Adaptive recommendation of teaching materials based on free descriptions in MOOC course

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Abstract— **National Institute of Informatics released a basic course for learning programming by MOOC. In the MOOC course, it is important to support learners according to their levels and needs. In this paper, we propose adaptive recommendation of teaching materials based on free descriptions in the course. For this purpose, we visualize free descriptions in the course, and clarify the differences between learners. This will be a help to recommend supplementary teaching materials suitable for the learners.**

Keywords—Recommendation; Free descriptions; MOOC; Visualization;

I. INTRODUCTION

MOOC (Massive Open Online Courses) provides university level educational opportunities to the society. In Japan, JMOOC was established in 2013. At the end of March 2017, JMOOC provided about 184 courses, and the total number of learners exceeded 703,000[1]. To enhance learners' motivation, JMOOC provides interactivity such as discussion board. The information of free descriptions in discussion board and so on will be useful for each learner to recommend suitable supplementary teaching materials.

Analysis of free descriptions has been used for improving teaching materials [2][3]. For example, S. Kandula et. al. tried to infer the patient's information needs from his/her electronic medical records, and used topic modeling to match topics[4]. Zapata-Gonzalez et. al. described a hybrid recommender system for personalized search of Learning Objects using data mining [5].

In this paper, we propose adaptive recommendation of teaching materials based on free descriptions in the course. This will be a help to recommend supplementary teaching materials suitable for the learners.

II. PROPOSED METHOID

Fig.1. shows the proposed method. We assume that learners' expectations for learning materials change as learners progress. If we can see the expectations of learners by analyzing the free descriptions, it would be helpful to realize recommendation of suitable supplementary teaching materials. However, in order to realize such recommendation, we have to assume that the free descriptions depend on the levels of the learners.
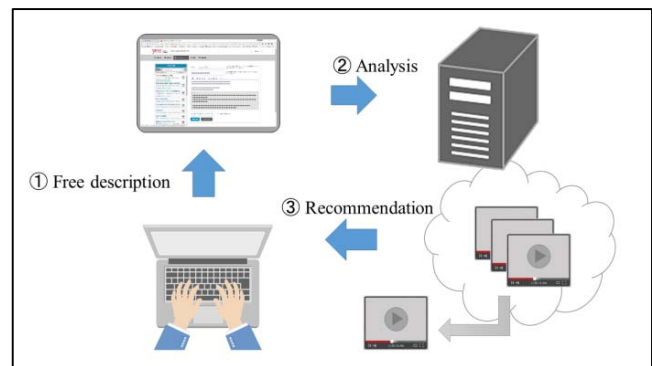

Fig. 1. Proposed method.

III. VERIFICATION OF HYPOTHESIS

To verify the hypothesis that the free descriptions depend on the levels of the learners, an evaluation experiment was carried out.

A. Course overview

The course used for the evaluation experiment is a MOOC course for programming. The course "Hajimete no P (The first step of programming)" was released by National Institute of Informatics at "gacco" which is one of the JMOOC's platforms. The lecture took place from August 9, 2016, and lasted 4 weeks. Three teachers and one navigator took charge of the lecture. In the first week, three teachers introduced attractiveness of programming and the learning method based on their experiences. As the basic knowledge of programming, they also introduced the concept of variables, variable types, arithmetic operations and arrays. In the second week, the tweets in learners' web browser were modified using JavaScript. The learners learned the fundamental elements of programming, such as statements, loops, conditional branching and functions by changing source code of JavaScript. In the third week, they learned slightly complicated programming elements, such as case statements by modifying the Racket game [6]. In the 4th week, some algorithms which exist behind the computer and

programming were introduced through game programming without PC.

Each lecture consists of 3 to 5 videos and comprehension quizes. In addition, we set up the discussion board. During the same period, some supplemental lecture videos were released for deeper understanding of programming. The number of students attending the course was 6,859, which exceeded the average number of students at "gacco" in the last year. The number of discussion threads reached 210, which greatly exceeded the average. The learners answered to the pre/post-questionnaire about this programming course.

B. Methods

The pre-questionnaire contains the information of programming experience. The levels of experience are categorized to 4 levels as shown Table 1. The number of learners for each level is also shown in the table. 2,549 of free descriptions concerning expectation to the course were also obtained.

In order to visualize the differences of descriptions, correspondence analysis was used. Correspondence analysis is a technique often used in natural language processing. Top 40 characteristic keywords were extracted and used for the analysis.

TABLE I.   CATEGORY OF PROGRAMMING EXPERIENCE.

Category	Programming experience	Number
01	Inexperience	1,309
02	I have studied programming by primary books or sites	597
03	I can make a program that I expect	391
04	I am programming daily basis	118

C. Results

Fig.2 shows the results of correspondence analysis. X-axis is the first component and Y-axis is the second component of the correspondence analysis. The position of each experience level is indicated by □, and labeled as "01", "02", "03" and "04" as shown in Table1. The keywords are indicated by ○. In this figure, if keywords and categories are located nearby, it shows that they are strongly associated with each other.

In Fig.2, category "01" is related to "amateur", "beginner" and "easy". For the learners of this category, it will be possible to recommend an easy-to-understand supplementary teaching materials. Category "02" is related to "pleasant" and "program". For the learners of this category, the contents for making actual and enjoyable program will be preferable. Category "03" is related to "way of thinking" and "language". For the learners of this category, the teaching materials that can deepen their understanding of programing will be preferable. Category "04" is related to "person" and "teach". For the learners of this category, teaching materials that are useful to teach other people will be preferable.

These results showed that the visualization of the free descriptions in the course is useful to clarify the differences between learners, and to recommend suitable supplementary teaching materials.
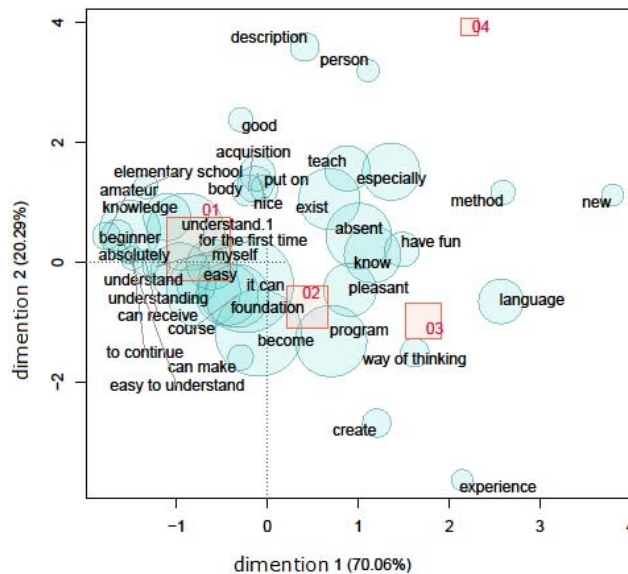

Fig. 2. Results of correspondence analysis of free descriptions in pre-questionnaire

IV. CONCLUSION

In this paper, we proposed adaptive recommendation of teaching materials based on free descriptions of the learners. For this purpose, we visualized free descriptions of the learners, and clarified the differences between learners. This will be a help to recommend supplementary teaching materials suitable for the learners. The detailed evaluation of the proposed method would be the future work.

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