Lessons Learned from Collaborative Research in Software Engineering: A Student's Perspective

Anakorn Jongyindee*, Pattara Leelaprute*, Masao Ohira† and Ken-ichi Matsumoto‡

*Faculty of Computer Engineering, Kasetsart University, Bangkok, Thailand
†Wakayama University, Wakayama, Japan
‡Graduate School of Information Science, Nara Institute of Science and Technology, Nara, Japan
Email: *{b5105896, pattara.l}@ku.ac.th, †masao@sys.wakayama-u.ac.jp‡matumoto@is.naist.jp

Abstract—Time zone, different work schedule, limited real-time information sharing, steep learning curve and different personal specialties; these are common limitations in the collaborative studies, especially when a researcher has just been introduced to the research field or working in a different environment (i.e. Internship programs). This paper introduces you with the experiences, challenges, difficulties, lessons learned, common fallacies and pitfalls in the collaborative software engineering research through the experience of 2-months collaborative research program between Kasetsart University in Thailand and Nara Institute of Science and Technology in Japan. Good mentoring and flat-style communication between professors and students are good indicators of the high quality result in the internship program. These information can be useful to professors, young researchers and internship students who will be conducting researches in such manner.

Index Terms—experience paper; collaborative research

I. INTRODUCTION

Collaborative research can be done in several ways from co-research between laboratories in the university, domestic collaboration research between different universities to international collaboration research from different countries. Each type of collaborative research has different obstacles and different number of problems encountered responsively. Kasetsart University (KU) and Nara Institute of Science and Technology (NAIST) have signed an agreement on academic exchanges and a memorandum of student internship, with the aim to know each other through the study and conducting researches in different environment, within a period of nine to ten weeks. Interestingly, after two seasons of this program, there were a total of 8 research papers from the intern students accepted in international conference and workhop ([1], [2] [3] [4] [5] for international conference and [6] [7] [8] for workhop) and three journal papers were submitted. The number of papers published not only indicated the success of the program, but students who joined this program also gained invaluable experiences living aboard, adapted themselves to the new cultural and different environment. And at the end of the program, most of them would like to study further in the field that they chose to do the research.

First author of this paper has participated as the internship student of this program in NAIST's software engineering laboratory. Though without prior strong background knowledge in this field, with support from many factors and good mentoring from colleagues, he had been able to conduct research in a different environment, submitted the work from this internship to an international conference that resulted in an award winning achievement, and then was invited to submit the work done in this program for the journal paper. This paper has gathered the challenges encountered, lessons learned, experience and pitfalls, what have been done and what can be improved from the student's perspective. This information can be useful to a student who is interested in conducting a research in software engineering field, in an international collaborative style, and also a professor who would like to initiate such kind program would benefit from this information.

II. INTERNSHIP PROGRAM

On March 28th, 2010, five undergraduate students from KU in Thailand were selected to study with Japanese students in software engineering laboratory at NAIST, Japan. It marked the first season of the internship program which would be held continuously for the consecutive years. The initial goal of this program was to exchange the cultural and student knowledge between universities. Most of the selected students from KU who were specialized in information retrieval field that is their topic in the laboratory in Thailand, came to exchange knowledge with the students in software engineering laboratory in Japan, where one of the topics was Open Source Software (OSS) analysis (to be precise, Mining Software Repository or MSR) which information retrieval can be applied to extract new knowledge from the OSS repository. They were introduced with new knowledge by studying the senior student's previous work, and later by studying with the Japanese students in the laboratory. After 8 weeks they came back with exciting stories and valuable knowledge to share.

In the year after, March 2011, five more exchange students were selected from KU to be dispatched to NAIST. The selected students were different from the previous year and they came from different laboratories with diverse expertise. In response to the different base knowledge, NAIST prepared more laboratories to match their topic of interest. After eight weeks of the program these students had studied different topics and made a presentation to the professors. Some of them obtained new knowledge and compiled the research results to submit to the international conference, while some implemented the interesting technology and added more value

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to the laboratory of their choice. In view of the burgeoning potential of the internship students, more laboratories would be open for the students and this program is growing each year. New six students are expected to be selected in the year of 2012 and the number is increasing.

III. CHALLENGES AND LESSONS LEARNED

From the perspective of students who chose to conduct an empirical research on open source software community in the NAIST's software engineering laboratory, this section will introduce the reader with challenges encountered and lessons learned throughout the 8 weeks of the second season of this program, and answer how the students are introduced with the laboratory's current project? How to manage the deadline or set the proper milestone to keep track of the student's work and share some lessons learned in the eight weeks period.

A. New expertise and knowledge

Challenge: How to introduce the students with new knowledge within the limited time given?
Different laboratories have different expertise, especially if the students are undergraduate students who have studied fundamental subjects in several fields. Also, only a few students have insightful knowledge of the specific field. Not only the laboratories need to prepare the learning resource for the new students, but also the ways to minimize the learning time in order to get the students to start conducting research in the specialties of that laboratory.

Lesson Learned : Summarize the main research topic and let the students know early.
Students are presented with the short presentation of the ongoing laboratory's research topic before their arrival. For the software engineering field, the students are expected to understand the summary of current research. Within the first week of the program they have to already understand what the main topics of the laboratory are, what the results of those current researches are, and if possible, what can be improved, so that the students can start their work as soon as they can decide the topic.

B. Placing the milestones properly

Challenge: How to set the deadline for research proposal, progress presentation and final presentation, within the limited time period?
With only eight weeks of the programs, not all students are expected to finished their research paper (or in some cases are research results), but they are expected to gain the initial knowledge or some tangible results which students can decide whether the result is good enough for publication or not.

Lesson Learned: Set the deadline for proposal early, keep track of the students progress and arrange the presentation session.
There is no precise answer as to what the best time to place the milestones for each research is, or how many milestones should be placed. The answer can be individual to individual, but they are balanced between too much work overhead (keep

Fig. 1. Meeting room is a good place for tracking everyones progresses, but individual follow up is required in order to delivered students full potential.

their progress post in every little period of time) and a lousy work schedule (too little milestones or too big time interval).

In case of the internship program, first milestone needs to be placed as early as possible because of the time limitation of the program and to direct the students mind in the research focus. However, during the early milestones, professor should not expect a precise or detailed proposal, only an outline of the research or some presentation of what they have studied from the related work are needed. For the research progress tracking, most laboratories have current periodic meeting; once a week, once every two weeks or even one big presentation once a month.

This periodic meeting is a good time to have a short presentation of what they are currently working on. And if the research has a early deadline (or in case of the internship, specific time of the end program), professor should let the students know their final presentation days early or specific date on the first draft to be submitted. In this collaborative internship program, students are expected to make a decision of their research topic by the first weeks, keep track of their progress every week in the periodic lab meeting, make a middle-term presentation (four weeks out of eight passed, one big presentation) and then the big final presentation of what they have achieved. This may not the best milestones placed, but it has worked well so far without putting too much pressure on the students.

C. Communication style

Challenge : Select the communication style, meeting or talking?, which is the proper way to answering the student's question.
Each research group needs to find a proper media for their conversation, especially collaborative style research; Video calling, lab meeting, e-mail based conversation, social network, web board and so on. All the above mentioned are ways that professor can employ for answering the students questions, but which one is the most effective way to keep

the balance between students curiosity and professors insight suggestions

Lesson Learned : Keep the communication style flat
Either approach of the above mentioned are preferable, as long as communication is carried out flat-style, the style where students feel comfortable to talk and discuss like they are talking to their colleagues which is in the same level, thus, we called flat-style conversation. Students tend to ask questions to the professors whom they feel comfortable to talk with, give them fair answers and insightful suggestions. If the professor is busy (which is, most of the case so) they can assign some mentor or someone who they can redirect the question to, so the students still have someone to steer their research back in the track.

D. Language and cultural

Challenge : Language barrier and cultural shock: language and cultures are not only daily life issues, language can become a large barrier for research discussions, and different work habits are reflected from different cultures
Thai and Japan are countries where English is not native language. For daily life basis fundamental English is (most of the time) sufficient. However when it comes to research discussions where many technical terms are involved, language becomes a great barrier in understanding the discussion context. Some topics require a detailed level understanding in order to move on. A cultural shock is also caused by the difference of cultures. This issues are more likely to appear in the collaborative style research where people from different countries need to maintain the level of their relationship though out the research time.

Lesson Learned : Use English for pre-screening the students, discuss with figures for communication issues, and think to mitigate the cultural shock
It is mandatory for professors to consider the communication skills as one of the important factors to select students to conduct a collaborative style research (for example, oral exam for communication skills, have the students write their proposal in English to see their writing skills or use popular English proficiency score such as TOEFL to see both). For the internship program it is the best to have host's country professor talk with the students prior to their arrival so that the professors can prepare the right documents or choose a proper mentor for students and the students can ask away the questions they have in their minds. In the meeting or conversation where the detailed understandings are sensitive, using figures as media for communications with the students and writing them on a white board or paper where participants can interact with are a good approach to exchanging a research idea. Fortunately since Thais and Japanese cultures share many things in common, they respect to their elders and tend to listen to their seniority so minor adjustments are required in order to get along. However, participants need to think relatively that each of them have different background to maintain the relationship and keep the research progress.

IV. FALLACIES AND PITFALLS

Fallacies, mistaken beliefs which may lead one to difficulties or danger. Pitfalls, hidden traps or unsuspected difficulties along the route. We gather the common mistakes in the collaborative research from the student's perspective as well as suggestions and how-to avoid them in this session.

Fallacies : Keeping track of the student's research progress on the periodic lab meeting is enough
Pitfalls : Not all the questions, work progresses are being brought up in the periodic lab meeting

Even though the laboratory may set meeting schedules frequently, students who conduct researches always have questions, and most of those questions are not brought up in the meeting room (Fig. 1), some specific questions about the research or report of the small problems encountered would not be brought up in the lab meeting because students thought that not everyone need to spend their time in the small matter. Only major progress of their work tend to be presented in the meeting, while their tiny progress or small questions (but important) are preferred to be raised only in private conversation with professors or their mentors, during the day time or even during dinner. Professors or mentor cannot rely on the meeting as the middle man to track the student's research progress. Advisor of the students in the research should find some time to have a conversation outside the meeting room, or make it easy for students to contact them if they needed anything. Doctoral students who stay in the laboratory most of the time (and willing to help) is one of a good candidate for a professor to redirect those student's questions when he/she is not available.

Fallacies : Students can learn how to conduct a research purely from the previous laboratory's work, or papers they have been assigned to read.
Pitfalls : Students tend to believe what they have read. They usually learn the hard way from their own mistakes, not from the others. If the assigned papers have limitations or specific criteria that they need to know, students are likely to ignore them, and apply the methods or approaches learned from those papers to their research without any concerns.

Some exceptional students handle every task assigned perfectly, unfortunately, most of them do not. Advisor who assigned the research paper to student via e-mail or pure citation should not expect the students to fully understand what they have read (in the limit time). If the professor emphasize the main topic of the paper or at least add their own opinion to the paper before assigning the students to read, one or two sentence of the main idea that professor emphasize can reduce significant amount of the time that students require in reading the entire paper. It is not easy from the student's point of view to learn from the bottom-up approach while finding the mistakes or keeping the limitations in mind at

Fig. 2. Student receiving Best Student Paper Award in IWSM/MENSURA 2011. With good efforts and right environment factors, good research results or even an award can be achived

the same time. Many good publication research papers have unique limitations of the approach, some special criteria such as structural of the data, or bias of the result they have collected and so on. They may or may not emphasize it in their publication, but experienced professors who can easily find these limitations or flaws in those work should share their opinion to the students or point out to them where to look. This will significantly reduce the time students need to learn and prevent them from learning something without knowing its limitation.

V. CONCLUSION

In this paper we have shared the experience through the perspective of students who conducted a collaborative style research between KU and NAIST in the software engineering field. Firstly, we introduced the challenges and lessons learned throughout the internship program. Secondly, we summarized the research topic and made a presentation to the students at the early stage, which is a good approach for students to prepare themselves if they would like to enter a new research field (In this case, software engineering research). We then set the proper milestones in the program to keep tracks of the student's work and determined the balance between presentation overhead and lousy work schedule, which can make the students feel comfortable while they still can hand over their work on time. Close monitoring with the flat-style communication between students and their advisor is also a good way to clear out student's questions.

Then we summarized the fallacies and pitfalls, the mistaken beliefs and hidden traps or unsuspected dangers, respectively. Professors who rely only lab meetings to meet and advise the students cannot expect the students to deliver their full-potential. Students always have questions, and busy professors should find someone (such as doctoral student under their advice) whom they can redirect student's questions when needed. Adding the professor's own opinions (In some cases, the limitation, criteria or bias of the paper) on the research

paper while assigning it to students will significantly help the students to understand the main idea. The methods or examples in this paper are not claimed to be the best approach to optimize the collaborative research such as internship program, but it is viable, and has proven its effectiveness by practical use. Professors and students should remind themselves the importance of their roles in the research group, and do their best to find the balance among one other in order to achieve the preferable research result.

VI. ACKNOWLEDGMENT

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