engineering education traditionally relies on a standard lecture-based learning and readings format to teach students about the discipline. This paradigm is comfortable for instructors, as it is the accepted standard in most disciplines in higher education. However, software engineering contains many subjects that rely on tacit knowledge. By definition, this knowledge is difficult to transfer through traditional communication, such as reading and lecture, instead necessitating practice and learning-by-doing. Furthermore, traditional software engineering courses do not teach students business concepts, instead couching the program in core computer science and the study of abstraction. Without understanding business context, students are less able to see the impact that their work makes throughout their careers and require more on-the-job training in their initial positions once out of school. [8] used business-oriented cases in teaching and learning SE at their institution. Their goal was to let student’s experience studying, analyzing and proposing solutions to a real-life information technology related business problem. The results show that the students are able to identify significant issues, identify alternative solutions and communicate findings both in writing and orally through CM. They are also capable of analyzing complicated and unfamiliar problems. CM encourages students to develop their critical thinking, learn to work in teams, improve their presentation and writing skills. IT that delivers a sustainable competitive advantage in a manner compatible with the Business such as linking between the business plan and the IT plan, comparison between the business strategy and the IT strategy. There have been a few recent uses of case studies in SE education [5], [6],[7] [8] and [9] . These studies used some variation of the typical case study based approach used in management education.

III. TRADITIONAL APPROACH AND CASE METHOD APPROACH IN SE

Software engineering (SE) is a broad field that encompasses many different areas. With the inception of Internet technologies, software engineering has become associated with a vast majority of areas, such as system development, parallel processing, database engineering and data management, network and distributed system security, software architecture and design, programming languages, performance modeling, graphical user interface design and others. However, there are certain skills that can be taught that will allow students to handle these multi-discipline areas in the software engineering environment. SE profession demands software engineers to be knowledgeable and competent in both technical and non-technical aspects. It normally employs traditional lecture-based approach (attending lectures and tutorials, doing reading and assignments) that uses whiteboard and projector to present topics. Students simply
listen to lectures, absorb and memories facts only to reproduce them in the examinations. The conventional learning process is arid, less interactive and reactive rather proactive.

A. Traditional approach in SE

Traditional classrooms follow a lecture format that is instructor-centered. This structure maximizes the amount of time that instructors have to speak to their students, but limits the time available for lecture alternatives, like active learning activities, discussion, and in-classwork. A major problem with the lecture based teaching is that the student is usually a passive audience during lectures and doesn’t get involved in the learning process. Moreover, students feel that SE a theoretical subject and of no use in future. Lectures suggest a reactive approach where the students are expected to react to a solution presented as opposed to proactively thinking about the problem on hand. Students can get a short-term goal such as getting a good grade but lacking the long-term goal of learning. Most of educators and practitioners agree that the traditional teaching method does not work well for teaching software engineering. Computer science educators have taken different approaches to teaching software engineering over the years, both as a result of changing methodologies as well as individual beliefs about what teaching methods work best in a particular academic environment. Many educators feel that current practices of teaching software engineering are not adequately preparing students for the real world of software development. [10] summarize the problems with current teaching approaches:

No product – students are creating projects, not commercial grade products

Short duration – single semester, or two-semester, courses impose an artificial time constraint

High turnover – new students each semester means the talent pool remains shallow and student skills are not developing based on previous experience

Low complexity – by necessity given time constraints and skill sets

No maintenance – as a result of short duration, students do not experience a key aspect of software development, the maintenance phase

No customer – most software engineering projects do not interface with a real customer

To address these shortcomings, different approaches to teaching software engineering have emerged. One of the solution to these approaches is to use case method approach.

B. Case method approach in SE

Case Method (preparing case study solution, presenting case study solutions, participation in class discussions and writing detailed solution reports) is sometimes referred to as Case Learning [3] and Case Study Approach [4]. It is a teaching technique by means of real scenarios as a tool for delivering a subject. The real scenarios are in the form of case studies or rather teaching cases that are usually developed based on real events or sometime even fabricated. The teaching cases come together with teaching notes that act as a guidance to instructors on how to deliver the case. The cases capture real scenarios in order to get real experience and situations that happen in the real world which are more relevant and engaging [5]. In addition, CM also promotes student-centered learning where students discover the knowledge of the subject themselves through self-preparation and group discussion [6]. CM is an active and student-centric learning method. It provides a mechanism for learning concepts, skills, tools and techniques in presence of a context where the instructor and students are engaged in a meaningful manner. CM enables students to relate their experiences to the learning process and improve the learning through problem solving activities. When using CM students, engage in reading, analyze cases and execute discussions with peers and instructors which make the classroom is being active. [7]
### TABLE I. CASE STUDIES

<table>
<thead>
<tr>
<th>Type</th>
<th>Case studies</th>
<th>Example of business oriented case</th>
<th>Example of real cases</th>
<th>Top requirement s</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-E</td>
<td>E-commerce Application</td>
<td>Trade of Jewelry, Online Stationery Wholesales System, Cherry Meals to you, Online Commodity Price List for Myanmar</td>
<td>Shan State Special Gifts</td>
<td>User Info database, User Accounts, SMS and e-mail alert, Easy to use User Interface</td>
</tr>
<tr>
<td>C-M</td>
<td>Management Application</td>
<td>Education Aid Service</td>
<td>Inventory Management System, Car Modification System</td>
<td>User Info database, User accounts, Area and Time of booking</td>
</tr>
</tbody>
</table>

### IV. SOFTWARE ENGINEERING EDUCATION USING CASE METHOD

Case studies as an instructional method, use of cases can bring both theory and practice, to do learning by engaging students in the University of Computer Studies of Taunggyi. Cases are suitable for professional education as they can be used to create a collaborative learning environment for experiential learning through contextualized instruction that could actively involve the learners could model professional action and thinking and provide feedback. Case study approach is a student-centric modern learning approach that is capable of effectively assisting traditional learning approach such as lecture-based. [1] Student centered learning which students are involved actively in the learning process whereas the teacher is facilitator or coach or supervisor. It also develops students’ skills in decision making, problem solving, critical thinking, analytical thinking, group work and various interpersonal skills. [1] Case study approach has been adapted for use in many different environments, for different reasons, including teaching lifelong learning skills, allowing self-pacing of content, teaching in which students routinely struggle and opening up traditional lecture to more active learning.

The students not only can teach and learn SE especially in business-oriented cases from IT business plan but also real cases which are to let student’s experience studying, analyzing and proposing solutions to a real-life information technology as optional. Typically, case method approach or any non-conventional approaches have been found most effective in smaller classes. Even though the large classes (ranging between 100-130 students) can get the compelling results indication the effectiveness of case method approach. Both lectures and case studies were used for teaching. A survey is recorded students’ perception about their competencies and learnings from different case studies. The objective of the survey was towards the use of CM in teaching and learning SE. Data are collected by means of a questionnaire containing questions ‘yes’ or ‘no’ answer and choose four choices. The participants were second year students, third year students, fourth year students and fifth year students from the University of Computer Studies, Taunggyi 2016-2017 Academic Year. The different case studies chosen by the students were identified as shown in the table 1. There are six survey questions reflecting on their experience as follows:

**Question 1:** Do you know how to do requirement analysis and specification phase? If you know you do make yourself, choose four choices such as lots of help or some help or very little help or without any help.
Question 2: Do you know how to do design phase? If you know you do make yourself, choose four choices such as lots of help or some help or very little help or without any help.

Question 3: Do you know how to do coding phase? If you know you do make yourself, choose four choices such as lots of help or some help or very little help or without any help.

Question 4: Do you know how to do testing phase? If you know you do make, choose four choices such as lots of help or some help or very little help or without any help.

Question 5: Do you know how to do management phase? If you know you do make, choose four choices such as lots of help or some help or very little help or without any help.

Question 6: Do you know how to do documentation? If you know you do make yourself, choose four choices such as lots of help or some help or very little help or without any help.

Each pair of students or individual student was to answer these questions in the class.

The Figure 1 represents the frequency of answers for each question asked to the participants. The survey is based on the students to rate their confidence-level in performing certain tasks. The evaluation is done for six phases involved in a software project such as requirement analysis and specification, design, coding, testing and management. The evaluation consists of four choices: lots of help, some help, very little help and without any help.

The goal of the learning process has been adapted for many different goals such as to develop many skills in decision making, problem solving, critical thinking, group work and various interpersonal skills.

V. DISCUSSION

The case method combines two elements: the case itself and the discussion of the case. A teaching case is a rich narrative in which individuals or groups must decide or solve a problem. Cases provide a rich contextual way to introduce new material and create opportunities for students to apply the material they have just learned. In a case discussion, students do the work of the discipline, rather than watch or read about how it is done by others. By engaging in the case, students apply the concepts, techniques and methods of the discipline and improve their ability to apply them. Case discussions bring energy and excitement to the classroom, providing students with an opportunity to work with a range of evidence and improving their ability to apply the vocabulary, theory and methods they have learned in the course. Case method teaching makes students more responsible for their own learning but also reduces teachers control.

As shown in Figure 1, results corroborated that case method approach is more effective and interesting for learning SE than the lecture based approach. At least 50% students felt that they can accomplish the tasks, across accomplish the tasks across all categories, with little help. Coding is taking all major decisions was one of the most difficult for students. This lack of confidence is more related to the nature of the task and its complexity. It is required second year and third year students who have limited exposure to technology, multi-disciplinary knowledge and abstract thinking. Students were comfortable with design related tasks and documentation.
Additionally, CM is meant for oral assessments where students are assessed based on their participation and contribution in discussions. The students can gain benefits from the effort.

VI. CONCLUSIONS

The Case-oriented teaching education creates an active environment by encouraging learning, discussion, team working and higher order thinking. The case method provides a platform for learning the concepts, skills and techniques in presence of a context such that the instructor and student are engaged in a meaningful discussion and the learning becomes students centric and active. Furthermore, Case Method approach can help the students to gain and retain realistic experience to concepts of Software Engineering as they are applied in the real world, and the students of today can be groomed as excellent professionals who have experienced the intricacies and complexities of the real world as well as tried their hands to get more effective learning environment. Over all, case method approach is the most suitable for teaching and learning goals of software engineering education. In this university, there is holding IT business Contest and Project show. But these are chosen from the students as optional. If the students are indispensable taught using case method, it will be more effective learning technique. As future plan, current software engineering course will be added the case studies. Whereby, students will gain how to develop software not only theoretical skill but also practical skill. Moreover, they will improve other skills such as independent and lifetime learning skill, problem solving, critical thinking and creative thinking skill, interpersonal and teamwork skill, communication skill and self-asessment skill.

REFERENCES


