Abstract

With the rapid permeation of information technology, the demands for software system development are increasing. From such social background, people who are capable of designing and developing such systems are required. However there is little opportunity that the students experience total application systems development in the form of project like a practical setting. The authors have been offering a class called “System design” since 1997. The authors have also been developing a group learning support system. In designing and developing software systems, software inspection has been widely acknowledged as an effective technique for detecting defects in artifacts. Our experience showed inspection was effective for the students’ exercises. However because of time constraints of university education, time for sufficient face-to-face inspections in the classroom was not allowed. The authors provided a Web-based inspection process support system. We applied this system to the real exercises of the class.

Keywords: Software Engineering Education, Software Inspection Process Support, The Internet

1 Introduction

With the rapid permeation of information technology like the Internet into our society, the demands for software system development and the complexity of such systems are increasing. From such social background, people who are capable of designing and developing such systems are required. Development of software systems has several phases such as planning, analysis, design, programming, and testing. Via these phases, a software system is released for use. Software systems are usually developed by organizing a project which consists of several members. Therefore project management techniques that allocate members to tasks, create schedules and manage the progress are also important. Software development in a practical setting is essentially collaborative work.

However there is little opportunity that the students experience total software systems development in the form of project like a practical setting. Based on the background, we have been offering a class called “System design” since 1997. The class aims at designing and developing a software system in the form of group learning. The goal of the class is to help students learn and acquire the skills they need to design and develop software systems, especially system analysis and design, project management, and collaboration and cooperation techniques [5]. The workload of students in this class is high, so it is indispensable to support for students to learn effectively and efficiently. To overcome this problem, we have also been developing a group learning support system [4, 6].

Software inspection has been widely acknowledged as an effective technique for detecting defects in artifacts [2, 3]. Our experience showed inspection was effective for the students’ exercises [5]. However because of time constraint on university education, time for sufficient face-to-face inspections in the classroom was not allowed. We provided a Web-based inspection process support system.

Some inspection process support systems have been developed thus far [1, 3, 7]. They provided solutions for various important aspects for inspection:

* Support various roles in inspection meeting [1, 3, 7]
* Realization of paperless inspection [1, 3, 7]
* Inspectors can perform their inspection on their workstation [1, 3, 7]
* Comments can be shared. [1, 3, 7]
* Inspection for multi-media documents [3, 7]
However the following two aspects are not taken into consideration in the above articles.

* Monitoring the progress of several groups: In education in university, several groups do their exercises in parallel (in our case, around eight groups run in parallel each year). The teacher side (teacher and teaching assistants) has to grasp the progress of each artifact of each group, and give advice and/or suggestions if necessary. However this function was not provided.

* Managing the comments associated with the artifacts (comments in an inspection meeting must be taken over in the next inspection meeting): From our experience we found the following: based on the inspection comments from the teacher side, the group revised the artifact. When re-inspection was performed, the comments needed to be taken over for the next inspection meeting, because the inspectors check the submitted artifacts by referring the previous inspection comments. When registering an artifact in the system, if a user named another name, comments cannot be taken over.

In the next section we describe our inspection process support system that took into consideration the above requirements and some results from its application.

2 Web-IPSE: Web-based Inspection Process Support Environment

Our experience showed one inspection for a group in the classroom (in the face-to-face fashion) took around one hour. Therefore it is impossible for all groups to spend their inspection within the classroom because of time constraint on the university class (we have only forty hours per year per class). However it is not so easy to set up an inspection meeting outside the class because the students, TAs, and teacher have their own schedules. After the inspection meeting, we asked each group for submitting an inspection report (meeting minute of an inspection meeting), but the quality was not good and the students tended to forget or did not understand some comments and/or suggestions the teacher side proposed. Based on the backgrounds, we provided online asynchronous inspection environments. It supports the following three major facilities.

(1) Support of the inspection process

The inspection process is shown in Figure 1. Prior to the inspection meeting, a group registers the artifacts for inspections into the system. The system analysis and design specifications are usually created with not only texts but also diagrams, figures, tables, and so on, by using word processors, presentation tools, drawing tools. The documents created by using the tools are uploaded into the system.

![Figure 1: The inspection process in this class](image-url)
Once a group selects the artifacts and requests inspection, the notification message for requesting inspection is sent to the teacher side. When an inspector (teacher or TAs) selects an artifact of the group, a window appears to display the artifact and describe comments (Figure 2). Each inspector can write comments independently, and can view the comments of other inspectors. After describing the comments the inspector decides whether re-inspection is needed or not. When all inspectors finished to inspect, the result is notified of the group automatically. An inspector who judged no need for re-inspection does not have to participate in the next inspection meeting. However he or she can give comments to the artifact. The artifacts that finished the inspection are opened to outside the group.

(2) Monitoring the progress

The teacher side does inspection for all groups. Each group may have some artifacts for inspection. It is difficult for the teacher side to grasp the progress of the artifacts. We therefore provided the progress monitoring functions. We represent the progress of each artifact by the status value. The state transition diagram of each artifact with respect to inspection is shown in Figure 3. We have “waiting for inspection”, “in progress”, “finished” as the status value. “Waiting for inspection” means that the group is creating or modifying the artifact and the teacher side is waiting for the group requesting inspection. Once the group submits the artifacts and requests for inspection, the status value is changed to “in progress”. After all inspectors write their comments and decide necessity of re-inspection, the status value is changed to “waiting for inspection” and the results are notified of the group. Once all inspectors approve the artifact, then the status value will be “finished”. The system also shows the number of inspection. This value is counted up when the students requests for inspection.
Figure 3: State Transition Diagram of the Inspection Process

Figure 4 shows a screen shot of the progress list. An inspector selects the artifacts whose status is “in progress” and blank of his/her status column. The status of each inspector shows his/her judgment whether re-inspection is required or not (finished). By this function, both the students and the teacher side can grasp the progress of inspection for each artifact.

Figure 4: Screen Image of Monitoring the Inspection Process

(3) Support of version management and configuration management

As development makes progress, the artifacts (documents and/or programs) may have to be revised. Version management is therefore very important. In the inspection process, this is true. As the results of inspection, new artifacts may have to be created. This means configuration management is also required. In configuration management, which
version of which artifact is valid must be specified by the group.

Figure 5: Relationships between artifacts and the comments for them in the inspection process

Based on the inspection comments from the teacher and TAs, the group revises the artifact. There is a case re-inspection is required. When re-inspection is performed, the comments needed to be taken over for the next inspection meeting, because the inspectors check the submitted artifacts by referring the previous inspection comments as shown in Figure 5. When registering an artifact in the system, if a user can specify its file name, comments cannot be taken over. Therefore the system manages the file name. When registering an artifact, the system asks the user for which the artifact is the revised version and the version number.

3 Results from its application

We applied this inspection process support system to the 2000 class. Four groups from all (eight) groups selected online inspection with this system, and the reminder selected face-to-face inspection (but two groups of the reminder selected online inspection for the second time inspection meeting). We asked why they selected the way. The groups that selected online inspection said that this way could be time saving, is easier than face-to-face way, or did not need to meet altogether.

The groups that selected face-to-face inspection said that when the teacher or TAs told what the members could not understand during the meeting, they could ask the teacher or TAs on the spot. Some said that as inspection is important, meeting by face-to-face is right.

We also asked advantages and disadvantages of the way they selected. The results show as follows:
Those who selected face-to-face inspection meeting said the advantage was to understand well by discussing directly. On the other hand, online meeting will be sure.
Those who selected online meeting said the advantages were that as the teacher and TAs write comments, they could save efforts to write down comments from the teacher and TAs, certainly understand what the teacher and TAs said and share the comments among members. On the other hand, the disadvantages were that it took time to finish because of asynchronous communication, it was very difficult to convey their ideas and thoughts by documents only, or it was better to receive comments and/or coaches from the teacher and TAs by oral.

From these results, to succeed online asynchronous inspection, the teacher side had to follow up requests from students’ groups diligently and the students improve skills of document writing. Inspection was well performed (the number of inspection is few) for the groups that wrote design documents with concrete examples and/or figures. On the other hand, the number of inspection was many for the groups which submitted highly abstract documents.

4 Conclusions

This paper has described a web-based software inspection process support system. This system had an advantage that the comments from the teacher side were recorded by the system and shared among members with no group’s efforts. On the other hand, students pointed out that it was difficult for them to convey their intentions by documents only and it took time to finish the inspection process because the result was sent to after all inspectors (four persons in this practice)
gave comments.
We will collect quantitative data with respect to the learning processes by experiment and analyze the data.

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References