Case Based Teaching for Requirements Analysis in Software Engineering

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Abstract. In Chinese universities and colleges, the education for software engineering lack practice. During the teaching of requirements analysis, the lacking phenomenon is even more serious. In this paper, the importance of practice education on requirements analysis is highlighted. Therefore, the concept of case-based teaching for requirements analysis is proposed. Some cases are provided and given education process. The extension of case-based teaching for requirements analysis can offer experience and practice to undergraduates in computer related majors and lay the foundation for them to carry on work of requirements analysis.

Introduction

Software engineering is the application of engineering to the design, development, implementation, testing and maintenance of software in a systematic method [1]. Undoubtedly, it can instruct the development and maintenance of computer software. Thus, software engineering is one of the compulsory courses of computer related majors.

In software engineering, software is considered having life cycle. The life cycle of software can be divided into three phases, definition, development and maintenance. Moreover, software engineering can be divided into 15 sub-disciplines belonging to different phases [2]. Requirements analysis, whose tasks include elicitation, analysis, specification and validation for software requirements, is one of the three affairs in the definition phase and executed after problem definition and feasibility study. Right now, the task of requirements analysis is to confirm that which works do this software project cover [3].

In practice, requirements analysis is an important and difficult affair. Firstly, requirements analysis concerns the success and failure of software project [4]. In requirements analysis, the requirements to all aspects of this software project from users should be obtained, analyzed and approved. Then, the logic model of project can be build based on these required. If some errors are happen in requirements analysis, consequences range from using experience being affected to users’ requirement not met.

However, it is difficult to make requirements analysis availably. Users often have little professional knowledge on software. As a result, there always exists obstacles in the communication on requirements. It is common that users’ requirements descript seems deficiency, inaccuracy and incomplete. Moreover, it may change constantly. The tasks of software requirements analyst include not only abstracting obvious requirements, but also mining hidden ones.

In fact, in a long run, demand exceeds supply in qualified personnel resource in this field. The real cause of shortage of qualified personnel is that some problems exist in training process. The related major of our universities and colleges, which is in charge of cultivating software talent, has to bear the blame.

Though software engineering has been set as a course in our universities and colleges, some problems exist in this course. The most significant one is that there are many directions or instructions on teaching material but little practice in the course. Consequently, teaching process
dislocates with practical utilization. Students can understand the course but cannot solve practical problems [5]. In fact, even projects are very similar, they have difference on requirements. Therefore, statements and instances in teaching material are not enough to cultivate students to get necessary experience. However, such experience is important for practice.

Case design

Requirements analysis is a type of creative work based on experience and knowledge. The first prerequisite of accomplishing requirements analysis is experience and knowledge having accumulated to some extent. Thus, the primary purpose of case based teaching is to provide valuable experience to students. For this purpose, cases are designed as below. All these cases are analyzed based on the concept of use case [6].

Case for Submitting and Reviewing System of International Conference

Submitting and reviewing systems are widely used in international conferences. Most of important international conferences use two types of systems, respectively. These international conferences ran smoothly for many times based on them.

In such a system, there are multiple actors which have complicated actions. In this paper, these actions of actor are regarded as use cases. Before students beginning their analysis, not only the interactions between authors and the system, but also those between reviewers and it should be described by teacher. In detail, in the former situation, interactions include submitting, checking state of manuscript and etc. In the latter, those include reading requirement of review, responding review request and marking manuscript and giving comment and etc. These are obvious requirements.

It can be inferred that there are other actors who manage classifying manuscripts, matching them and reviews, etc. Otherwise, system cannot fulfill its functions. Find all actors and their use cases to finish requirements analysis is the task of students. In requirements analysis to this case, students can try to mine the hidden actors and their use cases. As a result, the ability to refine all requirements according to a part of actors and their use cases can be practiced. Above are hidden requirements.

Case for Given Warehouse-Supermarket Chain

In China, there exists a famous warehouse-supermarket chain. In cities, especially large ones, of China, multiple warehouses were built. Each of them is not only a large mall for shopping but also the supply source of adjacent supermarket. In other words, on one hand, each is a warehouse. On the other hand, it is a supermarket at the same time.

On the surface, the application system of the given warehouse-supermarket chain has nothing difference with that of common supermarket. In fact, though they have the same functions, such as purchase, sale, save, check and etc., the system of the warehouse-supermarket chain has extra businesses, such as arranging stock from warehouse to supermarket, managing membership cards, collecting water & electricity fees. Among these extra businesses, collecting water & electricity fees is hard to be found by imagination or assumption. Observation on the ground is required to finish the task of requirements analysis.

Teacher should encourage students to interview the chain for observation for finding its differences on businesses other than common supermarket. Main points for observation include confirming types and numbers of good from warehouse to supermarket for each time of supply, setting functions of membership cards and giving details of collecting water & electricity fees. The purpose of this case is to practice students to obtain the ability to refine requirements, particularly hidden ones, from the basic flow of an enterprise.
Comparison between System for Safe Product in Coal Mine and That for Wisdom Construction Site

The goal of these two systems is to manage workers. Both systems need to check attendance of workers and then to compute payment for them. Naturally, a beginner of requirements analysis believes that they are same in requirement. However, their different in application conditions decide that they have distinct requirements. Thus, making a concrete analysis of concrete problems is necessary, especially in this case.

Firstly, method of attendance management is much different in these two scenarios. In the first scenario, the work space is closed. That is, a coal mine always has a few opening. Therefore, only one or several gate is needed to be set at every entrance, respectively. Moreover, for each entrance, only one staff is required. His routine business is to confirm that only one card on one’s hand. In this way, check attendance can be executed effectively. Nevertheless, such a method is no use in the latter scenario because construction site has no certain doorways. In detail, in a construction site, the work space cannot be closed. Even if gates are used in entrance, workers can leave the work space during the working time by getting over the wall and come back before work stopping time by the same means without found. However, attendance management within this work space which is above ground can make use of mobile phone.

Moreover, though safety protection is required in both systems, they must different in pattern because each of them exposes to different security threats. In addition, how to compute payment requires to be discussed based on the different scene. For instance, counting number is fit for evaluate some kinds of work, while counting time is better in another situation.

Students need to finish requirements analysis of these two systems, respectively. One of difficult points is how to check attendance in an open or semi-open environment. This case can help teacher to tell students a truth that similar software may have distinct requirements.

Teaching Process

Obtaining Requirements from Different Way

For the above three cases, the way to obtain requirements are different. Moreover, the difficulty for the purpose increases in one by one case. In the first case, teacher describes some requirements indirectly. Others should be obtained through the analysis of students. In the second one, requirements different with common supermarket should be obtained through interview. Requirements of the last case should be obtain just through thinking.

Refining All Actors in Software

As a necessary actor, system administrator exists in all cases. Further, each case has its own peculiar actors. In the first case, some actors, such as author and reviewer, have been given by teacher. However, the rule of concealed evaluation decides that these two actors cannot communicate with each other directly. How to realize indirect communication is the problem remained to students. Such a task can be realized through the matching between directions and keywords beside manuscript given by authors and the reviewing scope given by reviewers. Therefore, there is another actor for the matching. In the second case, actors, such as cashier, loss prevention, stock administrator, dispatching staff and etc, need be found by students through observation. In the last one, actors, such as head, overman, workers in different type and etc, should be found through considering.

Design Use Case for Actors

Actors’ use cases should be confirmed after they are found. Some use cases those is hard to be refined are listed as below. In the first case, use cases of the third actor are hard to find. Its use cases at least include matching manuscripts and reviewers, dealing with reviewers’ opinion and dealing with authors’ complaint. In the second case, excepting checking out, cashier’s use cases include counting remained goods. The latter use case is for providing dispatching reference. In the last case,
to compute payment, overman’s use cases include checking attendance of works who are paid by the job and production number of those who are paid by the hour.

**Giving Final Result After Group Discussion**

For the same case, different students have different view. Time should be given to them for discussing and debating. To facilitate giving mark, my suggestion is that discussing and debating should be carried out between every two students. A final plan is obtained after that. The two students should sign on it. The sequence of sign should be decided by one’s contribution.

**Marking Score for Each Plan**

Teacher should give mark to each requirements analysis result. Then, each student can get a score according to result and his/her signature on it.

**Conclusion Remark**

Requirements analysis is the focus of software engineering practice. However, in a long run, there is a shortage of talents who fit for such a job in China. Consequently, the development of software industry cannot be met. One important reason for such a phenomenon is, though requirements analysis needs experience and knowledge, our universities and colleges have not provided enough support.

In this paper, case based teaching for requirements analysis is proposed. Such a plan can provide real-life opportunities for practical experience to students. In detail, three cases are used. The difficulty of them increases one by one. In this teaching process, students can accumulate experience of requirements analysis as a solid foundation for their future development. Such a topic should be studied by us. Related experiment instructions should be finished in the future.

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**References**


