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Support for the Cycle of Task Extraction, Goal Setting and Assessment in Research Activities

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Abstract: We previously developed a research activity concierge (RAC) system, which is a platform to encompass general research activities, and applied gamification to this system to keep user motivation high. However, even with the RAC, non-research-savvy students have difficulty executing tasks. In this research, we introduced a mechanism to support task execution in research activities by implementing automatic task extraction into the RAC.

Keywords: Research activity, task execution, automatic extraction, gamification, seminar

1. Introduction

Research consists of various activities. However, it can be seen that the everyday activities are very mundane. Scientists must often carry on without immediate visible results. On the other hand, gamification—the use of game design elements in non-game contexts (Deterding, Dixon, Khaled and Nack, 2011)—has attracted enormous interest across a range of different areas, including education (Cronk, 2012; Kotini and Tzelepi, 2015). We have developed a comprehensive gamification framework for research activities (Ohira, Sugiura and Nagao, 2015; 2016). Specifically, it provides a research activity concierge (RAC) system, which is a platform for recording and organizing everyday challenges and tasks arising in discussions and for visualizing the results when they are applied to real actions.

However, it is difficult for non-research-savvy students to accurately handle day-to-day challenges and completely execute day-to-day tasks. In this research, we focused on the discussions in seminars and introduced a mechanism to support task execution in students' research activities by implementing automatic extraction of task statements into RAC. Moreover, we conducted experiments to quantitatively evaluate the effect on research activities of the proposed RAC and a qualitative assessment by a questionnaire. The paper will report the results of supporting task execution.

2. Research Activity

The IDC (interest driven creator) theory (Wong, Chan, Chen, King and Wong, 2015) has recently been attracting much attention, and learning and teaching methods have been changing from "examination-driven" to "interest-driven," that is, students study what interests them. Also, to fully engage in research activities, researches must be interested in them. However, students often do not know what kind of activity to carry out because they have not been shown a global image of research. Therefore, it is thought that research activities can be more smoothly executed by preparing guidelines of research activities for such students. We have classified all research activities into 11 main activities and 100 sub-activities. We call this the research activity map and express it in the mind map format.

Challenges and tasks also need to be clear for research activities to be smoothly executed. In particular, students just starting their research have difficulty setting appropriate challenges and tasks on their own, and discussion within the research group is extremely important in resolving this. We have been developing and operating a system to record seminar content including videos, slides, and a summarized transcript. After a seminar, students review and organize what was discussed. Reviewing seminar content takes effort, so a mechanism is needed for focusing on salutary opinions and advice for subsequent activities and actively promoting the recording and organizing of challenges and tasks.

3. Research Activity Concierge

The research activity concierge (RAC) is a comprehensive support system for general research activities that introduces a gamification framework for organizing challenges and tasks on the basis of seminar content and visualizing research activity on the basis of the performance of the tasks. The research activity concierge system consists of three basic tools: the research activity organizer (RAO), the research activity visualizer (RAV), and the research activity watch-dog (RAW). RAO organizes challenges and tasks on the basis of seminar content, and RAV visualizes research activity on the basis of the performance and tasks. RAW is a tool that constantly monitors the information input and output from RAO and RAV, describes the current status of activity to the user, and recommends actions.

4. Task Execution Cycle

The task execution cycle consists of three phases: "task extraction" using seminar contents, "goal setting" based on tasks, and "assessment" of task achievements.

4.1 Task Extraction using Seminar Contents and Goal Setting based on Challenges and Tasks

Although looking again at seminar content including useful discussions for research activities is important, it also requires time and effort. Thus, task statements have been automatically extracted by using a machine learning model that has metadata in a seminar content and linguistic information of the utterance as features (Nagao, Inoue, Morita and Matsubara, 2015).

A user judges whether or not the statement extracted automatically is really a task statement and clicks the appropriate button on a statement list in the statement view of RAO. The task/non-task statement information is fed back as a teacher signal and is used for active learning (Settles, 2010) that updates a task statement extraction model (Figure 1). After judging a task statement, a user quotes the fixed task statement to a note view and creates a memo. Four types of progress tags can be attached to a created memo: not-started, in-progress, completed, or pending. Moreover, target actions can also be selected from elements included in a research activity map and attached to memos in the form of tags. Thus, created memos can record the research activity to which they are related.

A student with little experience of research activities often feels uncertain about how long to spend executing one of several tasks. Therefore, the time spent on each task should be managed. In this research, we introduced a scheduler for task execution as a function of RAV. In the task scheduler, graphs and a calendar are arranged, and users can see the approximate ratio and achievement status of tasks. Moreover, users can schedule task executions on a timetable. Users can plan a reasonable task execution schedule by checking their free time. The free time is calculated by subtracting the scheduled time of all the tasks from the maximum activity time set beforehand. Since RAV sets a rule-of-thumb achievement time of a target action on the basis of results of a questionnaire to students, the simple automatic scheduling function is also implemented in the task scheduler.

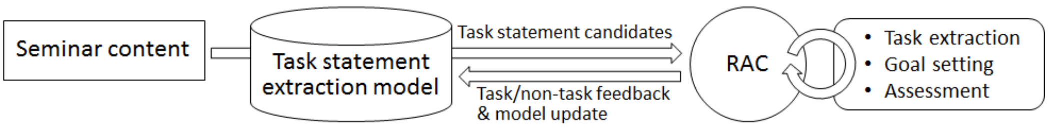

Figure 1. System overview.

4.2 Recording and Evaluation of Task Achievements

After task execution, users record details, such as the contents of execution, on the memo that quotes the task statement and change the progress tag of a memo to "completed." Furthermore, users evaluate the contents of task execution. The present RAC already has self-assessment and mutual evaluation functions. However, since the memos about research activities were private, we had not previously touched upon the assessment of the contents. In this research, we enabled the RAC to unfold the memo about a task that was clarified at a seminar before laboratory members. Then, we enabled it to receive a sensitive assessment in accordance with the contents of execution of the task.

5. Experiments

The subjects that participated in the experiments ranged from undergraduate seniors (B4) to second-year graduate students (M2) in the department of information engineering and computer science. There were eight students (B4: three, M1: three, and M2: two) in our laboratory. We randomly divided each grade into the intervention group (proposed system) and the control group (conventional system) and carried out crossover comparison tests in the first semester (Apr. to Jul.) and the second semester (Oct. to Dec.) of fiscal year 2016. The comparison result for their systems is shown in Table 1.

Table 1: Evaluation of task awareness rate of proposed (P) and conventional (C) RACs.

	System	Ave.	SD	Effective # of students
Task awareness rate (%)	P	61.4	23.3	6
	C	36.2	32.1	2

As a result of performing a t-test of the task awareness rates between the proposed and conventional RACs, a difference was found that had the significance level of .05 (p-value = 0.0481). Moreover, when two students used the conventional system, their task awareness rates became high, but the difference between systems was several percent and thus not very large. We also administered a questionnaire to users after they had used the proposed RAC. Seven out of eight students answered “strongly agree” to the statement “Tasks I forgot were extracted.” Moreover, seven out of eight students responded positively to “RAC positively affected research activities,” “I was more motivated to organize tasks,” and “RAC is useful.”

Thus, the function for automatically extracting the task statement in the proposed system effectively distinguishes between tasks. However, in the free description of the questionnaire, users who answered “undecided” to above three statements said they had “not acquired the habit of using the system,” so we can consider using push messages to urge use of the system.

6. Conclusion

In this research, to smoothly promote a student’s research activities in a university laboratory, we added a task execution support function to a research activity concierge (RAC), which is our present research-activities support system. As a result of conducting a practical use experiment of the system for students engaged in undergraduate and postgraduate research, we found that the proposed RAC was able to grasp the existence of tasks more correctly than the present RAC.

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