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An Effective Planning and Reporting System in Academic Research Labs

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Abstract

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Successful research needs teamwork and collaboration with effective communication. To achieve that, planning and reporting are common practices among research team members. Well-designed reporting and planning tools are needed so that mentors and students can perform their research and reporting activities efficiently and fulfill their respective responsibilities. In this thesis, we investigate and implement the initial stage development of the planning and reporting system in academic research labs that facilitate effective collaboration among students and between students and their project mentors (e.g., postdocs, professors). We found that: (i) students could be motivated by having in-person (person-to-person) meetings, feedback, attentive supervision, and user-friendly engaging system, (ii) mentors also expected to get feedback from students, and (iii) potential usefulness and the shortcomings of participants' system and its constituent parts. We also take particular note of barriers that inhibit plan and report writing and functions that hold a lot of promise if done well. We report with recommendations for improvement and initial stage improvement that should promote greater team efficiency, more productive engagement of the individual members, and better outcomes for their projects.

key words activity reporting, planning, collaboration, efficiency, research teams, blog, students, motivation

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Chapter 1

Introduction

Vital factors for success in research are teamwork and collaboration [2, 16, 55]. In general, researchers collaborate with partners from different labs [10]. However, critical roles and responsibilities are also shared by students so they must help their lab projects run smoothly [49]. Students themselves consist of graduate students and undergraduate students who have different workloads and different abilities in helping work in the lab. For example, every graduate student (e.g., Ph.D., M.Sc.) must work hard in making progress with their own research and their own thesis. In addition, each undergraduate student (e.g., B.Sc.) helps lab work by doing basic work such as programming and being an assistant in experiments contained in the lab project [36, 61]. Therefore, practices or systems are needed that can facilitate efficient collaboration between fellow students and between students and their project mentors (e.g., postdocs, professors).

Reporting [42] and planning [56] are two common practices in research collaboration. Activity reports are usually written by students to inform their mentors about their progress [40, 45]. Besides, students share their research plans to discuss or declare their goals, scope, schedules, and deadlines with their colleagues and project mentors. Both of these practices can be done in various forms (e.g., verbally or text-based) and in various time frequencies (e.g., weekly or monthly). Various computer-supported tools can be used for these practices, namely emails, document sharing tools (e.g., Google Doc) and other team collaboration tools (e.g., Slack) [39].

Reporting activities in the workplaces of knowledge workers were evaluated by re-

cent studies [5, 11, 39]. However, the working conditions and types of tasks are different from research stakeholders (e.g., students, mentors, supervisors) that have high autonomy and flexibility to find time to set their schedules. For example, knowledge workers tend to follow plans that have already been determined by their managers and planning is not such a regular task [34]. Besides, knowledge workers commit to 9-5 working hours strictly. However, early career researchers have high flexibility and autonomy [52]. A greater variety of contraints is owned by under graduate students. Most of their time is taken up in many courses. Also, they have to utilize breaks between courses or late evening time slots to attend their labs and do their research. Seeing this situation, it is not easy for mentors to keep their students engaged with their lab activities and track research duties. As for graduate students, they face many challenges and responsibilities. They have to assist in teaching [24, 48] courses, write research papers and funding grant applications, make progress in their thesis work, present their work, all while supervising undergraduate students [1, 22]. In the meantime, undergraduate students have cope with many courses, homework, and reports and exams [13].

Looking at the situation above, collaboration tools and procedures are well designed, so students and mentors can fulfill their respective responsibilities and perform their research and reporting activities efficiently. Besides, there is still no clarity about how technology can contribute to research labs and facilitate collaboration between mentors and students. Therefore, we ask: *(RQ1) what are the strategies that individuals in research teams use for planning and reporting? (RQ2) how might different stakeholders (mentors and students) experience planning and reporting tools differently? (RQ3) what are the expectations, requirements, and pain points of these stakeholders? (RQ4) how can we improve the current planning and reporting system to better support collaboration?*

To address these questions, we did two studies: (1) understanding users by inves-

tigating the planning and reporting practices for early career researchers and students using a lab reporting system; (2) developing the initial stage of reporting and planning tools. In Study 1, a qualitative study was conducted with members of the research lab including several postdocs and student candidates for different levels of degrees (Ph.D., M.Sc., B.Sc.). Lab members who were participants in Study 1 had experience in planning and reporting using an established blog system by which they shared reports and plans for collaborative purposes. Lab members need to write blogs and have weekly meetings where their blog contents are discussed with each other. We think we chose a perfect fit environment in which to study the use of technology for planning and reporting practices in student-to-student and student-to-mentor situations.

Our findings from Study 1 demonstrate: (1) in-person meetings can increase student motivation to write blogs; (2) while detailed feedback provided by mentors can improve the students' blog quality, mentors expect to get feedback from students as well; (3) different design considerations such as blog categorization based on the project topic, priorities and social interactions between lab members can support blog writing. From the insights and guidelines for design, we conducted Study 2 to develop the initial stage development that include blog categorization, priorities, and social interactions between lab members. We also implemented the experience point, level, and leaderboard to engage student on accessing and writing blogs. Besides, users need to write their weekly reflection to adjust their attitudes and actions, and make it easier for everyone to achieve their work targets. Our findings, implications, and initial stage development provide further benefits for research labs and academics who looking for foster student efficiency in lab and to support early career researchers and their professors with better lab management practices.

1.1 Thesis Overview

The writing of this thesis consists of five chapters, namely Chapter 1 Introduction, Chapter 2 Related Work, Chapter 3 Study 1: Understanding Users, Chapter 4, and Chapter 5 Conclusion. In Chapter 1 Introduction, a general description of the implementation of this thesis consists of background and overview. In Chapter 2, related research is presented that supports the theory of planning and reporting in academic research labs. This chapter explains about effective collaboration in research, students in research labs, planning and reporting practices in collaborative research, and collaborative research tools for planning and reporting.

In Chapter 3 the procedure of implementing Study 1 is presented to understand the user, an explanation of the blog system being studied, the results of qualitative studies, and design implications for the future design of planning and reporting systems. In Chapter 4 the system requirements for Study 2, mapping design and implementation results, and future development plans are explained. Finally, Chapter 5 provides our conclusion for both of our studies.

Chapter 2

Related Work

This chapter contains descriptions of related work to this thesis problem. We report on the previous work that supports collaboration to meet standards of excellence in teams and collaborative research projects. We describe the important roles of students play in research labs and the challenges they face. Next, we describe the related works of planning and reporting practices. We close this section by describing technologies that are currently used for planning and reporting.

2.1 Effective Collaboration in Research

An academic mantra says, "publish or perish!" [19]. Academia is becoming increasingly competitive and competition demands an ever-higher quality of efficiency, communication, creativity, collegiality, and integrity [23, 31, 46, 58]. Researchers need to cooperate and collaborate with professionals from different disciplines [23]. By better facilitating collaboration between the researchers, tensions of differing collaborative and competitive motivations within academia could be managed towards greater productivity [31]. For example, the Bioinformatics challenge competition encourages researchers to gather and collaborate for competitions or to conduct joint research [47]. With the current funding agencies that encourage large-scale collaborative research programs, researchers could get benefits such as working with higher productivity and more efficiently [32, 53], an increasing number of citation, and better use of existing resources

[62].

In research, several important factors are necessary to achieve maximum results; these include teamwork and collaboration [2, 16, 55]. With more and more knowledge being generated by research teams, team-based collaboration is one of the more important factors in research organizations and scientific fields [28, 60]. With more resources, effective research will be obtained [9], where diversity within a research team is used to obtain high quality, team members need to learn how to conduct research effectively [55], how to fully participate as a team member [7], and how to adjust behaviors according to the circumstances [59]. For example in the field of Computer Science, teamwork is very important to investigate effective teamwork practices by providing valuable feedback to improve the performance for teamwork situations, and reflection so that ways to improve effectiveness can be determined and adjust behavior according to teamwork circumstances [59]. Greater effectiveness in research could be derived from team-based collaboration that can identify important issues according to discussed priorities and on that basis design and execute good research plans and experiments [55]. However, many challenges confront researchers in collaboration, for example, commitment, transparency, trust, communication, and monitoring [33].

2.2 Students in Research Labs

To achieve ease and fluency in carrying out collaborative lab projects, students in the lab should be assigned necessary functions and roles [49] through which they can contribute to basic research tasks such as coding or assisting in experiments [36, 61]. However, the capacity of students to contribute in research labs is usually underestimated. This might be due to their perceived or actual lack of skills or motivation. Different skills are required when working in a team compared to working alone [55]. University

students usually struggle in applying collaborative skills [38] and in coordinating with other team members and supervisors [21]. Another challenge in collaborative research is the participation of students in the practical activities of the lab. Undergraduate students may not have taken teamwork seriously and thus may have become less motivated to perform different types of activities [14]. This lack of motivation [56] is mainly caused by lack of experience and lack of clarity regarding instructions received from their mentor or supervisor [17]. Thus, more support is needed if students are to become proficient and efficient lab participants and if their ability to learn independently is to bear sufficient fruit for the whole team [56]. Such support can be provided through the designed facilitation of collaboration between the students, their colleagues, and their mentors. Collaborative research is a discipline in itself and it requires specific organizing and planning if research activities are to warrant the investment in time, money, and resources [56]. Each facet and each participant requires intelligent placement, consistent transparency, and ongoing assessment so that all team members can function together as one organism and so that effectiveness in the research project can be optimized [42].

2.3 Planning and Reporting Practices in Collaborative Research

Collaboration in a research lab is usually achieved by planning [56] and reporting [42] each practice so that they understand how their contribution integrates with the whole and the goal of their work. In this reporting, done regularly (e.g., weekly or monthly), students share their previous work and their plans in text or oral form to achieve their goals together with their colleagues, mentors, and supervisors. Oral planning and reporting are usually done at lab meetings by showing and discussing work to lab members, informing each other of the general situation in the lab and the

project, by encouraging each other to get their work organized and summarized properly, by creating an environment for lab members to learn communication skills, research problem-solving skills, and share feedback [56]. With person-to-person lab meetings, lab members can construct a decision structure in their research projects and build trust between members [53]. Besides, a work that has been completed or that is still in progress, e.g., a conference poster, a grant application, a manuscript, or a conference talk, can also be presented and discussed at the weekly lab meeting to get feedback [42].

Besides participating in regular lab meetings, students also need to be supervised regarding the coordination of their research and presentations [29] by providing comments and input to improve the quality of students' research [45]. Mentors and supervisors are responsible for initiating, leading, and monitoring the progress of their research teams [59]. By receiving reports from students, mentors and supervisors can carry out their responsibilities and assist students in making plans and self-reflection [45]. Assistance and direction given by mentors and supervisors are important to support scientific creativity [56]. Students need supervisors and mentors who care enough to show interest in and appreciation for the plans students make, also directing them regarding how to improve the quality of their research plans and their implementation [37]. The planning and reporting of students at lab meetings allow all members to receive critical feedback, to ask questions, and to make constructive suggestions [56] to increase their research productivity [42]. Therefore, the coordination in research teams needs help from technical systems in practicing planning and reporting [6].

2.4 Collaborative Research Tools for Planning and Reporting

Activity reporting in workplaces has been investigated in recent studies [5, 11, 39]. Research collaboration is available in many software packages [9] but not so much to simultaneously plan and report collaborative practices. At present, the tools used for collaborative research need to be easily transportable to the web to facilitate communication and use anywhere [12, 32]. Besides, the tools required to help mentors and supervisors in managing activities and direct the flow of communication with the team [18, 52]. `Microsoft Teams` [41], `Zoom` [8, 30], `GroupMe` and `Slack` [3] are the common discussion platforms that are being used in Universities for online collaboration. By using the `Slack` API, prior research made a `Slack` bot for self-tracking system work activities that also includes reflection and planning features [35]. Also, past research has focused on project management web-based applications to track and streamline both simple and complex laboratory projects [9, 25]. For example, `Trello` [57] and `Asana` [4] helped users to increase their efficiency in communication [53]. However, previous research that used `Trello` to apply the agile method in collaborative research, reported that `Trello`'s user experience in collaborative research does not always allow users to interact deeply in web communication [32]. They also used `Trello` not only for the research project but also for workshop planning, new methodologies' design, and the evaluation of lab policies [32]. Team size limitations and difficulties in adapting the system to the online environment are problems that need to be resolved so that work can be more effective [32]. However, these tools are not specifically used or focused on the lab system; they are for collaboration in general. Also, the focus is more on projects without differentiating between stakeholders such as mentors and students, and without considering experiences, problems, and expectations about the tools. Recently, many

tools have emerged like `monday.com`.[*1] But such applications are more in the form of the to-do lists and do not fully support planning and reporting.

Given that, the working conditions and the types of tasks that knowledge workers do are different from what people do in academia [34, 52], there is limited understanding about the **use of technology** such as text-based **reporting and planning in research labs**. Besides, there is not enough information about how **different stakeholders** (students, mentors, supervisors) might experience communicating their work with the use of technology-mediated reporting and planning tools. Further, few studies exist on what **type of feedback** is useful for **students** and can improve their reporting and planning practices and motivate them to be involved in the research tasks. Considering these research gaps, we conduct a qualitative study with experienced users (different stakeholders in research labs) to better understand their practices and the content that is usually exchanged between lab members.

[*1] https://monday.com/

Chapter 3

Study 1: Understanding Users

The objective of Study 1 was to better understanding the strategies and technologies that early career researchers and students use for planning and reporting in academic research lab. We also probed requirements, expectations, and problems that users encounter in their planning and reporting. In this chapter, we discuss the methodology, results, and discussion of the qualitative study that we conducted.

3.1 Methodology

To find an environment for our study, we searched a laboratory in which its members were proactively using technology for planning and reporting practices[*1]. A blog on their internal website was developed by this lab where all members write their reports and declare their plans every week. For the past seven years, this tradition has been practiced out in the lab. The lab members write the blog and hold meetings once a week. The content of the blog has been presented on the meeting along with discussing those contents with other members and the lab supervisor. Early career researchers and students from various levels are also part of the group in the lab. Therefore data representing different levels and stakeholders (e.g., mentors, supervisors and students) have been obtained. In the rest of the thesis, postodocs and Ph.D. students are refered

[*1] For privacy reasons, we will keep the lab ' s name and its location anonymized.

as *mentor* (M), and M.Sc. and B.Sc students are refered as *student* (S).*[2] Thus, this chosen lab, in our opinion, is an ideal environment in collecting valuable insights about planning and reporting practices

3.1.1 Apparatus

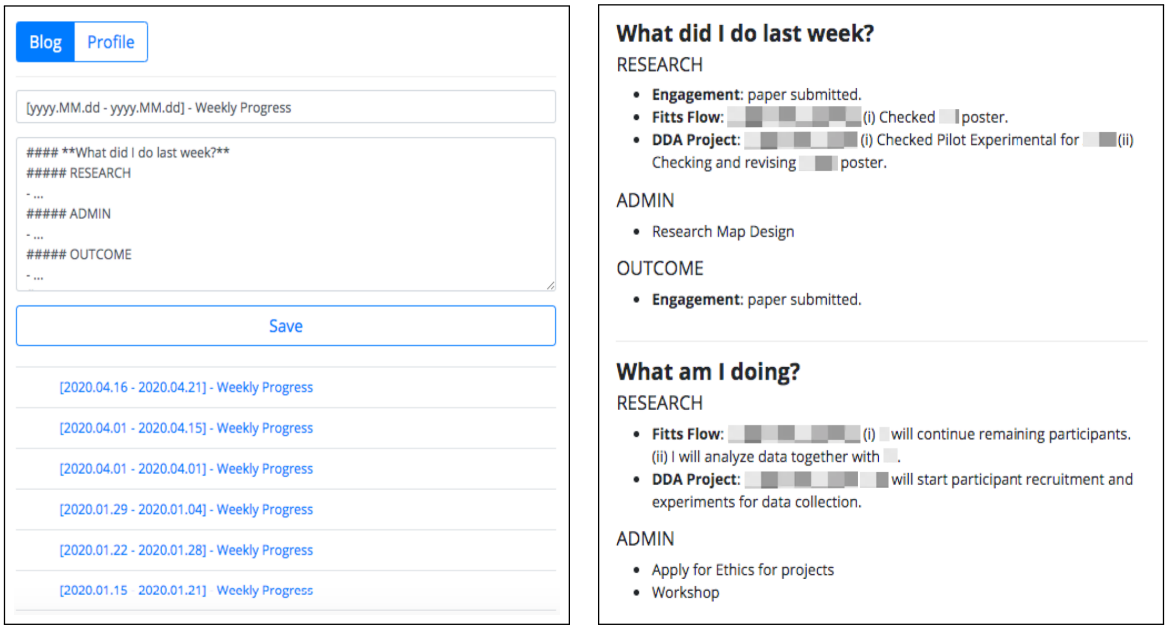
The research team that we studied has built its own internal blog on AWS EC2. This blog is in the form of a static website which was developed with Python Tornado. The data and files were integrated with Amazon Simple Storage Service (Amazon S3). The server used is Tornado Web Server 5.0.2. On the internal website, the admin will create an account for each user so that they can submit their plans and reports. The blog provides a template using Markdown*[3] as a guide for filling in the report and plans. The title is in the form of a date range, the body of the report dealing with the previous week and the plan for the following week. *This week*'s report was divided into three categories: 'Research', 'Admin', and 'Outcome', while the *following week*'s plan did not include 'Outcome'. After writing the blog, users press the 'Save' button to save and publish their report so that it can be seen by the other members (Fig. 3.1a).

At the bottom of the report and plan text fields, users can view reports they have previously published. By clicking on the title of the previous report, the user can re-read the report. Inside this website, there is a feature that helps users organize their weekly meetings; it shows the latest posts from all team members. The user simply presses the right and left buttons to view reports from each team member as shown on Fig. 3.1b.

This website can also be accessed by smartphone. Users need to open this website

*[2] Although, in research labs, Ph.D. students perform two roles as both students and mentors, given the focus of the thesis and to create a balance across the range of the participants, we classified them as *mentor* in the study.

*[3] https://daringfireball.net/projects/markdown/syntax



(a) blog input and history page (b) latest blog

Fig. 3.1: The blog interface: (a) Users can write the planning and reporting entries while seeing the previous reports, (b) Preview of the latest report for each member

in their smartphone browser to read and write their reports and plans using the form shown in the Fig. 3.1a as seen in the computer browser.

3.1.2 Participants

From 26 lab members, we recruited 12 participants (half females, mean age = 26.9, range = $23-35$) from the engineering and computer science field. Participants included five mentors (mean age = 30.8, range = $28-35$) and seven students (mean age = 24.1, range = $23-26$). The five mentors consisted of one postdoc, one visiting researcher, and three Ph.D. students. The seven students consisted of three M.Sc. and four B.Sc. students. Each mentor had several project members in their project group. However, mentors and students could also collaborate with each other for inter group projects. Each mentor read reports from project members, reported their projects' progress to

the lab supervisor, shared their plan for each member of the project (i.e., what each student should do and when), and discussed the project plans on the blog system. Students could also write the blog for their own project leaders (mentors) and for the lab supervisor. Participants have used the blog for periods of from one month to three years; mentors had more experience than students (mean experience: Mentors = 22 months, Students = 14 months).

3.1.3 Task and Procedure

After obtaining information about our experimental procedure, participants signed a consent form (see more detail in Appendix A). They then participated in an interview session with an average duration of 50 minutes (range = $40-60$ minutes). All interview sessions were one-on-one sessions between an interviewer and a participant. We collected information about the participants' planning and reporting strategies and the tools they use. We also asked about the usefulness and the weaknesses of their strategies and tools. We also investigated their preferences regarding frequency of use, format, and content, and we investigated the social aspects of their practices. The user interview guidelines can be seen in Appendix B for the detail. Ten interviews were conducted on campus. Two participants were traveling abroad at the time of the experiment so we conducted their interviews via Skype video call. All interviews were audio recorded for further evaluation.

3.1.4 Data Analysis

All audio records were transcribed verbatim and imported into Atlas.ti analysis software to help with the data processing. We used the codebook thematic analysis [51] to analyze the interview content. We created an initial list of codes and identi-

fied the emergent themes. Our codes and themes are identified by summarizing what participants said or the main things they replied concerning that area. The codes and the themes were double checked. We found 25 small themes and five main themes explained in the Section 3.2. Finally, we used relevant quotes from participants to report significant findings in the thesis. Participants were identified by their roles and assigned numbers (e.g., M4 is a mentor in the fourth list of participants and S2 indicated the second student participant).

3.2 Results

This section explains our findings about how in-person meetings can motivate people to write reports and formulate plans. The role of feedback and supervision while planning and reporting are also reported here. In addition, the usefulness, shortcomings, and participatory ideas for improvements to the planning and reporting system are highlighted. Finally, our findings were concluded by presenting barriers to planning and reporting practices.

3.2.1 In-person Meetings Can Motivate Blog Writing

In-person meetings are very beneficial when collaborating on research. By having weekly meetings, several participants reported being motivated to write their blogs. Each lab member, before the meeting, submitted the blog and then used it as a meeting tool by displaying it on a large screen and discussing various blog items. Different levels and genres of motivation for writing blogs were identified: (i) there are those who write blogs regardless of the physical meeting (i.e., they write the blog even if the meeting is cancelled); (ii) there are those who write blogs only if there are meetings.

Six participants (2Ms-4Ss) reported writing their blogs without considering if the

meeting was happening. S2: *"if I know there are no meetings this week or this month, I keep writing the blog. Maybe no one has read it, but that has already become my habit."* In contrast, five participants (3Ms-2Ss) reported writing the blog only when an in-person meeting was scheduled. M2 writes a blog because he wants to be a good role model for the students in the lab. M2: *"I write only when there is a meeting. I want to be a good example for students because, if I'm not writing, students might wonder why mentors do not write a blog while students have to write them."* Participants reported using alternative tools other than the blog for their personal planning (e.g., Google Calendar). Therefore, in the absence of a meeting, S6 felt that using her personal planning tools was enough: *"I do not write a blog when there are no meetings. I have used the schedule book and Google Calendar. So, I can manage schedules, tasks, time and deadlines using my tools. So I do not arrange my tasks in the blog."*

On the other hand, for those who have regular meetings and daily in-person discussions, blog writing is not an essential task. Compared to using the blog, five participants (4Ms-1S) felt direct discussions were more effective. M1 reported not reading students' blogs when having daily discussions: *"even when my students wrote a lot in the blog, I would not read it because we have daily discussions. So, I knew what she was doing, and I did not need to read her blog."* Although not as frequent as daily discussions, M4 reported discussing with students several times a week and knowing more about students compared to reading their blogs. M4: *"Surprisingly, I did not need a blog. For now, I have spoken with my students several times a week. I already knew what they are doing."* Four mentors reported preferences for personal reporting compared to weekly laboratory meetings or reading their students' blogs. M1 reported personal reports were better than the blog: *"If she could report to me personally, maybe I would prefer it over a blog."* Students did not write the blog in detail. Therefore M4 described direct discussion is necessary: *"The student blog did not seem to be that detailed. My*

students and I needed to talk a lot more privately than reading their blogs."

3.2.2 Using the Blog Could Improve the Communication between Mentors and the Lab Supervisor

Blog writing was perceived as a proper tool for members (4Ms-2Ss) to communicate their progress and plan with their supervisors. While mentors write the blog to communicate with the lab supervisor, students used it to communicate with their mentors and the lab supervisor. M4 reported writing a detailed blog which she felt is easily tracked by her supervisor: *"reporting your activity is like talking to your boss or your supervisor. Providing more details can help him to easily track and understand my progress. If you do not have time to report it face-to-face, you can provide a report that is detailed and easy to find."* S3 reported that the supervisor's reaction to the blog could help her understand how to do things better: *"If I need to get feedback from my supervisor, I have to first report the work I have done. Usually his replies help me realize whether I did a good job or if I need to change my way."*

Participants prefer to write blogs in detail so they can communicate more information to the supervisors. On the other hand, knowing that their blogs will be read by their supervisors motivated the members to write. Based on the experience when he was traveling, M2 reported that planning and reporting become more meaningful if the supervisor is aware of what is happening in the lab: *"in the short time when I was not in here, I had a weekly meeting as a planning and reporting practice. My supervisor was aware of what was happening in the lab. What was the next step? He was involved in this planning and reporting."* Furthermore, half of the participants reported receiving constructive feedback from their supervisor. M4 reported that her supervisor tended to comment only on whether the blog is not easy to comprehend or if it is too concise: *"People only give feedback if you write too short or if they cannot understand what you*

write." S2 thinks it would be difficult for a supervisor to track everyone's progress at the same time, so writing a detailed blog might help her/him get a better understanding of the lab research progress: *"I think my supervisor does not know all details of what I am doing right now. Therefore, he wants people to write as much detail as possible."* However, four participants (3Ms-1S) reported that their mentor or supervisor did not paid attention to the contents of their blogs. M2: *"It was obvious that no one read the blog. My supervisor should have at least read what people in the lab were doing."*

Blog writing was perceived to be a proper tool to communicate with the head of the lab, project supervisors or mentors. Specifically writing detailed blogs was perceived as more effective. On the other hand, engaging with the blog, for example by reading the blogs and commenting on the content was expected from mentors and supervisors as they can motivate students to be more involved in the lab research.

3.2.3 Blog Writing Helps to Solicit Feedback

Receiving feedback and advice from supervisors or mentors can encourage students to correct their mistakes and to work harder or more effectively than before. Students may use feedback to alter their behaviors in order to meet their goals and deadlines. Besides, we also find forms of feedback that can help early career researchers in conducting their research.

Feedback-based Improvements on Research Activities

When running in-person meetings in the laboratory, participants usually receive feedback from their colleagues, mentors, or their supervisors about the content of their blog. Receiving comments during the meetings was an effective practice to improve their research activities. Feedback helped five participants (1M-4Ss) learn and improve

their planning and reporting methods. S4 mentioned that if positive feedback was given to her, she would use that comment to improve her blog: *"if someone praises me, I can even do better."* Interestingly, even the feedback exchange between other colleagues can be a motivating and educating factor. For example, S2 tries to imitate the way a person organizes her/his work when that person receives positive feedback: *"if I see another person was getting praised, I check that person's blog to see how s/he organizes the project on the blog and I copy that"*; S4: *"... if someone praises someone else, then I will look at that person's blog. I try to learn from it."* Five different participants (1M-4Ss) reported being happy when getting praise or positive feedback. M2 felt pride when getting positive feedback: *"when it's about your blog, positive feedback is cool. Because you know, everyone likes to be praised."*

The majority of participants reported that receiving negative feedback can also be helpful without causing too much worry. M4 realizes that she must work hard when getting negative feedback: *"I think if I get negative comments, I will know that I have to work harder."* S2 added that other people can give negative feedback when he has flaws or when he is not making good progress: *"people can criticize my shortcomings, things that I do not do correctly can be seen from my blog."* If other people get negative feedback and S5 has not made good progress too, she will not worry because there are people who are in the same position as her: *"... I feel everyone is the same as me and I do not have to worry much about myself."* However, four participants (1M-3Ss) felt awkward when confronted with negative feedback. S2 perceived the negative feedback disproportionate with his performance: *"... that is not about my shortcomings, normally I will feel awkward, cringe, I do not want to see (or hear) those comments."* Meanwhile, M3 felt that negative feedback can cause a misunderstanding when first hearing it: *"when I first heard negative feedback, I might have misunderstood and interpreted it wrongly. Then, I realized that negative feedback is not something that drives you to*

change your mind, but a way to make you understand what is happening and give you more information to become better."

Participants discuss the feedback and improvements they can make when they get constructive feedback. Feedback and discussion was not limited to the weekly lab meetings (2Ms-2Ss). For example, S3 reported that feedback can be offered and answered in a variety of spaces: *"everyone can give comments, questions, and feedback. You as the recipient must answer it in many variations of space (online and offline)."* Another method reported by S2 was private in-person discussions: *"if the other person's feedback can make a real contribution to my work, I would like to discuss it after the meeting."*

Mutual Feedback Exchange between Mentors and Students

It is necessary to understand who is giving feedback and what kind of feedback is given. The majority of participants reported that they would seriously consider 'any type' of feedback and would not ignore it. M5: *"I care about the comments from everyone. Even if they do not have the same project as mine, but they give me comments, I still respond to them"*; S2: *"I care about very little things [feedback] like advice or a suggestion ... ."*

Nine participants (4Ms-5Ss) reported it is better to get feedback from members 'who are knowledgeable'. S5 can perceive the comments as illogical if the person giving the feedback is someone who does not understand her research: *"people who comment must understand what I write on my blog. Otherwise, it does not make sense to me."* Typically, members who have a better understanding of others' blog are higher hierarchy members (mentors). M3: *"I think I have to get feedback especially from a top-level person like my supervisor or postdoc mentor."*

On the other hand, four mentors expected feedback from students. M1: *"I would*

be happy when bachelor students discuss in the meeting. Last week, I heard a student took a screenshot of my blog and posted on the lab student group in LINE (a messaging app) and asked other students what the contents of the blog mean. So, I hope students rather can interact directly during meetings." Further, some students (2Ss) reported their colleagues do not interact enough with each other. S12: *"I want every member to comment on the blog, but bachelor students might not comment on it."* According to S1, bachelor students will not talk to older members in several aspects including the blog: *"comments from bachelor students is not a big deal for me. I do not think they want to talk to you on several themes, including the blog."*

Useful Forms of Feedback

Ten participants (4Ms-6Ss) discussed the verbal form of feedback. For example, S3 reported that a clear and spoken detailed suggestion can be more helpful: *"the more detailed the feedback asking me How?, What?, Why?, regarding what I have done would be more helpful"*; M3: *"I prefer the form of suggestions or questions that are valuable which is meant to clarify or acknowledge my research."* Two mentors reported that feedback that critically evaluates the members can be more helpful than non-evaluative feedback. M1: *"people should be able to evaluate each other's blogs, something like competition for example, whose idea is the best in the plan [the best idea] or whose is the best in the report [the best reporter]."* S4 suggested evaluating feedback by posting comments or "liking": *"It would be useful if we could write comments under each other's blog or if there were buttons like good or bad that we could click."* However, M2 and M4 do not like evaluating blogs or people as good or bad. M4: *"I do not like evaluating people, such as using thumbs up or thumbs down. I do not like writing blogs that get a lot of thumbs down. So what? Evaluations like this have no meaning"*; M2:

"if five people give a good or bad vote in the blog, it will be not good for the atmosphere of the lab."

3.2.4 Potential Development to Enhance Planning and Reporting Practices

When Did Blogs Fulfill Their Purposes?

Our participants overall found the blog writing to be a useful practice in organizing meetings, supervising students remotely, and using different usability features in blogs. Two participants (1M-1S) reported that the blog did help to organize their meetings. M1: *"the blog helps me to manage meetings. For example, you actually build the discussion in the meeting based on the blog content."* On the other hand, five participants (3Ms-2Ss), including M1, further explained that the blog was only used for meetings. M1: *"I feel that this blog is actually a nice tool for meetings."* Two mentors reported that writing a blog made them aware of what they were doing. M4 reported the reason is that the blog can track the work they have done: *"we can use it to track what we have done, what we are doing, and what has been fully completed"*; M1: *"Indeed, when you write a blog, you can reflect by yourself. So, you would be aware of what you have done."*

Three participants (2Ms-1S) reported that the blog was very beneficial for remote access. S5 reported that writing the blog when remotely situated is beneficial for helping mentors and supervisors: *"the blog is a great place to report the things I have done for my mentor, especially when I'm not in the lab and I' m away from the lab. By reading the blog, mentors and other lab members can find out what I have done when I was out."* As a mentor, M1 also reported having many students to supervise and guiding them remotely using the blog: *"I want to guide them remotely. Then the blog is very*

beneficial. When I have too many students, the blog is very beneficial."

Different usability features of the blog design mentioned during the interviews include, e.g. seeing the previous blog, reading everyone's blog on one page, and having templates for writing the blog. Three participants (2Ms-1S) reported that reading the previous blog in the bottom of the blog's input is useful. S4: *"in the blog, when I wrote the blog this week, I was able to see the blog last week. Yes, I think this is a useful feature."* M4 reported that this feature could help her to compare previous reports: *"When I wrote my blog for this week, I could see the previous blog. I needed this to compare last week's plan and this week's report."* Four participants (1M-3Ss) reported seeing the latest blog from each lab member as a useful feature. S6: *"In meetings, everyone read the blog, and it was easy to move to the next person on the blog. I think this feature was very convenient."*

Four participants (1M-3Ss) reported having a template for writing the blog as a useful feature, as seen in Fig. 3.1a. The template allowed M4 to organize what needs to be written on the blog: *"if there were no template on the blog, I would have to write the blog by myself from scratch. That would be difficult."*

What Could be Improved with Blog Design?

For obtaining optimal benefits, the current blog system can be further developed. Our findings highlighted several suggestions for developing blog design, such as providing labels for obstacles encountered, filtering blogs by categories and projects, automatic blogs, and improving communication within the blog.

In general, planning and reporting could help participants recall and relate what they have done towards the current situation. However, three participants (1M-2Ss) reported the blog did not help them connect last week's report with the current week's

plan. M4: *"Because the blog was conducted every week, I could not see the whole process of what has happened. How many steps do you have right now and what are the next steps you have to do. The blog was just a little leak of what had happened. Supposedly, it was connected with the previous week, but it seemed that there is no connection to the structure of this project."* S3 found it hard to connect all the reports that she wrote: *"Connecting reports from all the weeks is hard. I did not know what I did two weeks ago. I could not even connect the blog this week and last week. I also could not connect blogs that are related to each other."*

When blog users were writing tasks in text-editors, M4 and S2 suggested adding labels to help understand if the reader had any obstacles in pursuing the project. M4 reported that users could select the level of issues in each task: *"after each item of the task, we should be able to select options such as 'I do not have obstacles', 'this task runs smoothly', or 'I have some difficulties' and write the reason in the blog. Then, we could mark the tasks with different colors like a red for a project with many hurdles."* S2 also recommended marking the tasks with " important " and " urgent " labels: *"I think the blog also needed an emergency label. Sometimes, I worried about this at first. We should be able to label the urgent and important tasks that would become the first priority issues to be addressed for next week."*

M4 and S6 suggested filtering tasks based on their categories in the blog. M4: *"If I want to track a task that belongs to a research project or an administrative affair, I should be able to select and read only that category. "* S6 also suggested adding categories that he wrote himself: *"I wanted to add and choose a category from a task. From this task, I did research, alumni, job hunting, hobbies, coding websites for myself, and others. "* Six participants (4Ms-2Ss) suggested project-based blogs rather than an individual based blog. M4: *"I wanted to have my blog in the right structure. If I opened my blog, I could see my students' blogs below mine."* M2 added a suggestion that

mentors can mention their students on the blog and vice versa: *"maybe the blog will get better if a social tagging feature is added, for tagging between each other. For example, I'm waiting for my students in this section, then this should go to the next week's part of my blog. Or, in this section, my students are waiting for me to analyze this data or to help them write a title or whatever. Maybe social tagging can be done by both parties."* To establish a clear relationship between users and projects, M1 suggested designing an interface in the form of a mind map: *"I feel each project must have an identity. It should be tangible, something like an object. Then something like a mind-map can visually represent all the connections between the people and their projects"*; M5: *"I cannot see the relationship between people and their projects. The relationship could be in the form of dynamic graphs such as mind maps."*

Many other features can be added to the current blog design. These features are not novel; they are already available in existing planning systems. The features mentioned by five participants (1M-4Ss) are milestone, deadline, and reminder. M5: *"the blog needed a few milestones like important dates about my research. I think milestones or checkpoints were better than a text-based blog."* S5: *"maybe on the blog in the planning section, I need a calendar, so that everything is clear to me, like a reminder for my research."* S1 and S3 expressed their need for privacy settings with different disclosure levels for different contents in their blog. S1: *"we could set a password for privacy, and nobody could access our blog in that section."* Three participants (2Ms-1S) suggested automatic blogs. S6 suggested that the tasks could be automatically arranged so that the most crucial task will be listed at the top of the blog: *"I wanted to write a blog where all my tasks are automatically organized. I want the tasks to be automatically listed at the top. Then, I can move them away when I finish them. So, every time I check the blog, the thing I have to do next is at the top."* Meanwhile, M1 suggested that the blog be written automatically from other tools that it uses. M1: *"I wanted my blogs*

to be auto-generated based on the tasks that I have done in the personal tools that I use such as `Todoist`[*4]*. So, I will not need to write my report from scratch."*

S7 reported that communication between lab members about the blog is poor. To improve the quality of communication on the blog, four participants (2Ms-2Ss) suggested providing feedback and comments on the blog. S3: *"if someone else reads my blog, replies to it, and asks for clarification, when I write the next blog I will write it more carefully knowing that others might judge it."*

3.2.5 How Inhibiting Factors Depreciate Planning and Reporting Values

We categorize the barriers for planning and reporting practices into internal and external factors. Internal factors are related to the lack of intrinsic motivation or individual skills. We found that students tend to have less intrinsic motivation to do the planning and reporting due to having fewer things to report, sometimes it is hard to predict the duration of a task until completion, and some reporters lack the necessary skills to compose their reports. On the other hand, external factors such as events and environmental conditions could also be barriers to planning and reporting, e.g., a family event, a workshop, and other activities that do not relate to the research but are equally important to the individual.

Internal Barriers

Four participants (2Ms-2Ss) reported having less motivation when writing a blog as they think they have fewer things to report. For example, S1 who mainly did coding felt that he did nothing: *"the problem is when I write my blog since I was only doing*

[*4] https://todoist.com/

programming and fixing bugs, It sounds like I did not do anything." S5 felt he could not find anything more to write in a blog when he was doing activities other than research. S5: *"sometimes when I had other things to do this week and I did not do anything related to my project, maybe I would feel some pressure because I did not have anything to write on the blog. I know everyone is reading my blog, so not writing anything is probably not a good thing."* Four other participants (2Ms-2Ss) reported that it is hard to predict the duration of a task and a completion date. M4: *"when planning, sometimes some problems needed to be resolved and I don't know how long it might take to solve them."* S3 described assigning priority to duties and estimating distraction times could help to predict when their tasks would be finished. S3: *"sometimes I feel that I want to do many things, but I only have limited time. So, I have to prioritize my tasks first. Finally, I will estimate the time for each activity, and add it to the estimated distractions that will emerge."*

Undergraduate students found it was complicated to write a blog because they have less willingness to write a blog, epsecially when they are non-native speakers. Internal barriers such as lack of motivation often occur in undergraduate students. S7 reported that the lack of motivation arises because bachelor students did not care about research: *"honestly, they do not care about the lab research"*; M3: *"sometimes I knew that my students did not engage in research, so they have low efficiency in writing things."* M1 also reported that bachelor students usually did not do much work and were rarely in the laboratory: *"they don't do much research work compared to master level students and others. They were less likely than others to be in the lab."* S2 explained that bachelor students did not have work to do: *"maybe they did not have enough motivation because they did not have much work"*; S7: *"I think bachelor students' blogs were too simple. If they did not have activity last week or they did not make any progress, then they would not write anything on the blog ."*

Half of the participants (2Ms-4Ss) reported that the language barrier is a common problem because they are non-native speakers. S2: *"every meeting, I tried to write every plan as clearly as possible on the blog. But perhaps my blog was written not so explicitly because of my English."* Three participants (2Ms-1S) reported that students' blogs are not easy to comprehend due to the language barrier. M1: *"he [another student] just reported something. Reading it, I could not understand what he was doing. Maybe this was caused by the language barrier."*

External Barriers

External factors are uncontrollable situations and obstacles that may arise and dissuade participants from blog writing. Four participants (2Ms-2Ss) could not complete their work because something else had arisen. For example, M5 reported preparing for a workshop, applying for a travel visa, and preparing invitation letters. M5: *"honestly, I wanted to plan my research, but a lot of things suddenly came up. Many times like the last two months, I worked for workshops, but extra things like applying for a visa, making invitation letters, things that appear suddenly. All of these took my time so that I could not focus on research and blog writing as well."* S3 reported shifting her plans to the next week when the situation changed: *"when I got more work, all my plans shifted for the next week. So all of these tasks must be compensated. Factors like this, changing situations, must be considered in planning."*

Three participants (2Ms-1S) reported that using alternative tools for planning was more effective than the blog for self-reflection. S3 reported that the personal tools made her more aware of tracking the work compared to the blog: *"I managed Google Calendar for the time being for planning because I think this tool made me aware of my work more than when I write reports and plans on the blog. The blog should indeed help me to be*

always aware of my work."

3.3 Discussion

Our findings showed that planning and reporting practices can be improved (e.g., by having informative two-way feedback) was suggested by participants. In-person meetings improve the motivation of students. Useful design features can be added to the tools (e.g., blog categorization based on the project topic). On the other hand, this system has some barriers that need to be worked on. The language barrier affects not only the quality of written reports and plans, it is also a barrier to general teamwork practice in collaborative research [15, 10]. Different levels of research experience were also found to be a barrier to collaborative research [15]. However, these are to be expected where planning and reporting is specifically designed for education and training which necessitates interaction between different levels of stakeholders such as mentors and students.

Moreover, there is a significant learning curve in the use of the planning and reporting blog. Given the long experience of some participants in using the blog (from three months to three years), participants had become accustomed to using it. We received comments like *"... because you have used it every day, every week. I'm used to this blog."* Students who have just entered college are accustomed to making, learning, and communicating using technology [27]. More experienced users benefited from the effect of habitual use of the blog and they easily perceived its usefulness [54]. Therefore, it is difficult to find shortcomings in the blog because it is used routinely. However, some new users find it difficult to adapt when using such a system for the first time, finding that they are confronted by a significant learning curve [32].

Based on our findings, students have less motivation in writing blogs and blogs that

are written in detail, indicating that they are more responsible for their work as well as developers at a company [5]. However, events and environmental conditions, which are also equally important as research for students, are barriers that will not affect knowledge workers. Knowledge workers have schedules and planning that are already arranged by their 9-5 working hours. So, these barriers do not affect their planning and reporting. Difficulty in predicting the duration of a task until completion also only applies to students who have high autonomy and flexibility. Apart from that, blog writing can also help to solicit feedback for students while it is unsure whether it is also worked on knowledge workers when they combine the in-person meetings with prior written reports [39]. While we are comparing the activity reporting between students and knowledge workers, we could not analyze the difference in planning because it is not a regular task for the knowledge workers [34]. Next, in subsection 3.3.1, we summarize our findings in the form of answers to the research questions.

3.3.1 Addressing the Research Questions

In this subsection, we discuss our findings and formulate answers to our research questions:

(RQ1) What are the strategies that individuals in research teams use for planning and reporting? Regular (weekly) in-person meetings are held by our participants could help them get motivated to write their reports and make their plans in the lab system tool. Also, this tool worked in meetings to demonstrate their reports and discuss report items. Although, participants used the blog to communicate their research with their supervisor (head of the lab), direct discussion with other team members in a project (a mentor and students) is being preffered. Lastly, beside using the blog, alternative tools for their personal planning are used by our participants.

(RQ2) How might different stakeholders (mentors and students) expe-

rience planning and reporting tools differently? Planning and reporting tools helped mentors and students communicate their progress and plan their work with their colleagues are shown in our results. On the one hand, while students used the tool to communicate with their mentors and with the lab supervisor, they highlighted the importance of detailed feedback that should be provided by their project mentor. Such feedback can improve the quality of the students' reports. On the other hand, while mentors mainly write the reports and plan to communicate with the lab supervisor, they also expected to get feedback from students.

(RQ3) What are the expectations, requirements, and pain points of these stakeholders? Mentors expect the planning and reporting tool to facilitate collaboration, to help them organize the meetings and to supervise students remotely. Furthermore, the planning and reporting tools are required to be a readily available channel for feedback and comments. Nevertheless, undergraduate students who were non-native speakers found it difficult to write their reports and plans.

(RQ4) How can we improve current planning and reporting system to better support collaboration? The way to improve current planning and reporting system will be discussed in the next subsection 3.3.2.

3.3.2 Implications for Design

Based on the needs that we observed, we can design technology-supported tools for planning and reporting in collaborative systems. Our main goals are to help students to better collaborate with their mentors and supervisors and to promote an active research environment for all stakeholders who are involved in research labs. These design implications are expected to facilitate productive team member interactions, to increase participation, to ease each users ' concerns, to engage and motivate students to write useful blog entries and to improve the efficiency of research work.

Facilitate Interaction to Increase Participation

One of the barriers to using the blog for bachelor students was the lack of motivation and/or skill in writing. Our findings revealed that interaction between lab members in the form of in-person meetings can increase their motivation to write their blog entries. The active and interested involvement of mentors and lab supervisors in reading and commenting on blogs is vital to student motivation and to the overall quality of the blog. Disinterest at this level not only robs the blog of its potential to improve in usefulness, it can demotivate students and render the system a burden. Those who actively monitor the students' blogs and react with timely and pertinent feedback can better motivate lab members to feel the need to continue writing their blogs. Although initial motivation often comes from feeling compelled because they are being monitored by mentors and supervisors, students ultimately get used to blog writing. Therefore it is recommended to:

- Consider features that *support stakeholders (immediate) blog updates* (advice, hints) when other lab members have read/seen the blog. For example, the professor could get a notification for a blog update from the lab members and the blogger could receive a 'Seen by' notice from the system. "Seen by" feedback is similar to what is commonly used in instant messaging applications such as `WhatsApp`.[*5] In order to increase productive interactions between supervisors and students, the blog could include features that enable the giving of reminders or tasks directly to the students.

If students find the motivation to be creative in writing this blog, the quality of collaboration between laboratory members can be better. Lab member participation can also increase by providing social features among lab members. Improvements in these

[*5] https://www.whatsapp.com/

areas help develop a communicative and competitive work environment, so that the quality of research results can also be improved. Participants mentioned that the current blog does not show the hierarchy in the lab. In the current system, supervisors and mentors cannot interact with a student or see which project the student is assigned to. The blog does not support online interactions between lab members or between supervisors and mentors and their students. Furthermore, interaction between lab members is needed to get feedback between lab members. Therefore, it is recommended to:

- Consider the design of features that *support interaction among fellow lab members*, such as providing comments or feedback on their blogs or assigning or tagging other lab members to the tasks they write.

Make the System Easy to Use to Improve the Efficiency of Work

User friendliness is an essential part of motivation, engagement and productivity in the use and value of the blog. If the user feels less effort in creating and evaluating his blog, users will not only be able to meet their research targets but will also increase the efficiency and quality of their research. Currently, the blog is written individually by the lab members. However, work done by students in a project is not only dependent on individual effort but also on getting help from mentors and supervisors. Each project succeeds due to the efforts of more than one person, and each individual ' s efforts are enriched by the other contributors. As our findings show, participants prefer to make a report or a plan based on the project. The use of blogs can make it easier for everyone to track the progress of each member ' s own work, the work of other individuals and the progress of the whole project. Planning and reporting using blogs also makes it easier for supervisors to follow the work done by their lab members. If lab members can track their work clearly on the blog, they can focus on what is necessary and what is the right

direction to achieve their targets. Therefore, we offer the following recommendations:

- Technology tools should *organize the reports and plans based on projects* that can help the mentor and supervisor access relevant information during the project and compare current work with previous work and with the goal of the project. This will also support mentors to consider the work-load of each student and inform them regarding how to assign tasks to those who have less to do.

Some participants began to get used to using and writing a blog. Some participants also found it helpful to write blogs using an existing template. The template is a simple text-based template consisting of 'reports' (tasks completed this week), 'outcomes' (outputs of completed work), and 'plans' (tasks to be done next week). The report and plan consist of research tasks (related to research and projects) and administrative tasks (not related to research but related to the laboratory). Without the template, some participants found it hard to start writing their blogs. Several participants are dependent on the template as a reference to assist in writing their blogs. So it is recommended to:

- Consider *various forms of template design* for writing blogs in order to facilitate and improve the habits of lab members in writing blog entries.

Given that members of research labs are often international students, their language skills usually are often not at a high level. In particular, undergraduate students are not accustomed to writing in English (which is commonly used in the laboratory). This lack of skill can confuse other members regarding the writer ' s intentions on their blog. Moreover, short blogs written in simple language were not well-received by most of the participants, where they felt the blog was too simple and lacked meaning. Last, in writing a blog, participants find difficulties such as estimating deadlines. So it is recommended to:

- Consider features that can support *writing clear and well-explained blogs* for undergraduate students. Web extensions such as `Grammarly`*[6] might help students check sentences while they are being written. Also, bloggers may need help in *estimating the completion of their tasks*. For instance, technologies using Natural Language Processing and Artificial Intelligence may be applied to learn from past experiences and estimate the duration of similar tasks in future projects.

When lab members work on more than one project, they are likely to miss deadlines due to the workload and the complexity of divided interests. Coupled with the weekly meeting, the tasks carried by lab members must be scheduled and subject to deadlines if the whole team is to function well. Awareness of all responsibilities, procedures and deadlines is essential if lab members are to integrate with the functioning and goals of the whole project. However, they need to be able to distinguish between important tasks and urgent tasks and what priority each task has in the order of things in general [44]. Urgent tasks require immediate action (a matter of time), while important tasks are indispensable to long time goals (a matter of dependency) [44]. The task that has to be done for the week should be chosen by its degree of urgency and importance; it should be at least important if not urgent. In the interview, several participants suggested assigning priorities to the tasks. Therefore, we offer the following recommendation:

- The features that already exist in *off-the-shelf planning software*, for example `Todoist`, can be applied to the planning and reporting system to help the collaborative work. These features include the assignment of priority levels to each task and the notifying lab members of their respective tasks, deadlines, and progress on the blog so that lab members can be more efficient at work.

*[6] https://www.grammarly.com/

Engage Students to Gain Willingness in Blog Writing

Planning and reporting need to be engaging if lab members are to feel encouraged to write their blog entries. For lab members, engagement factors can strengthen their desire to write a blog in their own words, not just based on what was said by the mentor. With the desire to write blogs based on the individual's own words, lab members can engage in planning and reporting practices willingly, develop their writing skills, and improve the quality of their blogs entries. Besides being engaging, blogs also need to be user-friendly so that they strengthen the desire to write planning and reporting entries. M1: *"[...] if game elements can be used in a completely invisible way they can motivate me."* This motivation becomes one of the factors that can change thinking into immediate action. Therefore, it is recommended to:

- *Motivate lab members (students in particular) to participate* by increasing the incentives for lab member participation when using blogs, for example, using gamification elements such as rewarding badges for the "blog of the month". Another approach, more consistent with HEC principles [50], would be to increase the intrinsic motivation of the students whereby they would voluntarily engage in the lab activities either for the sake of interest (e.g., enjoying learning new skills) or because of the worth of their actions (e.g., contributing to research). Focusing on different elements of self-determination theory [20] (i.e., autonomy, competence, and relatedness) is recommended.

Our findings show that by using and writing a blog, participants can become aware of what they and other people are doing. With the help of a blog that can track tasks done every week, participants obtain useful data to adjust how they will work in the future. If a blog can increase self-reflection, participants can adjust their attitudes and actions and make it easier for everyone to achieve their work targets. So, it is

recommended that:

- Tools should be able to support lab members to *increase self-reflection* that can help in the research efficiency and well-being. For example, the blog should ask meaningful questions so that members can better see their past work. The questions can be asked in the Likert scale form in order to rate themselves on efficiency, attitude, problems, progress, motivation, etc., each week [35].

Remote Collaboration

Online planning and reporting tools can have extra benefits for those individuals who do not have physical access to the research labs, in particular, for situations such as the COVID-19 pandemic where members are required to keep physical distance from each other. When it is not possible to conduct in-person meetings in the lab, remote supervision may be required to properly coordinate important tasks [43]. Previous research showed that communicating with others for person-to-person meetings can be done via video-conferencing tools [26]. However, video conferencing has a transmission delay of 1.2 seconds and this creates the impression that the responder is less friendly, not focused or distracted [54]. In addition, participants tend to take longer to organize their reports during meetings. If the content of planning and reporting has been organized in planning and reporting tools, communication between lab members using video-conferencing tools can be smoother. Therefore it is recommended to:

- Consider *features to conduct remote meetings*, for example, by connecting the video-conferencing tools, note-taking and meeting document links with the planning and reporting system. Appraisal features can also be included to increase interaction between the lab members during remote work by expressing their gratitude for a

specific task or giving a kudos award for a great job as implemented by `Linkedin`.[*7]

[*7] https://www.linkedin.com/

Chapter 4

Study 2: Blog Improvement

We developed an initial stage development to improve participant's blog system based on design implications stated in subsection 3.3.2. This development is expected to motivate students and increase users' efficiency in research. Therefore, we discuss the system requirement, mapping of design and implementation results, and future development plan.

4.1 System Requirement

System requirement is a statement that describes features of a system to satisfy the user's requirements. This system requirement is used for technical reference to the needs of software development in the initial stage of development. The system requirement section includes system description, target user and development scope, user stories, entity-relationship diagram, and prototype design.

4.1.1 System Description and Scope

We will improve the blog system that is being explored and evaluated on Study 1, starting from the initial stage development. The previous blog system had a lot of shortcomings and functions that hold a lot of promise if done well. Also, there is a need from the previous system so that barriers in writing plans and reports can be reduced. Our existing users are mentors who did not check students' blogs because

they already have their own discussion outside the weekly lab meeting and students who need to report to their supervisor and mentors but having less engagement in writing or accessing the blog. Study 1 is done by these existing users and provided design guidelines to develop planning and reporting tools that can promote greater team efficiency, more productive engagement of the individual members, and better outcomes for their projects.

However, there are limitations that not all the design implications from subsection 3.3.2 could be implemented in the initial stage development. Due to time, skills, and technology limitations, features that need a machine learning and artificial intelligence will not be developed. The gamification element will also be just as simple as the experience point and leaderboard because there is no deep testing and validation for what kind of gamification that will make users engaged with this system. So, we will develop the feature that supports supervisors and mentors' blog updates (advice, hints) when other lab members have read/seen the blog, feature that supports interactions within members on the system, and the system should organize the plans and reports based on the project. This initial stage development will continue to develop on AWS EC2. However, the previous system is a static website where all the data are saved into a file and stored on AWS S3. Thus, we change it into a dynamic website with a PostgreSQL database, SQLAlchemy, and Python Tordano.

4.1.2 Target User

A target user is a specific group of users or customers who will use products that can solve their problems. The specific group of users for the initial stage development is defined from Study 1: (1) project mentors; (2) students. Study 1 helped us to learn our users, their goals and needs, and the motives of their behavior. It also showed the difficulties that they have and how effective the user interface can solve their problems.

By understanding the users from Study 1, we are trying to cater to their needs on using a Planning an Reporting System to increase their efficiency in research.

4.1.3 User Stories

User stories are descriptions of a feature told from the perspective of the person who desires the new capability, usually a user or customer of the system. This perspective is taken based on the users' behaviors shown in Study 1. By defining user stories, the way of how a software feature providing value to users or customers is showed clearly and distinctly. It showed clarity on what to build, for whom, why, and when. User stories can become a standard way to communicate and summarize the functionality of the product by both technical and non-technical people since they are easy to define, understand, and revise.

The user stories of the initial stage development are shown in Table 4.1. Features that focus on a particular user will be written with the role name, for example: "As a mentor or supervisor, [...]". Meanwhile, "As a user, [...]" is written if the feature is accessible to all types of users. These user stories help us determine development priorities and structure in developing front-end pages. Information that can be changed and contained in all front-end pages will be displayed in the left navigation of the screen so that users can more easily access them.

Table 4.1: User stories of Initial stage Development

No	User Story	Importance	Front-end Page
1	As a mentor or supervisor, I can receive an email that notified my students' blog	Must Have	No front-end page

No	User Story	Importance	Front-end Page
2	As a user, I can create, update, and delete an Activity	Must Have	All the page except Leaderboard
3	As a user, I want to see the list of projects and activities for each week	Must Have	Weekly Report Page
4	As a user, I can click the link for a weekly meeting	Must Have	All the page except Leaderboard
5	As a user, I want to see the activities categorized by the projects	Must Have	Projects Page
6	As a user, I want to see whether my mentor and supervisor saw the report of each week	Must Have	Weekly Report Page
7	As a user, I can comment, like, and reply on other people weekly report	Must Have	Weekly Report Page
8	As a user, I can click the other people photo that links into their weekly report	Must Have	All page
9	As a user, I can add, edit, and delete a project	Must Have	All page
10	As a user, I can view all the members' blog on for each project	Must Have	Projects Page
11	As a user, I can mention others on the blog and comments	Must Have	All the page except Leaderboard

No	User Story	Importance	Front-end Page
12	As a user, I can fill in the reflections every week	Must Have	Weekly Report Page
13	As a user, I want to see the neighborhood leaderboard	Must Have	Leaderboard
14	As a user, I can gain experience point on each activity I made on the website	Must Have	All page
15	As a user, I can sort the blog by name, date, and priority	Nice to have	Projects Page
16	As a user, I can search the blog by keyword	Nice to have	Projects Page
17	As a user, I can create, update, and delete my contact	Nice to have	All page
18	As a user, I want to see the notifications	Nice to have	Top navigations

4.1.4 Entity-Relationship Diagram

To improve the system towards dynamic websites, a structural diagram used to design a database needs to be defined using entity relationship diagrams (ERD). An ERD contains different symbols and connectors that visualize two important information: the major entities within the system scope, and the inter-relationships among these entities. An entity in this context is an object, a component of data. An entity set is a collection of similar entities. These entities can have attributes that define its properties. An ERD has drawn on Fig. 4.1, the database design ideas are visualized and we have a chance to identify the mistakes and design flaws, and to make corrections before executing the

changes in the database.

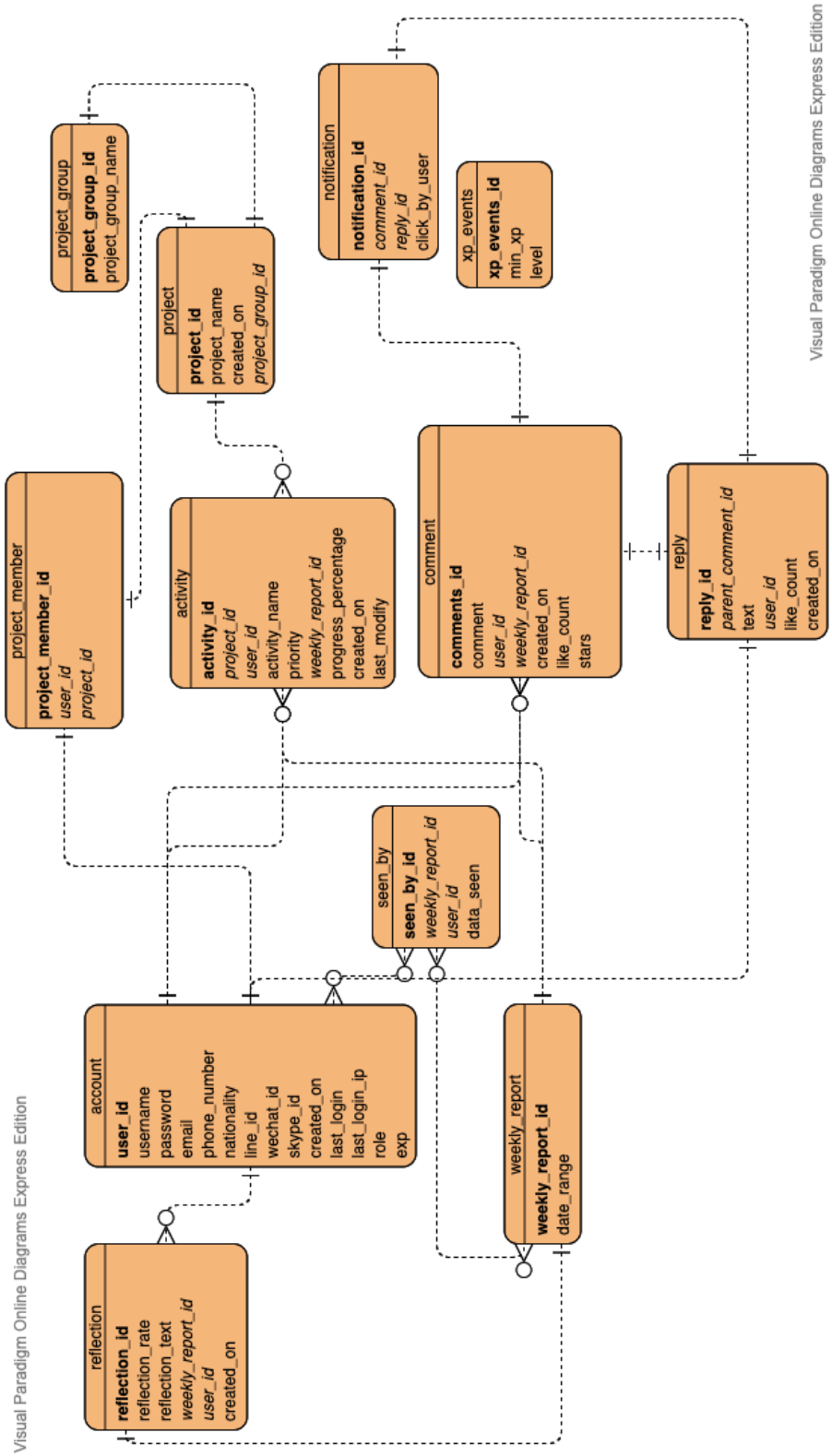


Fig. 4.1: Entity-Relationship Diagram of Initial Stage Development

ERD for this initial stage development has 12 tables with different functions. All of these tables are built in PostgreSQL according to the entities, attributes, and relationships contained in the ERD. The database table lists the table name, primary key, and content description that will be implemented in the core development stage. This can be seen in Table 4.2.

Table 4.2: Database Table List of Initial Stage Development

No	Table Name	Primary Key	Content Description
1	account	user_id	The account table has attributes that symbolize the user's profile and personal data. Mentors and students can be distinguished from the *role* attribute contained in this table.
2	activity	activity_id	Every activity contained in the plan or report will be stored in the activity table. Because the activity depends on who wrote the activity, the activity is the activity of what project, and the activity is written for the report within a certain timeframe, this table also stores foreign keys from the project, account, and weekly_report tables.

No	Table Name	Primary Key	Content Description
3	project	project_id	Projects are made into separate tables because one project has at least two users (supervisor and student). This project stores the attributes in the form of the project name and when the project was created, along with the_group_id project which is a foreign key to categorize this project belong to the project group.
4	project_group	project_group_id	The project_group table stores the id and name of the project group. A project will only have one project group, so this table is needed separately.
5	project_member	project_member_id	The project_member table is a many-to-many relationship table that stores the user_id and project_id.
6	weekly_report	weekly_report_id	The weekly_report table is a table that stores date_range which contains the date before and after each week. This table makes it easy to store weekly reflections, who sees this week's reports, weekly activities, and comments.

No	Table Name	Primary Key	Content Description
7	reflection	reflection_id	User reflection in the form of how much they try and contribute in this week along with their comments on what happened this week.
8	seen_by	seen_by_id	The seen_by table contains anyone who sees a user's weekly report.
9	comment	comment_id	Comment table is consist of comments, the number of likes in the comment, and if the comment is a star.
10	reply	reply_id	If the user gives a reply to a particular comment, the reply will be stored in the reply table along with the foreign key parent_comment_id
11	notification	notification_id	If a comment or reply appears on someone's weekly report, then the notification will appear based on the contents of this database.
12	xp_events	xp_event_id	This table is not related to other tables, but it stores a minimum of xp and a level that will determine the level of each user by looking at their experience points.

4.1.5 Prototype Design

The prototype is the result of translating user needs and functional needs into something more tangible. The existence of a prototype, allows users to review conceptual models faster. Making prototypes helps users visualize what the designer wants to give to the system to be built.

Before making a prototype of a system, several stages of analysis need to be done to produce an effective prototype. The stages are the making of information architecture, navigation design, visual design, mockup, and prototyping. The stages of mockup and prototyping will be discussed in the Section 4.2.

Information Architecture

Information architecture is used to describe how information is structured to support usability by developers and users. This information architecture contains intersections between content, context, and users. It is expected that users will be able to understand the information structure in the initial stage development and information related to its position. The information architecture of initial stage development refers to Fig. 4.2 using the site map diagram.

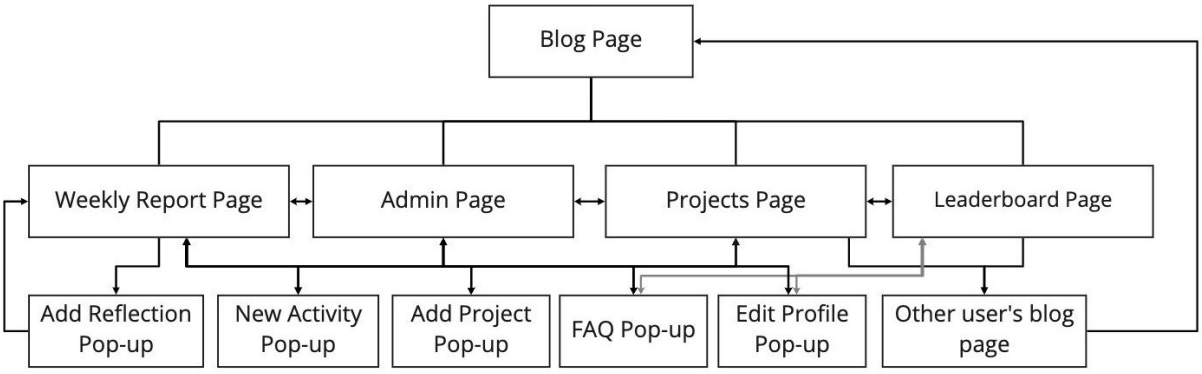


Fig. 4.2: Site Map Diagram of Initial Stage Development

Addition or reduction of experience points occurs on all pages except the leaderboard. The leaderboard only displays experience points and levels owned by other users and rank them from highest to lowest. Users will get three points when filling in reflections, two points for creating new activities, and one point for changing activities. Points from the user will be reduced when the user deletes an activity. This is done to prevent users from gaining points for new activities and deleting them repeatedly to increase their experience points. Then, users will also get 2 additional points if they have changed the progress percentage of activity to 100% which in the weekly report will be seen as "DONE". Finally, if the user does not write down any activity in one week, the user's points will be reduced by five points and checked every Monday every week.

Navigation Design

Navigation design is a continuation of information architecture so that users know their position in the system. This Navigation Design includes the form of buttons, navigation layout, menu clarity, and so on. Navigation that will be used at the initial stage of development is navigation on the left side of the screen which will continue to appear on all pages. This navigation will direct users to all pages available in the blog function, new activity pop-ups, add project pop-ups, FAQ pop-ups, and edit profile pop-ups. The mockup results from the navigation design are in Fig. 4.3.

Visual Design

The visual design emphasizes the beauty of the system interface. Color elements, images, and other basic design elements greatly affect the user experience received by

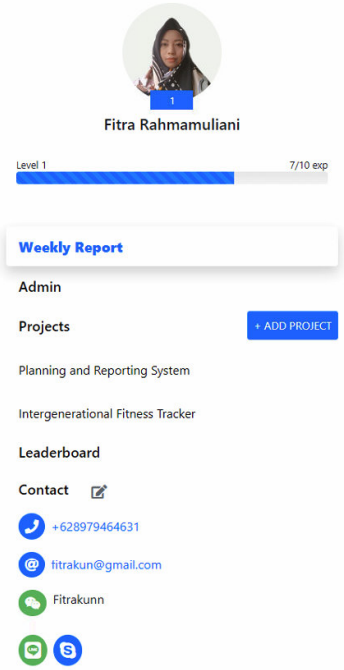


Fig. 4.3: Left Navigation Design for Initial Stage Development

the user. Initial stage development will be built using the Bootstrap 4 framework [*1] and the Font Awesome toolkit icon [*2] in front-end. All visual designs will follow the visual design of the framework and the icons will follow the Font Awesome icon toolkit with a blue background. Icons in the form of brand logos such as WeChat, LINE, and Skype will follow the background colors of each of these applications.

4.2 Mapping of Design and Implementation Results

Referring to the design that has been made before, every page that has been compiled in Fig. 4.2 site map diagram will be the basic guideline of the initial stage development implementation. There will be a file handler that consists of many handler classes at this initial stage of development because all are still included in one main

[*1] https://getbootstrap.com/docs/4.5/getting-started/introduction/
[*2] https://fontawesome.com/

page in this lab system, which is a blog. Mapping the designs with the implementation results can be seen in Table 4.3

Table 4.3: Mapping designs with implementation results

Page on the Site Map Diagram	Prototype Page and File	Handler Class
Weekly Report Page	report.html	MainHandler
Admin Page	project_admin.html	ProjectAdminHandler
Projects Page	projects.html	ProjectsHandler
Leaderboard Page	leaderboard.html	LeaderboardHandler
Edit Profile Pop-up	all files	ProfileEditHandler
Add Project Pop-up	all files	AddProjectHandler
Add Reflection Pop-up	report.html	AddReflection
New Activity Pop-up	all files except leaderboard.html	AddActivityHandler, DeleteActivity
FAQ Pop-up	all files	no handler (only view)

4.2.1 Screenshots and Design Changes

After designing the first mockup, we asked participants' lab members for feeback[*3]. Based on this mockup, we changed several parts of the interface. However, because we used several frameworks for implementation, the final design is following the framework's visual design. Here, we discuss the screenshot and design changes that we did on the initial stage development.

[*3] https://xd.adobe.com/view/7bb0cb3b-11cc-4d43-6cd7-d5fce83db7b0-0d81/

Weekly Report Page

Weekly report page is the page where users see when the first time accessing the blog from the lab system. In the top part of the page [Fig. 4.4], user can see their written review on that week, add new activity by clicking the new activity button, and add, edit, delete their activity on the planning and reporting section. The activity attributes that are shown on all the pages except leaderboard are the activity name, date-range, priority, and progress percentage. These activities are being categorized by the project.

When the first time user goes into this page, the user can see this week's report. If they want to see the previous week or next week's report, they need to click the chevron right or left icon and the page will be redirected to the report on that date range.

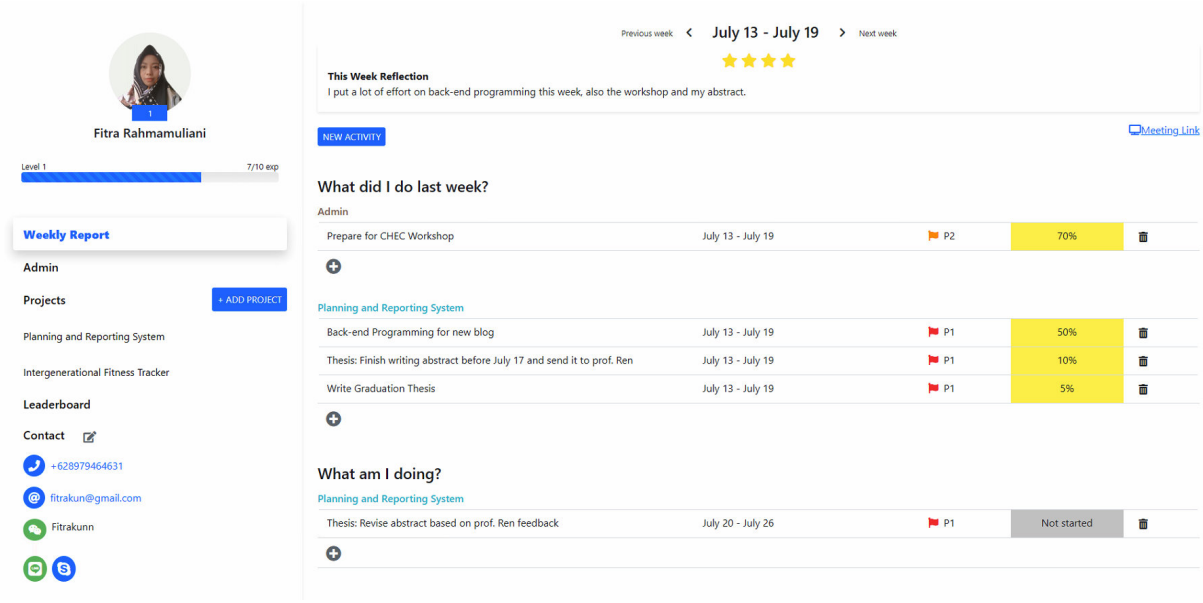


Fig. 4.4: Screenshot of Top Part of Weekly Report Page

In the bottom part of the page [Fig. 4.5], there is seen by a feature where users can see who already seen their blog. If the photo of the seen by a person has hovered, the user can see the detail of the date and time when that person has seen the blog. Under

the seen by feature, there is a comment section with the input with the submit button. When there is a comment, the user can click the like button or reply.

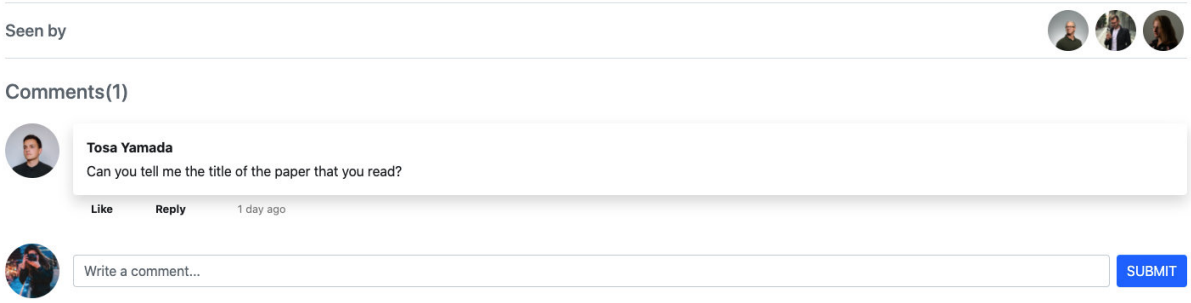


Fig. 4.5: Screenshot of Bottom Part of Weekly Report Page: seen by and comment

Admin Page

Admin page is a page where users can see all the administration report that they have been doing. Because only administration works, user can filter their administration report by clicking the dropdown that has the month and year. Just like the weekly report page, users can delete, add activities, and edit activities on this page too.

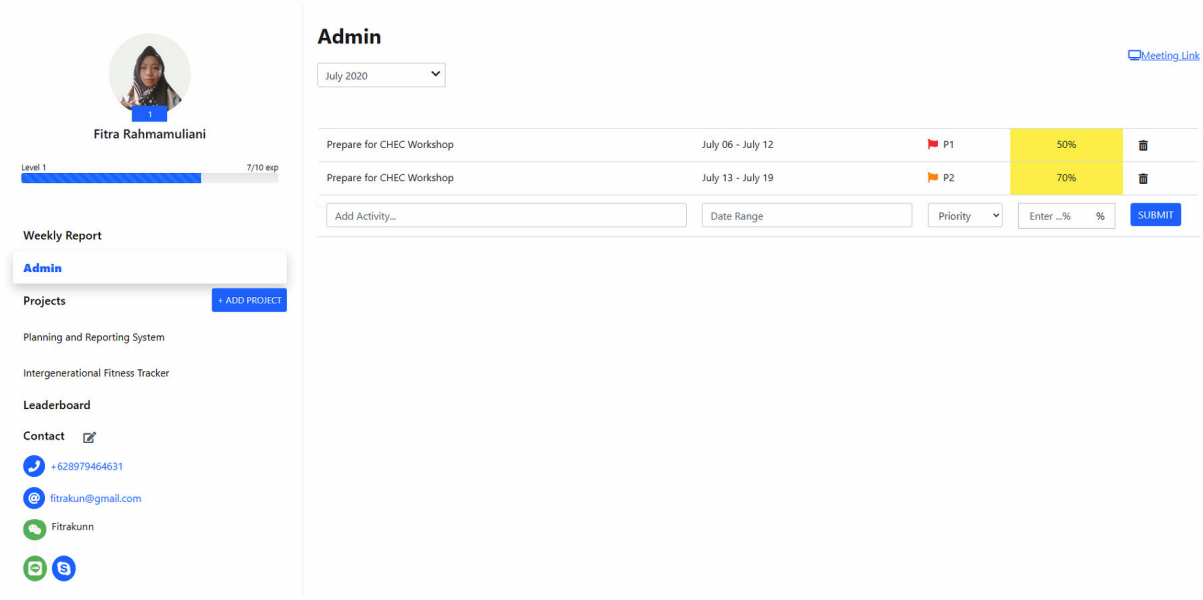


Fig. 4.6: Screenshot of Admin Page

Projects Page

On the left navigation under the *Projects* link, users can see the list of projects that they are having right now. When users click one of them, they can see the project name, members, this week's reflection of themselves, the new activity button, and all the activity of this project starting from this week. If users want to see the previous reports, they can click "Show previous reports" on each of the member's card. They can also sort the activity and search the activity based on the keywords. However, sort and search activities are the features that used Javascript and not included with the database or handler.

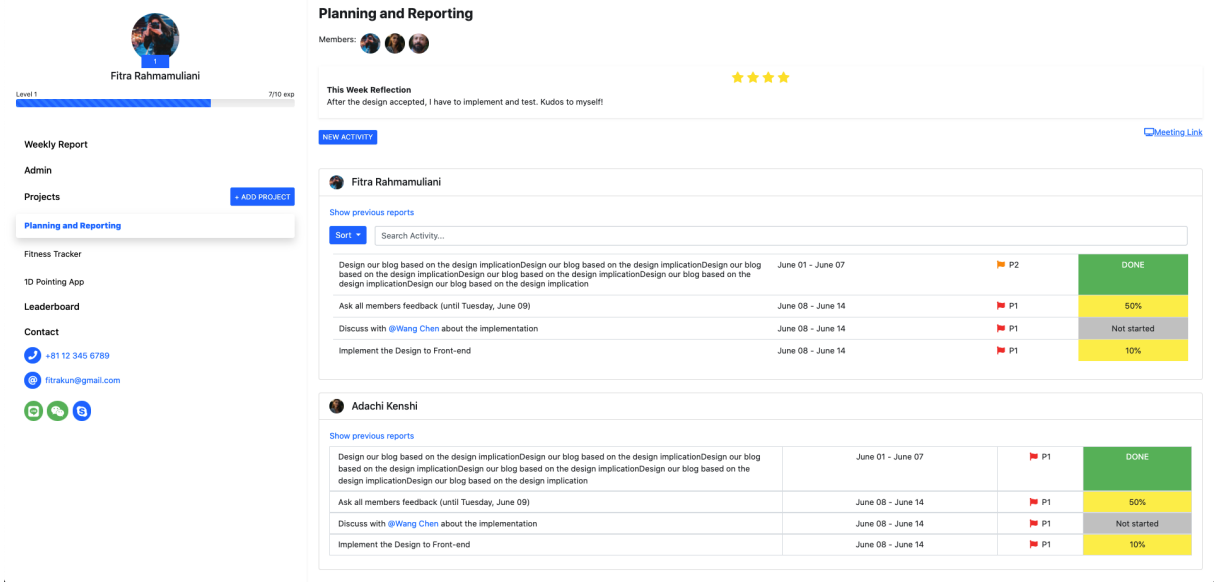


Fig. 4.7: Screenshot of Projects Page

Leaderboard Page

Leaderboard page [Fig. 4.8] is showing the rank of the experience point that users got every time they create, update, or delete activity and reflection. The login user is shown in the blue background and only the nearest four ranks will be shown on the

leaderboard. Other than that, the rank will be hidden by a button to show all rank. Here, every user can see their rank number, click the other users to see their reports, and the level and experience points of each user.

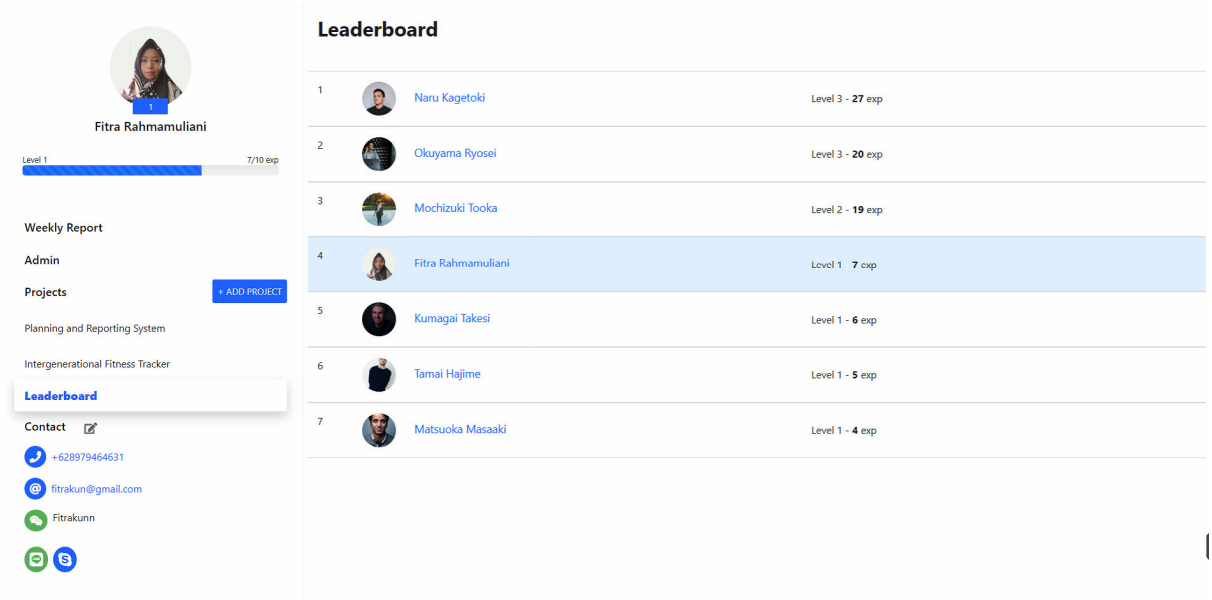


Fig. 4.8: Screenshot of Leaderboard Page

Edit Profile Pop-up

When users click on the edit icon, next to "Contact" on the left navigation, the edit profile pop-up will be shown as Fig. 4.9. Users can change all their contacts including email addresses, phone numbers, and all the social media accounts. However, they cannot change their user name because it will affect the other data of the lab system. In this case, users may change the photo profile with a warning that all the page on the lab system that has a photos profile will be changed too.

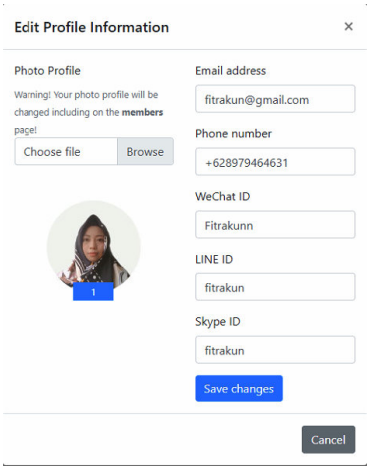


Fig. 4.9: Screenshot of Edit Profile Pop-up

Add Project Pop-up

From the button add project on the left navigation, users can click it and the Add Project Pop-up will show up as in Fig. 4.10. Users need to choose the project group from a drop-down input, write the project name, and write all the members of the project. The list of the project group is can be accessed only by the admin who responsible to take care of the website.

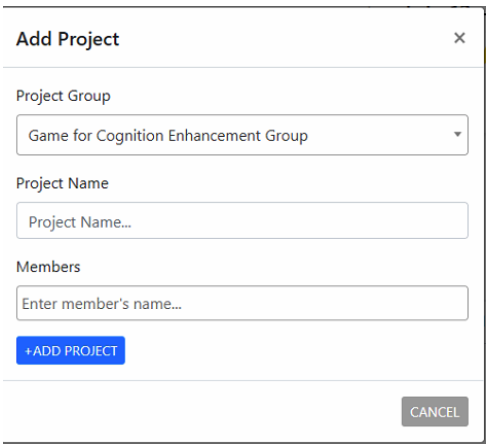


Fig. 4.10: Screenshot of Add Project Pop-up

Add Reflection Pop-up

Every week, add reflection pop-up will show up as seen in Fig. 4.11. This pop-up can also show up when users click on the "New Reflection" button on the top of the Weekly Report page. Here, users need to choose the rate of contribution of their work this week from the lowest not contributed at all to the highest extremely contributed. After that, they can write the reason why they choose the rate and submit the reflection. Users cannot edit their reflection after submitting, so they need to carefully think and take their time to reflect on their work towards their goals at that time.

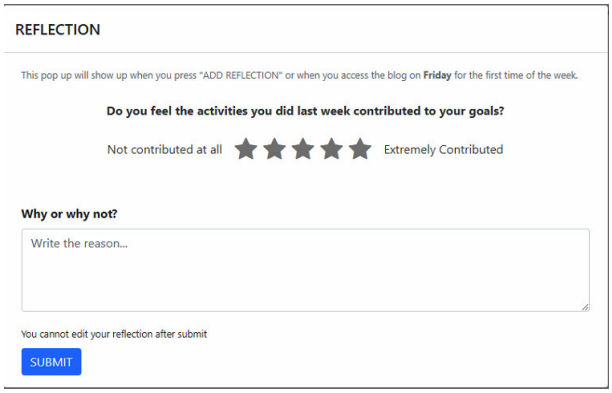


Fig. 4.11: Screenshot of Add Reflection Pop-up

New Activity Pop-up

If users click on the new activity button that is available in all the pages except leaderboard, the new activity pop-up [Fig. 4.12] will show up. Users need to write the activity name, project name, date range, priority, and progress percentage. After submitting the activity, the pop-up will automatically be closed and the page will be refreshed. Another way to add new activity is to click the button under the report on the admin and weekly report page.

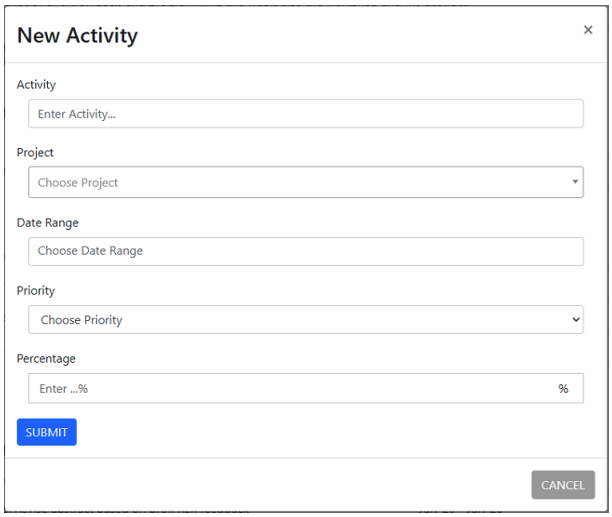


Fig. 4.12: Screenshot of New Activity Pop-up

4.2.2 FAQ Pop-up

From the left navigation bar, users can click the level bar under the photo profile and the faq pop-up will show up. This pop-up is explaining about how to edit the profile and the detail of the experience points of users. This pop up is not related to any handler because it only informs the description just by putting the information inside the template file.

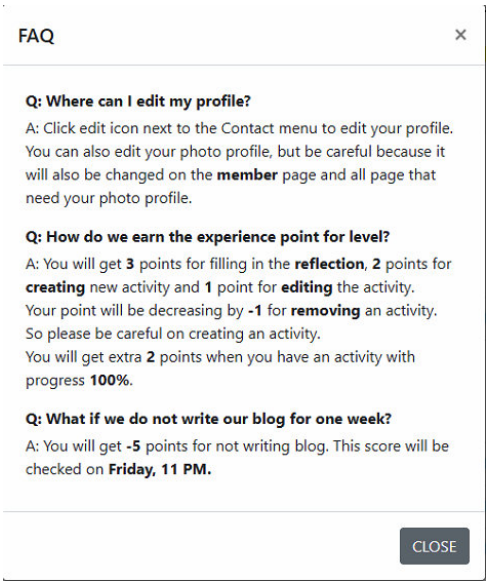


Fig. 4.13: Screenshot of FAQ Pop-up

Chapter 5

Conclusion

Planning and reporting continue to be beneficial for research teams, especially for collaboration. This study has presented two types of contributions.

First, we did a qualitative study to understand users on planning and reporting practices, investigating the planning and reporting system, and come up with the design implications. Our study found that participants have a strategy to hold weekly in-person meetings that helped them get motivated to write their reports on the lab system tool. Mentors and students experienced this tool by helping them communicate their progress and plan their work with their supervisor and colleagues. Detail feedback should be provided by the project mentor to improve the quality of student's reports and mentors also expected to get feedback from students. Reporting and planning tools are expected to facilitate collaboration, help research stakeholders organizing the meetings, supervise students remotely, and help on lab communication by giving feedback and comments features. Our study provides insight and design guidelines for the design and development of future technology supported tools.

Second, we designed and developed a new system that represented the results of the previous qualitative study. This new system was built until the initial stage in the form of a website that can be used by participants in the near future. Despite the technical limitations, this system has potential to be easier to use, more interactive to communicate related to the report context, and more engaging. This system is not only used by participants, but can also inspire designers and developers to create or

improving the current a reporting and planning tools in academic research labs.

For future research, the development of this system needs to continue into the next stage as written on the Section 5.1 and test it with the users. We highlight opportunities for researchers and designers to further streamline methods and engagement factors for a more efficient planning and reporting system.

5.1 Future Development Plan

Responsive website: This initial stage development of the planning and reporting system can be continued to develop into a responsive website to every platform. Different platforms and devices have different screen sizes and viewports. In the current development, there is no further analysis and testing on how the website works on a different platform.

Usability features: The notification feature in the initial stage development is as simple as when user comments, they will achieve the notification. However, when users mention someone else, users do not know whether they are getting a mention or not. Also when students update a blog, there is no notification on the project mentors' side.

The searching activity feature only works on the front-end side and inside the project page. This feature could be developed into the query searching and not only the activity, but also the comments, replies, or users. By having this feature, users can be easier to find the previous activity and comment that they need to consider.

Having an additional feature such as a progress timeline or project Gantt chart can also be included so students can be easier to see their progress towards their goals. Students can also understand temporal relationships quickly by seeing the chronological sequence of events or activities along a drawn line. A progress timeline feature will give more complexity to the system but could help students on tracking their projects and

set their deadlines.

Using Natural Language Processing and Machine Learning: To help students in writing a clear and well-explained blog, natural language processing and machine learning could be further developed on the system. The system could learn how students write and checked the sentences while they are being written. Besides, the system could give an estimation on completing the activity by giving the hint to the users based on the learning the past experiences on students' data.

Gamification Mechanisms: As mentioned in subsection 3.3.2, the gamification needs to be more engaging to motivate users on using the system and write their reports. The leaderboard could be categorized into weekly or monthly leaderboards and show the last activity and experience for each user. However, experience point, level, and leaderboard are not engaging enough to keep users on accessing the system. Future development needs to explore what kind of gamification mechanism that is suitable for this. For example, there is a "blog of the month" that chosen by a supervisor or project leader. It could be also chosen by an analytic system to calculate which report is the clearest.

Another gamification idea is to generate a quiz once a month related to users' reports and plans. This quiz is multiple choice and could be answered in a limited time (e.g., 30 seconds or one minute). If users answer it wrong, the experience point is going to decrease. Other than that, another point system like in-game money can also be further developed. Users can get a reward by buying something in the market using that money. For example, the market is including an avatar, customize the interface into a dark mode, border on the photo profile, etc.

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References

[1] Kristen Abbott-Anderson, Andrea Gilmore-Bykovskyi, and Annmarie A. Lyles. The Value of Preparing PhD Students as Research Mentors: Application of Kram's Temporal Mentoring Model. *Journal of Professional Nursing*, 32(6):421–429, nov 2016.

[2] Giovanni Abramo, Ciriaco Andrea D'Angelo, and Flavia Di Costa. Research collaboration and productivity: Is there correlation? *Higher Education*, 57(2):155–171, feb 2009.

[3] Rohan Ahuja, Daniyal Khan, Danilo Symonette, Shimei Pan, Simon Stacey, and Don Engel. Towards the automatic assessment of student teamwork. In *Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work*, pages 143–146, New York, NY, USA, jan 2020. Association for Computing Machinery.

[4] Asana. Asana, 2020.

[5] Lingfeng Bao, Zhenchang Xing, Xin Xia, David Lo, and Shanping Li. Who Will Leave the Company?: A Large-Scale Industry Study of Developer Turnover by Mining Monthly Work Report. In *IEEE International Working Conference on Mining Software Repositories*, pages 170–181. IEEE, may 2017.

[6] Ligia Batrinca, Muhammad T. Khan, Dorrit Billman, Basak Aydemir, and Gregorio Convertino. A timeline visualization for multi-team collaborative planning. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA '13*, page 157, New York, New York, USA, 2013. ACM Press.

[7] L. Michelle Bennett and Howard Gadlin. Collaboration and Team Science: From Theory to Practice. *Journal of investigative medicine : the official publication of*

the American Federation for Clinical Research, 60(5):768, 2012.

[8] Joanne Beriswill. Zoom redefines web conferencing for education. In *E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, pages 1208–1211, Las Vegas, NV, United States, 2018. Association for the Advancement of Computing in Education (AACE), Association for the Advancement of Computing in Education (AACE).

[9] Ari E. Berman, William K. Barnett, and Sean D. Mooney. Collaborative software for traditional and translational research, sep 2012.

[10] Barry Bozeman, Daniel Fay, and Catherine P. Slade. Research collaboration in universities and academic entrepreneurship: The-state-of-the-art, nov 2013.

[11] George Bradt. Inner work life: Understanding the subtext of business performance [8], sep 2007.

[12] Stacy Brody. Web-based tools for collaborative research. *Library Hi Tech News*, 34(8):8–19, 2017.

[13] A. O. Busari. Academic stress among undergraduate students: Measuring the Effects of Stress Inoculation Techniques. *Mediterranean Journal of Social Sciences*, 5(27):599–609, dec 2014.

[14] Janet Carter, Dennis Bouvier, Rachel Cardell-Oliver, Margaret Hamilton, Stanislav Kurkovsky, Stefanie Markham, O. William McClung, Roger McDermott, Charles Riedesel, Jian Shi, and White Su. Motivating all our students? In *Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE*, pages 1–18, New York, New York, USA, 2011. ACM Press.

[15] J. Alberto Castañeda, Francisco Muñoz-Leiva, and Teodoro Luque. Web Acceptance Model (WAM): Moderating effects of user experience. *Information and Management*, 44(4):384–396, jun 2007.

[16] Kendra S Cheruvelil, Patricia A Soranno, Kathleen C Weathers, Paul C Hanson,

Simon J Goring, Christopher T Filstrup, and Emily K Read. Creating and maintaining high- performing collaborative research teams: the importance of diversity and interpersonal skills. *Frontiers in Ecology and the Environment*, 12(1):31–38, feb 2014.

[17] Tony Clear and Diana Kassabova. Motivational patterns in virtual team collaboration. In *Proceedings of the 7th Australasian Conference on Computing Education - Volume 42*, ACE '05, page 51–58, AUS, 2005. Australian Computer Society, Inc.

[18] Peng Dai, Jeffrey M. Rzeszotarski, Praveen Paritosh, and Ed H. Chi. And now for something completely different: Improving crowdsourcing workflows with micro-diversions. In *CSCW 2015 - Proceedings of the 2015 ACM International Conference on Computer-Supported Cooperative Work and Social Computing*, pages 628–638, New York, NY, United States, feb 2015. Association for Computing Machinery, Inc.

[19] Mark De Rond and Alan N. Miller. Publish or Perish. *Journal of Management Inquiry*, 14(4):321–329, dec 2005.

[20] Edward L Deci and Richard M Ryan. Motivation and self-determination in human behavior. *NY: Plenum Publishing Co*, 1(1), 1985.

[21] A. Delfanti. Users and peers. from citizen science to P2P science, mar 2010.

[22] AnneMarie Dorland, Dawn Johnston, and Monica Jean Henderson. Movements in mentorship: Exploring shifting boundaries and roles in a faculty-graduate student-undergraduate student mentorship micro-community. *Papers on Postsecondary Learning and Teaching*, 3(1):111–119, 2019.

[23] Ferric C. Fang and Arturo Casadevall. Competitive science: Is competition ruining science?, apr 2015.

[24] David F Feldon, James Peugh, Briana E Timmerman, Michelle A Maher, Melissa Hurst, Denise Strickland, Joanna A Gilmore, and Cindy Stiegelmeyer. Gradu-

ate students ' teaching experiences improve their methodological research skills. *Science*, 333(6045):1037–1039, 2011.

[25] Sean R. Gallagher. The Use of Mobile Applications in Research. *Current Protocols Essential Laboratory Techniques*, 19(1), dec 2019.

[26] Robert M. Gordon. Psychodynamic Distance Training and Treatment: The China American Psychoanalytic Alliance Research. *Psychoanalytic Inquiry*, 40(1):56–63, jan 2020.

[27] H Green and C Hannon. Their space: Education for a digital generation, online version. *Accessed*, 4:2011, 2007.

[28] Roger Guimerà, Brian Uzzi, Jarrett Spiro, and Luís A. Nunes Amaral. Sociology: Team assembly mechanisms determine collaboration network structure and team performance. *Science*, 308(5722):697–702, apr 2005.

[29] Allyson F. Hadwin, Carmen L.Z. Gress, and Jessica Page. Toward standards for reporting research: A review of the literature on computer-supported collaborative learning. In *Proceedings - Sixth International Conference on Advanced Learning Technologies, ICALT 2006*, volume 2006, pages 1007–1011, Kerkrade, Netherlands, 2006. IEEE.

[30] Jessica Hannigan and Juan Carlos Gonzalez. Doctoral faculty teaching online: A qualitative understanding of methods to improve online teaching. *Journal of Educators Online*, 16(1), 2019.

[31] Tomislav Hernaus, Matej Cerne, Catherine Connelly, Nina Poloski Vokic, and Miha Škerlavaj. Evasive knowledge hiding in academia: when competitive individuals are asked to collaborate. *Journal of Knowledge Management*, 23(4):597–618, may 2019.

[32] Enric Senabre Hidalgo. Adapting the scrum framework for agile project management in science: case study of a distributed research initiative. *Heliyon*, 5(3):e01447, mar 2019.

[33] Kaushal Keraminiyage, Dilanthi Amaratunga, and Richard Haigh. Achieving success in collaborative research: The role of Virtual research Environments. *Electronic Journal of Information Technology in Construction*, 14:59–69, 2009.

[34] Vera Khovanskaya, Lynn Dombrowski, Phoebe Sengers, and Jeff Rzeszotarski. The Tools of Management: Adapting Historical Union Tactics to Platform-Mediated Labor. *Proceedings of the ACM on Human-Computer Interaction*, 3(CSCW):1–22, 2019.

[35] Rafal Kocielnik, Daniel Avrahami, Jennifer Marlow, Di Lu, and Gary Hsieh. Designing for Workplace Reflection: A Chat and Voice-Based Conversational Agent. In *Proceedings of the 2018 Designing Interactive Systems Conference*, volume :: of *DIS ' 18*, page 881–894. Association for Computing Machinery, 2018.

[36] Andreas Koeller. Experiences with student research at a primarily undergraduate institution. *Journal of Computing Sciences in Colleges*, 20(3):181–187, 2005.

[37] Vijay Kumar and Elke Stracke. An Analysis of written feedback on a PhD thesis. *Teaching in Higher Education*, 12(4):461–470, aug 2007.

[38] Robert Lingard and Shan Barkataki. Teaching teamwork in engineering and computer science. In *Proceedings - Frontiers in Education Conference, FIE*, pages F1C–1, Rapid City, SD, USA, 2011. IEEE.

[39] Di Lu, Jennifer Marlow, Rafal Kocielnik, and Daniel Avrahami. Challenges and Opportunities for Technology-Supported Activity Reporting in the Workplace. 2018.

[40] Jennifer Marlow, Laura Dabbish, and Jim Herbsleb. Impression formation in online peer production: Activity traces and personal profiles in github. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*, pages 117–128, New York, NY, United States, 2013. Association for Computing Machinery.

[41] Louis Martin and Dave Tapp. Teaching with teams: An introduction to teaching

an undergraduate law module using microsoft teams. *Innovative Practice in Higher Education*, 3(3), 2019.

[42] Lisa May and Tamara Runyon. LabScrum: A Case Study For Agility in Academic Research Labs. *PsyArXiv*, 1(1), 2019.

[43] Anna T Mayo and Carey Business School. Teamwork in a pandemic: insights from management research. *BMJ Leader*, 0:1–4, 2020.

[44] B McKay and K McKay. The eisenhower decision matrix: how to distinguish between urgent and important tasks and make real progress in your life, 2013.

[45] Robert C Miller, Haoqi Zhang, Eric Gilbert, and Elizabeth Gerber. Pair Research: Matching People for Collaboration, Learning, and Productivity. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*, volume :: of *CSCW '14*, pages 1043–1048, New York, NY, USA, 2014. Association for Computing Machinery.

[46] Christine Musselin. New forms of competition in higher education. *Socio-Economic Review*, 16(3):657–683, jul 2018.

[47] Nature Methods. Collaboration through competition, jun 2014.

[48] Chris Park*. The graduate teaching assistant (gta): Lessons from north american experience. *Teaching in Higher Education*, 9(3):349–361, 2004.

[49] John Jongho Park, Nathan Hyungsok Choe, Diane L. Schallert, and Alexander K. Forbis. The chemical engineering research laboratory as context for graduate students' training: The role of lab structure and cultural climate in collaborative work. *Learning, Culture and Social Interaction*, 13:113–122, jun 2017.

[50] Xiangshi Ren, Chaklam Silpasuwanchai, and John Cahill. Human-engaged computing: the future of human–computer interaction. *CCF Transactions on Pervasive Computing and Interaction*, 1(1):47–68, 2019.

[51] K Andrew R Richards and Michael A Hemphill. A practical guide to collaborative

qualitative data analysis. *Journal of Teaching in Physical Education*, 37(2):225–231, 2018.

[52] Katherine Sang, Abigail Powell, Rebecca Finkel, and James Richards. ‘ Being an academic is not a 9–5 job’: long working hours and the ‘ ideal worker’ in UK academia. *Labour & Industry: a journal of the social and economic relations of work*, 25(3):235–249, jul 2015.

[53] Lianne Schmaal, Dirk Ostwald, Christopher Ching, Johan Van Der Meer, Anisha Keshavan, Jean-Baptiste Poline, and Henry H Wheeler Jr Brain. From the Wet Lab to the Web Lab: A Paradigm Shift in Brain Imaging Research. *Frontiers in Neuroinformatics — www.frontiersin.org*, 13(3):3, 2019.

[54] Katrin Schoenenberg, Alexander Raake, and Judith Koeppe. Why are you so slow? - Misattribution of transmission delay to attributes of the conversation partner at the far-end. *International Journal of Human Computer Studies*, 72(5):477–487, may 2014.

[55] Ben Shneiderman. Teamwork in computing research, aug 2016.

[56] Jing Tian, Yoshiteru Nakamori, and Andrzej P. Wierzbicki. Knowledge management and knowledge creation in academia: A study based on surveys in a Japanese research university. *Journal of Knowledge Management*, 13(2):76–92, apr 2009.

[57] Trello. Trello, 2020.

[58] Theresa Velden. Explaining field differences in openness and sharing in scientific communities. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*, pages 445–457, New York, NY, United States, 2013. ::.

[59] Rebecca Vivian, Katrina Falkner, and Nickolas Falkner. Analysing computer science students’ teamwork role adoption in an online self-organised teamwork activity. In *ACM International Conference Proceeding Series*, pages 105–114, New York, New York, USA, 2013. ACM Press.

[60] Caroline S. Wagner, Travis A. Whetsell, and Loet Leydesdorff. Growth of international collaboration in science: revisiting six specialties. *Scientometrics*, 110(3):1633–1652, mar 2017.

[61] Karen Ward. Research with undergraduates: a survey of best practices. *Journal of Computing Sciences in Colleges*, 21(1):169–176, 2005.

[62] Marcus Antonius Ynalvez and Wesley M. Shrum. Professional networks, scientific collaboration, and publication productivity in resource-constrained research institutions in a developing country. *Research Policy*, 40(2):204–216, mar 2011.

Appendix A

User Interview Letter of Consent

LETTER OF CONSENT

I affirm that I understand that I will be participating in a study entitled Activity Reporting and Planning in Research Team for the purpose of understanding the requirements, expectations, and suggestions to investigate the pros and cons of the CHEC blog system. Participants will be asked several questions about their experience, requirements, and an ideal tool that can be helpful for their research.

The experimenter will record my answers to the questionnaire, and I have been informed that my involvement consists of:

- Participating interview about CHEC blog system for one hour

I am aware that at any time during or after the study I can contact any of the following people with any question, concern or complaint that I may have:

- Fitra Rahmamuliani (Master student), 227003v@gs.kochi-tech.ac.jp
- Kavous Salehzadeh Niksirat (Ph.D.), kavus.salehzadeh@gmail.com or 80.2973.4873
- Xiangshi REN (Supervisor), ren.xiangshi@kochi-tech.ac.jp or 887.57.2209

I understand that my participation is voluntary, and I am free to withdraw from the study at any time without prejudice or penalty. If I elect to withdraw after participating,

my participation data will not be used in further research. The whole experiment will last one hour.

Finally, I understand that my data will be kept confidential and stored in a password protected and encrypted digital storage. It will only be accessible to the first and second authors of the study and will be destroyed after the research is complete. My data may be presented as research findings only in an aggregate form from which I am not personally identifiable. The researchers would like to audio record your participation in the study. This tape will only be used for the purpose of observation. It will be stored securely and discarded once the study is complete. Only the researchers will view this footage.

☐ I volunteered for the experiment.

Date: _____

Signature: _____

Name _____

Appendix B

User Interview Guidelines

Qualitative Research: Activity Reporting and Planning in Research Teams

Study 1. CHEC Blog System

Author: Fitra and Kavous

Session Length: 50 minutes

Participant Name:

Current Education or position:

Gender:

Age:

Time/Date:

1. Instruction (10 mins)

[Read this part slowly, loudly, and let participant understand everything.]

- Thank you for participating
- First, I will explain to you what is the meaning of activity reporting and planning. An activity report refers to a summary submitted by someone to provide certain details to the higher hierarchy about his or her activities and performance over a given period. For example in the company, usually, someone will do the activity reporting to their manager or boss. Planning refers to a sequence of action steps to achieve the goal over a given period. For example, in a research lab, students need

to make planning for what should they do in one week.

- We are interested in designing a system for activity reporting and planning in a research environment. Please note that to work efficiently in a research lab, usually mentors or lab director require students to report their activities and show their plan. How they do the schedule for future events and so on. While students from their perspective might feel this not really necessary, based on the lab regulation they might be asked to do it every day, week or every month. Because actually, their supervisor needs to know how well students are doing. So today we gonna talk with you about this kind of system.
- Since you have experience of using CHEC blog system, we see your comments valuable that actually can help us to come with a more useful system. So today I wanna discuss with you about your previous experience, your requirements, and an ideal tool that can be helpful for your research.
- It is important for us in this discussion to know your "true" thoughts, ideas, and comments. We assure that the content of this talk will be confidential and except I and Kavous no one will have access to this conversation. In addition, in our report, we will use numbers instead of your name to keep you anonymous. To sum, we really appreciate any kind of critic and comment that you have in your mind.
- I will record the audio so that I can go back and review things later and make sure we get everything right, but later after making transcripts, we will delete all audio files.
- *[Ask the participant to sign the informed consent form.]*
- Now if everything is clear and you don't have a question, we can start the interview.

2. Participant's Current Approach (10 mins)

- What do you think about activity reporting?

- What do you think about planning?
- How often do you report your activity to your mentor?
- How often your students report their progress to you?
- How often do you plan your research?
- What are the things that you include in your activity reporting and planning?
- Which tools that you use for either activity reporting and planning your research?
- What do you think about your tools?
- What are the things that you find it useful in your tool?
- What are the shortcomings in your tool that you want to be improved?

3. CHEC Blog Experience (7 mins)

"Ok so now I want to talk about your experience with CHEC blog system"

- What do you think about this blog?
- How long did you use this blog?
- How often do you write your blogs?
- Do you usually write your blog regularly or you prepare only if you have a meeting?
- What did work well for you? What part of the interface particularly useful or helpful?
- What do you think of any shortcomings or something that you feel is missing in the current blog design?
- As a mentor, what do you think of your student's blog? How does it work for you to get informed about them? (International student? Japanese student?)

4. Time (3 mins)

- Do you think how often reporting your activity and planning can be beneficial for your progress? [If no answer daily, weekly, twice a month?]

- As a mentor, how often do you prefer for your students report to you?

5. Format and Content (5 mins)

"Currently, we are writing the blog and then we have a weekly meeting to verbally report it"

- Which do you prefer for reporting and planning? [Only writing? Only Meeting? Or doing both?]
- Please tell me more about that [Why?]
- So for writing, we are using text editor currently. What do you think of the current input method?
- How it could be improved?
- If you use a planning tool like a to-do list and others, do you use the same content when you are writing your blog? If yes, how do you use that information?
- As a mentor what do you want to know about your students‘ progress and plan?

6. The social aspect of the blog (10 mins)

"So, if you write the blog, everyone in the lab has access to that on the internet. Also, we are reporting it in the meeting where everyone sits and hear."

- What do you think this transparency that everyone sees each others blog?
- Who do you want to see or not to see your blog?
- What do you think if other people react to your blog? [for example, give a feedback]
- Let‘s imagine you do your blog, and you know that no one (your colleague, mentor, student, supervisor) will read it. How motivated you are to write it?
- If someone comments on your blog, who do you need the comment from?
- And whose comment doesn‘t really matter for you?
- Let‘s imagine you are in the meeting with all lab members and giving your report.

Your mentor or supervisor give a positive or negative feedback to you. (for example, praising or criticizing). What do you think of this situation?

- Let‘s imagine you are in the meeting with all lab members and giving your report. Your mentor or supervisor give a positive or negative feedback to other people like your colleague. (for example, praising or criticizing). What do you think of this situation?
- What do you think if this comment/feedback system come into real design? How it should be?
- How do you feel if your mentor/prof compare you with the others?

7. Wrap-up and Closing Questions (5 mins)

- If you would be able to design a magic tool that can help you to report your activity and plan your tasks, what should be like that? Can you explain more and why?
- I have been asking you a lot of questions. Is there anything you want to add or ask?
- Thank you for all of your time