Success Factors for Using Case Method in Teaching and Learning Software Engineering

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Abstract

The Case Method (CM) has long been used effectively in Social Science education. Its potential use in Applied Science such as Software Engineering (SE) however has yet to be further explored. SE is an engineering discipline that concerns the principles, methods and tools used throughout the software development lifecycle. In CM, subjects are presented to students by means of real cases whereby students themselves either individually or in group discussions work through the problems and issues presented in the cases. The CM approach is deemed necessary for SE education in order to expose students to real scenarios that challenge them to develop the appropriate skills to deal with practical problems. As a largely theoretical subject, SE students could understand more about the practical application of SE concepts and ideas via such active learning activities. This paper presents a survey conducted on two sets of students who were exposed to CM in learning SE. Besides confirming the acceptance of CM among SE students, the surveys aimed to discover the contributing factors and elements that influence the efficacy of the method. The participants consisted of 64 undergraduates that comprised local full-time and executive students. The survey was performed in two semesters through group interviews. Data from the survey were analysed qualitatively using content analysis. The results showed that there are four factors that are important to teaching SE using CM, namely Environment, Case, Instructor, and Student. Each of these factors has certain criteria and characteristics that suggest how CM can be successfully used in teaching and learning SE. These findings can be used by SE educators to more effectively plan the use of CM as one possible teaching method in SE.

Keywords: software engineering education, case method, empirical assessment

1. Introduction

It is of the utmost importance that software be reliable, efficient and effective in order to help humans in their daily lives (Hilburn, Mengel, Bagert, & Oexmann, 1998). Many tools that are used by people nowadays have some kind of embedded software which needs to be highly dependable because in some environments, they may affect living outcomes. Reliable software must be built by skilled personnel who are knowledgeable and well-trained in the subject. Such people must go through effective tertiary level education in order to achieve such qualities.

Software engineering (SE), a notion that was first introduced in a NATO sponsored conference in 1968 (Naur, Randell, Bauer, & Committee, 1969), concerns all aspects of software production starting from initiation through to its maintenance when it has gone into use. To produce high quality software, engineers adopt a systematic, disciplined, quantifiable and organised approach. It is about selecting the right tool for the right task and trying to work within financial and organisational constraints. Software engineers need to be well versed in the theories, tools and methods of software development as well as in managing changes, people and projects (Sommerville, 2010). To become competent software engineers that are relevant to the industry, SE students should thus be equipped with a strong fundamental knowledge and be regularly exposed to practical approaches and technology (Wohlin & Regnell, 1999).

1.1 Issues in Software Engineering Education

In the effort to provide the necessary knowledge to software engineers in both technical and non-technical aspects, SE courses tend to be overly theoretical and unidirectional in terms of instructor-student interaction. The normal teaching methods that are used to present SE topics tend to rely on whiteboard and projector. The effect of this method is that students merely listen, absorb and memorise lessons in order to regurgitate them in the examinations. Students are unintentionally trained to be followers rather than decision makers. Consequently, they become less creative and innovative in generating solutions. To enable the teaching and learning of SE to become more meaningful, an alternative method is needed (Varma & Garg, 2005). Students must be actively involved in the learning process in order for it to be meaningful (Sivan, Leung, Woon, & Kember, 2000). There should also be some practical elements in imparting SE knowledge since SE profession is indeed practical by nature. The traditional learning approach however is arid, less interactive and in fact, reactive rather than proactive. Subsequently, the dominant approaches fail to fulfil the industry's demand for high quality software engineers (Varma & Garg, 2005). In order to create an effective learning environment that blends both theoretical and practical elements, the Case Method (CM) is seen as a viable solution.

1.2 Case Method as the Potential Solution

CM is an established and effective pedagogical tool in Social Science education such as Law and Business. Its potential in Applied Science education such as SE however has yet to be fully explored. Case Learning (Wang & Yang, 2010) and Case Study approach (Garg & Varma, 2007) are among two other synonymous terms by which CM is also known. It uses real scenarios as a teaching tool in delivering a particular subject. CM encourages student-centred learning whereby students themselves discover the knowledge within the subject through self-preparation and group discussion (Bareiss & Griss, 2008). Typically, the cases will be more relevant and engaging if they are based on real events, experiences and situations (Jianmin & Jian, 2010). Case developers usually equip the cases with a teaching note (Erskine, Leenders & Mauffette-Leenders, 2003) that guides instructors on how to deliver the materials, for instance, highlighting important issues and providing sample questions. In exploring solutions in a case discussion, students place themselves in the shoes of the protagonists and try to analyse the issues that drive the decision-making process (Mauffette-Leenders, Erskine & Leenders 2007). This indirectly trains students to confront real issues and to develop experience in proposing practical solutions.

There is already a considerable literature that discusses the use of CM in SE in terms of its acceptance among students, the methods used and the topics covered. However, there are limited studies that focus on investigating the success factors behind CM implementation in teaching and learning SE. To address this issue, this paper identifies the factors and their corresponding characteristics or criteria that ensure the successful use of CM in the teaching and learning of SE. The discussion is based on the findings of a survey conducted with two groups of SE students. This paper is organised as follows: Section 2 provides an overview of related work on the subject matter; Section 3 briefly explains the methodology used in the survey; Section 4 presents the results; Section 5 discusses the findings; and finally, Section 6 concludes the paper and addresses future work and implications.

2. Related work

2.1 About the Case Method

CM, an active and student-centric learning method (Jianmin & Jian, 2010), enables students to relate their experiences to the learning process and improve their learning through problem solving activities. It provides a means for acquiring concepts, skills, tools and techniques in the presence of a context where the instructor and students are engaged in a meaningful manner. Students take on reading, analysing cases and executing discussions alongside peers and instructors, which then enliven the classroom atmosphere. CM arouses students' interest and attracts them to participate in class discussion which in turn develops their practical communication skills (Li & Zhang, 2010).

One of the most important elements in the CM is the case itself. It is either self-developed by the instructor or academic team, or retrieved from a case-repository. Most instructors prefer developing their own cases (Bolinger, Herold, Ramnath, & Ramanathan, 2011; Hilburn, Towhidnejad, Nangia, & Li, 2006; Razali & Chitsaz, 2010) because they can be customised according to the course plan and objectives. A developed case study can either be based on real-life events or it can be an imaginary one. The basic criteria for a good case include: a clear problem statement; focus on one issue or problem; and alignment with the program objectives. In addition, cases must be based on meaningful realistic situations, which do not contain ideal and clear-cut solutions (Jianmin & Jian, 2010). The rationale behind having no clear-cut solutions is that the answers finally offered should come from students'

deep analysis, discussion and understanding, rather than being self-evident. This facilitates students in enhancing their analytical and problem solving skills as well as promoting proactive learning.

2.2 Studies on SE and CM

SE education turned to CM as a non-conventional approach only a decade ago. As a result, there seems to be limited number of studies that have investigated the use of CM in SE education. One study sought to assess student acceptance levels towards CM in SE education (Razali & Zainal, 2012). Another study have applied action research methodology to compare the effectiveness of CM with traditional lecture-based approaches (Garg & Varma, 2007). Their results showed that CM is perceived as more effective and interesting than traditional lecturing, which confirms the hypothesis in their earlier study (Varma & Garg, 2005). CM also can improve students' communication skills, ability to apply concepts and skills learned in class, and help to instil a holistic view of SE.

Hilburn and Towhidnejad proposed a series of mini-cases covering the various topics of SE (Hilburn & Towhidnejad, 2007). They suggested this approach for using cases in teaching SE. The study found that students were motivated, enjoyed the activity and the realistic nature of the artefacts and scenarios, and benefited from the overall experience of the CM. Similarly, Yu Jia (Jia, 2010) presented a framework derived from using CM in both teaching and learning SE. The study reported that 95% of the survey participants perceived the approach as helpful. The results also showed that students learned much more than using conventional learning methods, enjoyed and were satisfied, and knew where they could apply the knowledge and skills.

Burge and Troy (Burge & Troy, 2006) let students experience studying, analysing and proposing solutions to a real-life IT related business problem. They used business-oriented cases in teaching and learning SE at their institution. Their results showed that CM can hone students' presentation and writing skills, encourage them to develop their critical thinking, as well as allow them to learn how to work in teams. Furthermore, students become capable at analysing complicated and unfamiliar problems, are able to identify significant issues, volunteer alternative solutions, and communicate findings both orally and in writing.

3. Method

The objective of the survey was to identify the factors and the corresponding characteristics that ensure the successful use of CM in SE. The earlier study has outlined a list of acceptance conditions from the perspective of usefulness, written assessments as well as group preparation and discussion (Razali & Zainal, 2012). This survey thus aimed to further refine the acceptance conditions. Data were collected by means of a group interview and were analysed qualitatively using content analysis (Krippendorff, 2004).

3.1 Sampling

The participants consisted of two groups: 34 local, multi-racial executive undergraduates and 30 full-time undergraduates, who registered for the Computer Science programme at a public university in Malaysia. This produced a total of 64 participants altogether. 'Executive' refers to part-time and mature students. 'Multi-racial' connotes the mixed races of Malay, Indian and Chinese while 'local' denotes Malaysians. The participants were selected on a voluntary basis. They suited the target population of the study because they had experienced learning using CM. The survey was performed in two separate sessions, within two consecutive semesters in year 2012.

3.2 Data Collection

The study utilised two sets of cases. One case was developed by the first author, which was dual-language. The version written in English was five pages in length whilst the one written in *Bahasa Melayu* (the national language of Malaysia) was seven pages. Both were presented in 1.5 line-spacing and printed on A4 size paper. The case was about the requirements elicitation process of a local telecommunication company. It concerned project establishment and people management matters. The methodology used and the issues faced when developing the case have been discussed in the earlier study (Razali & Chitsaz, 2010). The second case was taken from a textbook with a non-local setting and written in English. The case was about assessing acquisition and development options for a software project.

The students were given a week to prepare answers to questions regarding the case and produce a report. They had to do the assignment in groups of four or five people. Each group of students was required to present their answers in the class which was then followed by a class discussion. The students exchanged ideas and thoughts in the classroom. The instructor then concluded the discussion by summarising the possible solutions. The students were rewarded with participation marks each time they gave comments, explanations or suggestions during the discussion. After the session, the students were interviewed during which their reflections on using CM were elicited.

The interview utilised semi-structured and open-ended questions, which were designed specifically to investigate the characteristics that must be fulfilled for the successful use of CM. The characteristics were categorised under four *a priori* factors that are involved in case teaching and learning environment: Case, Environment, Student and Instructor. During the interview, the authors also collected brief quantitative data in terms of frequency on certain aspects. The interview questions for each factor were as follows:

3.2.1 "Case" Factor

The students were asked to identify the specific characteristics of the case that they feel are necessary to make the method work such as the nature of the case, the length, language used, local or foreign setting, and the presentation style. The interview questions were as follows:

1) After experiencing both approaches, which method do you like more: the Case Method or the traditional one? Why?

2) Do you gain knowledge or skills from this exercise? Elaborate.

3) Do you think the Case Method is suitable for teaching and learning Software Engineering (SE)? Why?

4) Do you think the Case Method is effective for learning SE? Why?

5) In which language do you prefer the case to be written in? International language (English language) or your mother tongue? For example, *Bahasa Melayu* for Malays. Why?

6) Which case setting do you prefer: a local or foreign setting? Why?

7) Were you comfortable with the length of the case given to you? Why?

8) Would you like the case to be presented to you in a multimedia or video format? Why?

9) If the Case Method is used as the only teaching and learning method throughout the semester, would you want the case to include real scenarios from several companies or from just one single company? Why?

3.2.2 "Environment" Factor

The students were asked about the classroom organisation such as the arrangement of the desk and chairs, the size of the class, the use of any supporting teaching tools and the assessment methods. The interview questions were as follows:

1) Is the arrangement of desk and chairs suitable? Please suggest an alternative.

2) Is the class size, in terms of total number of students, suitable? If not, what seems to be an ideal class size?

3) Do you think the class needs any supporting tools to be used during the class session? Why?

3.2.3 "Student" Factor

The questions were about group formation matters and any prerequisite requirements prior to CM experience as well as the time allocation for preparation and discussion. The interview questions were as follows:

1) Do you think that a student needs to have work experience to be able to learn using cases? Why?

2) If the case discussion exercise is presented to you in the first semester of your first year at the university, do you think you could readily answer the questions? Why?

3) Do you feel you have participated in the discussion? Why?

4) Which is preferable: discussion in a group or doing it individually? Why?

5) Do you like having the case discussions in the classroom or would you prefer to go back home and write your reports individually for assessment purposes? Why?

6) Which would you prefer: self-organised group formation or let the instructor decide? Why? In your opinion, how many students are optimal for a productive group?

7) Was the preparation time sufficient for you? Why?

8) Was the discussion time sufficient for you? Why?

3.2.4 "Instructor" Factor

The authors were keen to know the characteristics that a CM instructor should possess in order to successfully teach using cases in class. The interview questions were as follows:

1) Should the instructor just stand in front of the class or walk around while conducting the case? Why?

2)   Can you hear the instructor's voice clearly? Why?

3)   Was the instructor's presentation style suitable in conducting the case discussion? Why?

The interview sessions were video recorded with the students' consent. The videos were then transcribed into textual forms and analysed using content analysis. The analysis started with relevant research findings as guidance for initial codes. The interview responses were then analysed and categorised according to both manifest and latent content. The former is the specific and surface contents whereas the latter refers to the underlying meaning contained in the text. To identify the manifest and latent content, deductive and inductive techniques were adopted in the analysis procedure. Through the deductive technique, four factors were identified: Instructor, Student, Case and Environment. The factors were further refined as characteristics by using the inductive technique.

4. Results

The following are the results of the data analysis, presented according to the four main factors. To support the claims, some excerpts of the actual interview responses are provided.

4.1 "Case" Factor

The interview started with the most basic question to assess whether or not CM is accepted by the students as well as to understand its usefulness and suitability as a teaching and learning tool. There were 46 students favoured this method, with some additional conditions that will be discussed later in this section. Both groups of students agreed that this method could improve their knowledge and understanding of the subject matter. The value of adopting CM was seen to lie in its encouragement of self-confidence, enhancing soft skills such as critical thinking and problem solving as well as facilitating knowledge application. These aspects were mentioned several times by both groups.

> *"Yes of course. Now I know that certain models are suitable for a certain scenario such as the waterfall method."- Participant #15*

> *"Yes, indeed. We can learn how to apply our knowledge by using this learning method." – Participant #40*

> *"It builds my confidence in answering the questions. It sharpens my critical thinking." – Participant #50*

> *"We are able to learn from the brainstorming exercise." – Participant #51*

A few students also regarded the realness of cases as being very useful for them to understand how to apply their classroom knowledge to solving issues that they might face in the future. This advantage was also mentioned and supported by previous studies (Fuller, Croll, & Limei, 2002; Garg & Varma, 2007; Tan & Teo, 2009).

> *"The cases are real, thus we are exposed to how the enterprise makes decisions, going through various possibilities in making them" – Participant #2*

The students who were more reluctant to use this method raised issues regarding the fairness of the reward scheme during class discussion. They had some reservations because they felt CM was unfair to the introverted students who are shy to raise their hands and answer in front of the class. In a large class, the introverts might become "invisible".

> *"I feel that there is some unfairness, pity to those students who are introverts, they are shy to even raise their hands..." – Participant #20*

> *"I feel very nervous. Not everyone can stand up and speak like this, and I think there could be an element of unfairness..." – Participant #25*

> *"The introverts become invisible in a large class size." – Participant #17*

One student argued that the discussion session can be confusing. This is because it involves many different answers given by various students, which might not be accurate or relevant but the instructor still has to allow them in order to encourage learning. However, another student suggested that this issue is resolved by the instructor concluding the discussion at the end and giving general ideas on which answers are more suitable. The act of concluding or summarizing was also suggested by Li and Zhang in their research regarding case teaching (Li & Zhang, 2010).

> *"It is very confusing! My answer was said as good but the lecturer also seemed to accept answers from others, which were quite contradicting with mine. So, which answer is acceptable?" – Participant #19*

> *"The lecturer has to summarise and conclude the discussion in order to clear up the confusion." – Participant #23*

Another matter that was raised concerns case coverage, specifically whether the cases should rest within one single company or taken from various companies that cover different topics. A student suggested that all cases should surround one single company because they can learn deeply about that particular company, their methods of solving problems as well as their vision and mission. This would provide a unifying theme that makes the case easier to understand and visualise.

> *"In my opinion, it is good if we can focus on one single organisation from the beginning till the end. We can learn about that one particular company in depth." – Participant #5*

> *"Yes, I agree with him. We are able to sort of simulate that one organisation such as its costing, involvements, the phases they go through. Different cases might confuse us." – Participant #7*

On the topic of case presentation, the students offered different views and issues. One of them centred on the language used to write the case. The students favoured the use of both languages in presenting a case. The *Bahasa Melayu* version helped them understand the case, whereas the English version helped them understand the context of the terminology. The argument for needing the English version is because the nature of Information Technology (IT) and computing terms derive from English.

> *"...because of the case is in Bahasa Melayu, it is easy to understand. The only problem is the technical terms that originated from English Language." – Participant #19*

> *"Overall, I like Bahasa Melayu, but then because we are IT people, we need the English too." – Participant #30*

As for the local versus foreign settings, most of the students favoured the local settings as it is closer and relevant to them.

> *"If use local-based cases, I would understand more, feel it more. The case might be familiar to us." – Participant #49*

> *"When we use local cases, for example from the legal perspective, we should know better because it is our own country." – Participant#55*

A total of 27 participants preferred the case to be presented in the form of printed text. However, it is possible to complement the text with some multimedia formats to help them imagine the scenario more vividly. However, some students raised concerns that they might misinterpret multimedia case presentations since graphics normally carry implicit meanings.

> *"I prefer the case to be in the form of printed text. We could easily refer to it whenever we want, without the need to use computers or whatsoever device to run the graphics or video or audio." – Participant #28*

> *"I prefer text either printed or in softcopy version. It is OK to have both text and video but text is easier." – Participant #25*

> *"Some graphics would be an added advantage to understand the case." – Participant #40*

> *"I think it is not suitable to use multimedia presentation, we may misunderstand or the contents might be misleading." – Participant #55*

4.2 "Student" Factor

In terms of the prior knowledge necessary for them to understand the case, many students agreed that there is a need to have at least some basic knowledge of the subject matter. However, cases could act as a means of exposure for them.

> *"In my opinion, there is a need to have basic knowledge prior to using case method. It helps us to understand the case." – Participant #23*

As for the need to have work experience, it seems very unlikely that the requirement is a major factor. The group with no working experience thought they too could answer the questions. One student thought that working experience is merely an added advantage but not a prerequisite for answering the questions.

> *"No, there is no need for work experience. Many of us do not have work experience and we could still do the exercises." – Participant #55*

> *"Work experience is merely an advantage in understanding the case." – Participant #62*

Ample preparation and discussion time is important. One student commented that presenting the case as an impromptu 'pop-quiz' would not be effective. There should be at least some hints or pre-information on relevant

topics pertaining to the case. In the survey, one week was enough for analysing a 5-page case. It seems that the acceptable preparation time would be at least 1 page per day.

> *"If you come in and announce that you want us to analyse a case instantly, to me, that would be improper. You should give us some hints or pre-inform us in order for us to do some preparation...I do not think that would be effective..."* – Participant #17

> *"Yes, we had enough time for preparation."* – Participant #40

When asked whether they prefer to discuss in groups or individually, 44 students expressed a liking for the former. The students insisted on forming their own groups whereby they could choose friends who they knew very well, and were familiar and comfortable with when expressing opinions. If the instructor forms the groups, they believe that the time will be wasted in building rapport.

> *"Discuss in a group. When in a group, we can exchange ideas, argue about different understanding, thus we can teach each other."* – Participant #45

> *"In a group, but must divide tasks amongst members, and each person must know their task."* – Participant #50

> *"We want to form our own group because we understand each other."* – Participant #15

> *"We would waste time if you form our groups. We would need time to know each other."* – Participant #17

4.3 "Instructor" Factor

The instructor too plays an important role in determining the success of CM. The students suggested that the instructor should be a cheerful person; walk around and use the class space effectively; have a loud and clear voice; use a structured grading scheme in rewarding the students; and be able to manage and control the class in order to promote class participation. The instructor should also present the case in an interesting way. One student believed that the instructor should possess some industrial working experience so that he or she can share with students while conducting the case. One student recommended that there needs to be some 'chemistry' between the students and instructor. The instructor should know her or his students well; acknowledge their personal characteristics – such as knowing which students are introverts and which are extroverts.

> *"Someone who can handle a controversial discussion."* – Participant #5

> *"A person who is always happy!"* – Participant #7

> *"A cheerful person."* – Participant#13

> *"The lecturer must know her/his students; identify which person is an extrovert or introvert."* – Participant #27

> *"The instructor is someone who has a lot of experience whereby he or she can share past experiences with the students."* – Participant #15

> *"Walk around when conducting case studies."* – Participant #19

> *"Must use a clear and loud voice."* – Participant #27

> *"The instructor and students must 'click'."* – Participant #22

> *"The lecturer handles the discussion in an interesting way."* – Participant #60

> *"... The lecturer must know how to handle the class environment."* – Participant #61

Extra attention should be given to the students with introverted personality types. The instructor should take the necessary actions to encourage those who are shy and reserved to participate in class discussions. A student suggested answering questions in phases and calling out names so that each student has an equal opportunity to participate. If the time is not permitted, the discussion should continue in other sessions in order for all students to receive a fair assessment. Some students believed that introverts are often smart, but they are left out during discussions just because they do not want to raise their hands and talk in front of others. This would be detrimental both to the individual and the quality of the discussion.

> *"The lecturer must give more attention to the introvert ones."* – Participant #30

> *"The lecturer must give fair chances to each student in answering questions."* – Participant#25

> *"The lecturer must have a certain method in selecting who should answer, such as in phases or choose those students who did not raise their hands."* – Participant #20

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4.4 "Environment" Factor

Figure 1 illustrates the classroom arrangement where the case discussion was held. All desks were facing the front. There were three sections: middle, left and right. The right and left sections were a bit slanted. If looking from the front, the left and right sections were like a 'V' shape. The instructor's desk was at the front facing the three sections. The students accepted the arrangement and the physical size of the class. Regarding the class size, the students were quite comfortable with 30 to 34 people at one time, excluding the instructor. As for the introverts issue, one student suggested using a buzzer to replace raising hands. Alternatively, students may write their answers on a piece of paper to be passed over to the instructor.

> *"Maybe we could use some sort of buzzers to replace raising hands? – Participant #20*

> *"For the introverts, they can use a piece of paper to write down their comments and pass it to the instructor."* *– Participant #15*
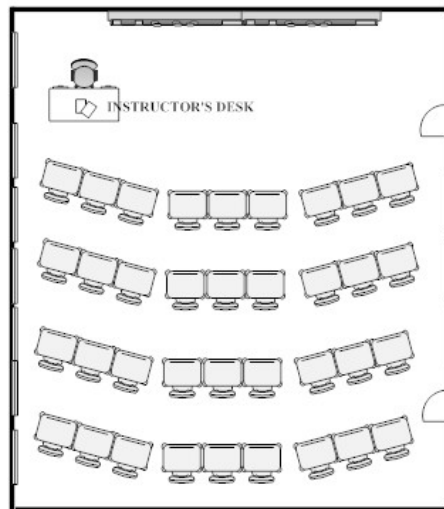

Figure 1. Class arrangement

5. Discussion

CM is generally accepted among SE students for teaching and learning the subject matter. There are four major factors that influence the successful use of the method, namely: Environment, Case, Instructor and Student. The analysis made on the data has enabled the formulation of specific criteria or characteristics that drive the efficacy of the method in the teaching and learning of SE.

Table 1 illustrates the factors and their respective criteria or characteristics. It also depicts the source of the criteria or characteristics as being either from the literature, first or second group interviews.

Table 1. Contributing factors for using the case method

Factor	Criteria/Characteristics	Literature	Interview 1	Interview 2
Environment	• Class size of not more than 34 students		✓	✓
	• Supported by tools such as using buzzers or notes to replace raising hands		✓	
	• Desks facing the front in a V-shape arrangement		✓	
Case	• Moderate difficulty	✓	✓	✓
	• Length of 3-5 pages if printed on 1.5 spaced A4 paper		✓	
	• For non-English native speakers, the case should be given in both mother tongue and English		✓	✓
	• Present mainly using text but can be complemented by multimedia elements such as graphics and audio	✓	✓	✓
	• Contain rich "realness" elements that originate from real scenarios in industry	✓	✓	✓
	• Concern one single organisation but may cover several different issues and perspectives	✓	✓	
	• Scenario is based on local settings, which are familiar to students	✓		✓
Instructor	• Cheerful		✓	✓
	• Able to control, guide and encourage the discussion	✓	✓	✓
	• Recognise the students' personal characteristics		✓	
	• Give extra attention towards introverted students		✓	
	• Move around while conducting the case		✓	✓
	• Summarise and conclude the discussion	✓	✓	
	• Use a loud and clear voice while conducting class			
	• Reward students handsomely in order to promote class participation		✓	✓
Student	• Possess basic knowledge on subject matter	✓	✓	✓
	• Possessing work experience may be helpful		✓	✓
	• Possess competitive spirit and confidence			✓
	• Volunteer to participate			✓
	• Given adequate preparation time	✓	✓	✓
	• Case discussion is better done in a group	✓	✓	✓
	• Self-organised group formation is permitted	✓	✓	✓

6. Conclusion and Future Work

This paper has discussed a survey conducted on two different groups of students who used CM in learning SE. The results indicate that there are four main factors that contribute to the acceptance of CM among SE students as a method for teaching and learning SE. The factors are Environment, Case, Instructor and Student. Each factor has its own constituted criteria or characteristics that determine the efficacy of the method.

The results may not be conclusive. They can be refined further by replicating the study in different contexts. Future research may investigate how the factors and criteria or characteristics influence each other. Later, the findings can be used to formulate as a framework that can guide SE educators to use CM in teaching.

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