Development of Micro-Blog Based Discussion Environment for Participants in University Lecture

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***Abstract*—The aim of this study is to evaluate the effectiveness of micro-blog based discussion support system in dialogue situation. Especially as a typical example of dialogue situation, this paper offers interactivity for traditional-style university lectures including lecturer and students. To support the discussions, Twitter clonal Web application is developed with LAMP and Ajax, and it works as information transmission platform enhancing interactions and collaborative activity on the virtual space. The proposal system is working during lecture, where the Ajax based user interface is dynamically updated in real time. All students can post their comments and questions by the form of short message through the web browser on each own cell/smart phone or PC under unique handle name. The proposal system is only available within local area network, and only messages about the contents in the lecture are accepted by operational guideline. The proposal system continues to work during lecture, and it keeps the participants updated about the interaction. The situation of discussion also keeps displaying in projector screen or lecturer's own PC, so the lecturer can get to know the looks of students such as the depth of understanding and the difficulty level of the contents, and besides, students can easily cooperate with each other. The features of the proposal system are designed by reference to the advantages of some previous works on discussion mining and collaborative learning.**

***Index Terms*—Supporting Discussion Activity, Micro-Blog Based Discussion Support, Twitter, Web, Discussion Mining, Collaborative Learning**

I. Introduction

THE authors have previously developed an interaction support system between participants in lecture for promoting knowledge distribution and improving reusability of knowledge [1]. The authors have been now interested in a conspicuous characteristic of social Web typified by Twitter, interactivity and real-time property, and proposed a discussion support environment which positioned a website of micro-blog based message board as information transmission platform. The proposal system has been designed to be intended for lectures in university. All audiences, who are students in the case of university lecrtures, can post their questions and comments during lecture at any time when they need. All participants can always see the present condition of discussion and also its process on the Web through browser on their own PCs or smart phones since the proposal system automatically continues to update the interactions in real time. Most of all, the proposal system can entertain many students, so we consider that it has a potential for stimulating discussions. Similarly the students' messages can help the lecturer to teach their understandings and to schedule the progress of his lecture since the lecturer can check obtained questions and comments quickly. The students can also offer each other advice and assistance to understand the story of lecture, so the lecture with the proposal system will be more fruitful than the usual typical lecture without some information and communications technology (ICT) tool. Additionally the authors have thought to be valuable for utilizing the history data of messages stored in database. As for the technology front, the proposal system has been implemented by micro blog based web application with LAMP. To perform real-time property, the user interface was developed by Ajax, automatically updatable client side Web interface technology, then it can work simultaneously with real discussion. While taking a lecture, virtual interactions are concurrently generated on projector screen, each one's computer screen, or each one's smart phone. The authors expect that the virtual interactions might activate the usual lectures.

This paper examines the effectiveness of the proposal system for supporting lecture and its progress management by actually introducing the real discussion situation on a trial. Specifically, the effectiveness was evaluated by a research meeting in laboratory. The final goal of this study is to apply for university lecture with a lot of students. Until now, we completed the basis environment and operational guideline of the proposal system. This paper reports the experimental results obtained by a meeting in an author's laboratory for junior year students. From the experimental results, we felt that the interactivity in discussion were activating more with the support of the proposal system.

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II. Related Works and Background

A. Related Works

There have been many researches for supporting interactions in dialogue situation, and among them, developing systems to provide knowledge sharing and to generate knowledge distribution have attracted much attention. The purpose and scale of dialogue situation are diverse. For example, seminars or meetings in laboratory are the case of the small scale, on the other hand, conferences or lectures are the case of the large one. Today for the various dialogue situations, computer based communication support systems have been developed which can smoothly feedback listeners' thinkings, opinions, comments, questions, and understandings to the lecturer or speaker, and the subject is a hot topics as research in the field of ICT [2]. With sophistication of ICT and dissemination of cheaply-available personal digital devices with high-performance and multifunctions, the environment to implement the usual ideas for supporting knowledge

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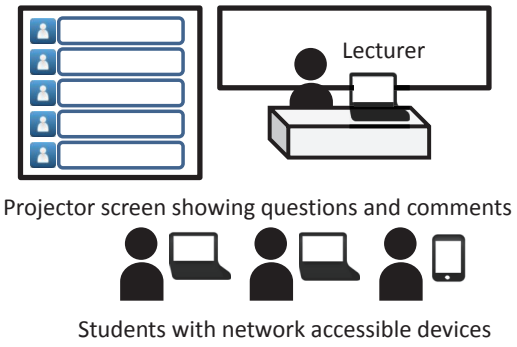

Fig. 1. Usage Example of the Proposal System

distribution is now being enhanced. As previous works promoting knowledge sharing and distribution in dialogue situation, an interactive lecture by sharing screen and the use of digital pen [3], an automatic discussion development by voice recognition technology [4], and an acquisition technique of nonverbal interaction by motion capture and camera devices [5] are held up as the examples. Furthermore many researches of ICT in education have dealt with lectures and classes as dialogue situation, and they have reported some support methods of the interaction. As a typical example of these, we can show a report developing a lecture support system which can obtain questionnaires and student's answers from portable digital devices such as cell phones, and display these results on the sharing screen according to lecturer's question. In recent years, these practice cases and efforts can be usually seen in journals and conferences in education.

B. Background

As usual, typical academic meetings such as presentations in research conferences and university lectures have followed the presenter-centered progress. The format based on the typical lecture has been enough only for the organization that there is a presenter who has advanced knowledge on a specific field, and the presenter provides an explanation for audiences where most of their knowledge is relatively-even. However, when audiences' values or understandings on learning areas have extremely diversified, the typical lecture form is insufficient. The case is also similar that the progress of lecture fully depends on discussions between participants including the speaker. These two cases are prominent example requiring positive statement from audiences.

Let us think the case that there is large difference in the basic knowledge or background of learning process between audiences in lecture. This situation is already common in communities such as recent universities because this type of community is usually large scale, and it accepts people with various types of values. Under this situation, the progress management of lecture and determination of lecture contents are difficult for the lecturer without participants' statements. If the lecturer can positively obtain the responses of participants each time during the lecture, the lecturer can immediately reflect the obtained comments into the just lecture and future lectures. As the result, entire understandings and satisfactions may be improved. Furthermore, if there is an environment for voluntarily producing complementary collaborative activities from participants, each participant can help and complement each other. As the result, the lecturer will not have to respond questions from participants individually, and then smooth progress of the lecture may be possible. It is important factor that the relationship of all participants. The answer from a participant is more efficient than from the lecturer because the difference of understandings is relatively small between participants, and psychological hurdle for asking questions is low.

III. Proposal

The system developed by this paper provides virtual communication opportunity similar to Twitter. The difference from Twitter is the usage which the proposal system is used in real dialogue situation and it is applied to only closed local network environment, but Twitter is used in open network environment on the Internet. Interactive information distribution between participants in discussions would be supported by the advantage of micro blog based social Web, immediacy. At present, the proposal system covers university lectures as an application example of dialogue situation. The concept of the proposal system is shown in Fig. 1. The proposal system is a Web application implemented by LAMP: Linux, Apache, MySQL and PHP. Ajax based UI of the system is displayed at exclusive screen during lecture, so all participants in lecture can share the condition of virtual discussion updated in real time. Each participant necessarily brings some kind of network accessible digital device into the lecture, and the network usage is available in the lecture room everywhere without regard for wired or wireless. This is an important precondition of the proposal system. Lecture rooms in the authors' institute have two projector screens, and different contents can be displayed each other. Therefore for example, the proposal system is thought to be used by that the one screen displays UI of the proposal system, and the other displays lecture materials. Even under the environment with only one projector screen, the proposal system is also available by using extension display setting, which can display different contents between PC and projector screen like multi monitor. In this condition, the lecturer's own PC monitor shows the proposal system, and the projector screen shows lecture materials.

As previous arrangement to operate the proposal system, each participant accesses to the Web server through Web browser and login to the system under unique ID. All participants make the system operational with active window in accordance with the lecturer's direction, so the condition of discussion continually-updated is always available from each participant's device including the lecturer. The participants may freely post their message by inputting the message to the posting form during lecture, and the result is instantly reflected to the UI owing to Ajax with jQuery. With the proposal system, interactive information distribution will be activated, and comments and questions from the audiences will be sent to the lecturer instantly and casually. Not only the opportunity to send messages from audiences to lecturer, this study expects that collaborative activity between audiences will be easily generated during lecture. The lecturer proceeds the discussion with checking UI of the proposal system in the interval of lecture. If an interesting comment or an important question is posted, the lecturer can respond or can add the explanation about this message quickly. Also the messages may be useful for adjusting the lecture speed and

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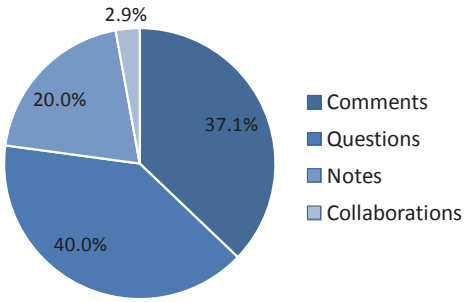

Fig. 2. Rates of Posts in All Presentations

making lecture materials because the contents of messages are related with the degrees of understanding. The more the system is used, the more the log data is automatically stored, and obtained log data is thought to be extremely valuable because it will be available for data analysis. Lecturer can pursue his/her talk with real time feedback from audiences' comments, further interactivity is expected more than the usual format of university lectures.

IV. Experiment

A. Experimental Conditions

This section shows experimental conditions. The proposal system is designed for applying real lecture, but this paper used it for a small dialogue situation and evaluates its effectiveness because the main work of this paper is preparing for introduction of the proposal system into lectures. Specifically the proposal system was applied for an annual research meeting in laboratory. This paper expects the members in laboratory to give much data because the relation of members in laboratory is closer than the relation of audiences in lecture, so psychological hurdle for posts may be relatively low. One university teaching staff (academic adviser) and ten junior year students joined in the experiment. The meeting theme was senior year students' research subjects reported from the interim presentation held a few days before. In the experiment, each research subject was discussed with the abstract papers. Two experiments were conducted once a week, and each experimental time was 60 minutes. In the first experiment, the academic adviser concentrated on speaking all research subjects, and did not post. The participants were instructed to freely post their honest opinion during the presentation. Some examples of messages were previously shown, such as an honest feedback about the subject, a proposal which can improve the idea more, a question about difficulty point, and a negative opinion. There was no restriction on the number of posts and its content, and all messages followed individual initiative. In the second experiment, each student gave a presentation on a research subject he/her interested in, and at that time, the academic adviser joined posting together with other students. 9 of the audiences were with PCs, and a audience was with a smart phone. The first experiment gave each presentation 15 minutes where there were 4 presentations, and the second experiment gave each presentation 10 minutes where there were 6 presentations.

B. Results and Discussion

Each experiment obtained the average of 257 posts. Each post was classified into 4 groups according to its content by the authors' vision.

- **Comments**: Thinkings, statements, proposals and objections.
- **Questions**: Questions about exploration.
- **Notes**: Posts reciting important points and provisions of related information.
- **Collaborations**: Questions for an audience's post, and answers to an audience's question.

The rates of 4 groups are shown in Fig. 2. Collaborative activities were fewer than originally expected, but the rate of collaborative activities is over 50 % if the provisions of related information and the proposals are classified into the collaborations. Therefore we can consider that the interactions between participants was enough supported. The result provides a future work, development of an automatic classification method based on relationships between words.

The tendencies of the posts depending on the contents of presentation were examined by a network analysis method. In this analysis, words in each abstract paper of presentation were used. Relational strength between words was calculated based on the probability and the frequency of appearance of words in an abstract paper, and then a word-network diagram was generated where two words with strong relationship were connected. We can visually understand the characteristic of presentation from the word-network diagram. Two typical examples are shown in Fig. 3. The size of nodes and the width of links between nodes correspond to the appearance frequency of words. The word-network was generated by extracting pairs of nouns, verbs, and Japanese specific irregular conjunctive nouns (Sa-gyo irregular conjugation). In the word-network, each pair of words forms some clusters. For example in Fig. 3 (a), there is a large cluster. In contract, Fig. 3 (b) has some clusters. The cluster itself is assumed to be a topic because the cluster is a group of words spoken together. So Fig. 3 (a) is a presentation with one large topic. This paper discussed word-network diagrams in relation to

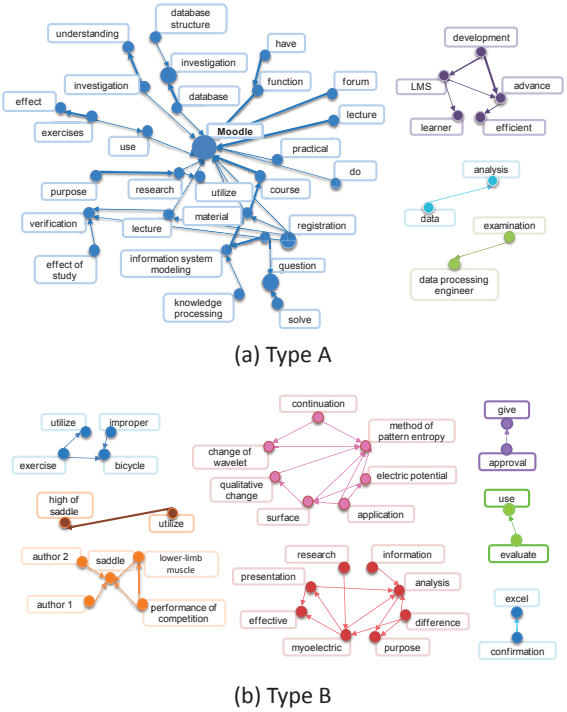

Fig. 3. Network Structures of 2 Types of Presentations

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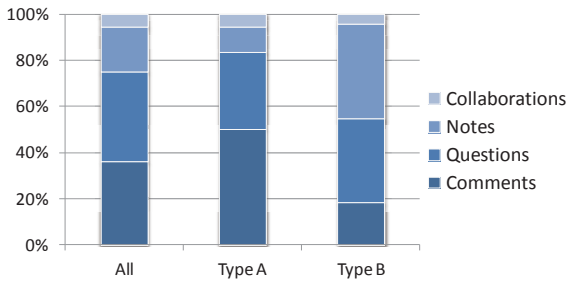

Fig. 4. Rates of Posts depending on the Type of Presentation

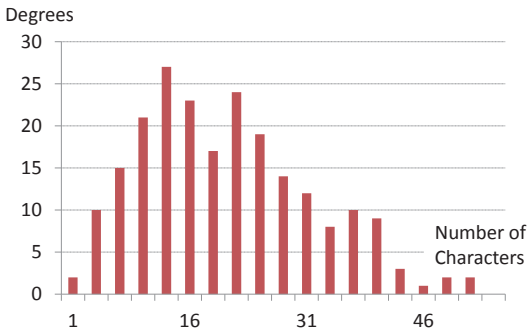

Fig. 5. Frequency Distribution depending on the Number of Characters

the contents of posts. In the presentation with one core topic (large cluster) like Fig. 3 (a), there was a tendency that a lot of proposals about the presentation or each one's opinions were received. On the other hand, in the presentation with some small clusters like Fig. 3 (b), there was a tendency that a lot of notes and questions were received. To ensure the results and discussion in Fig. 3, the rates of posts depending on the word-network structure was made as shown in Fig. 4. From Fig. 4, the contents of posts were noticeably different depending on the word-network structure.

Overall tendency is as follows. The number of posts was relatively few in the presentation whose objective was easy-to-understand or detail was difficult. On the other hand, the number of posts was larger in the presentation whose explanation of preconditions was insufficient. In the presentation easily understandable, there were many posts which had nothing to do with the progress of presentation. When speaker shows many concrete examples in the presentation, many posts were received which deeply related with the progress of presentation. This tendency was similar in the presentation which was conveniently added some supplemental explanations. As mentioned above, the number of posts and their contents were notably changed depending on the format of presentation.

The number of characters of all messages in a dialogue opportunity was examined. Fig. 5 shows the frequency distribution depending on the number of Japanese characters. We can see that most messages were with short sentence from Fig. 5. The average of characters is approximately 20, and there were few messages with over 50 characters. After the experiment, the proposal system was subjectively evaluated by the interviews from speakers and audiences. According to speakers, it was enough to understand the audiences' points even messages with short sentence, so the speakers could timely add the exploration in response to the messages. The proposal system was evaluated as effective discussion support by the speakers. Additionally, most of audiences said that short sentence based post is convenient because the input work of short messages from keyboard is not a heavy burden even while listening presentation. And also there was an opinion that the meeting with the proposal system was more exciting than the usual because the message board was frequently updated owing to the short sentence, then the virtual discussion could be developed along with the progress of real presentation. Therefore this paper concluded that the proposal system is effective as discussion support for all participants in dialogue situation.

V. Conclusion

This paper established a micro blog based information transmission platform for university lectures to provide interactivity and collaboration opportunity between participants including speaker and audiences. This paper conducted some experiments to confirm whether the proposal system can generate opportunity for questions and comments to the speaker, and can promote audience-to-audience communications. From the experiments, the proposal system was efficient for supporting the progress of discussion for speaker. Most of obtained messages were 50 characters or less, but audiences give us many feedbacks that short sentence based post is the most suitable because the audiences have to post while listening presentation. Each message was an adequate amount of characters for speakers to check while presentation, and was enough to understand the point of discussion even short sentence. Speaker could feed some important points back into the presentation immediately. As this paper had applied the proposal system for the small lecture, the proposal system is thought to be effective as lecture support method because students' comments and questions were directly obtained during lecture.

In the near future, the proposal system will be introduced on a trial basis to a large lecture. In the authors' faculty, all students have a laptop PC, and they bring each own PC to specialized lectures in accordance with the direction of lecturer. Therefore there is probably no barrier for students to use the proposal system. Currently we have no firm operational guideline, so it will be developed through the trials to obtain sufficient and suitable comments.

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