Evaluation of Mobile Learning System for Healthcare Support

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Abstract—This paper presents an evaluation of the mobile learning system for healthcare support, which is designed and developed from view of previous research results and problems. The system is an e-mail text-based communication system independent with sorts of terminals, based on mailing-list system and approved various communications by one-stop account. The system offers users’ availability for checking their own data which is reflected by every day’s reply data, and daily mails have many variation because they are not automatically sent but nurses writes and sends every day, which let e-mails not routinely but humane and improved. We have validated the system by the field test, where we have evaluated and discussed the results.

Keywords: healthcare support, mobile system, e-mail communication, system evaluation

1. Introduction

Health is essential for us human being to live a happy and pleasant life. We need to sustain the motivation to keep healthy habits. Research data by Japanese Ministry of Health, Labor and Welfare address that health consciousness of the Japanese people is getting higher and higher in these days. At the same time, however, the number of people who claim their health problems is increasing. This may be because life styles of Japanese people change and that cause of the irregular life cycle and increase of stress. That indicates many people have any health problem caused from lack of normal nutrition or activity, though high health consciousness. We insist that it is important to have adequate health consciousness.

[1] reports that university students who have high health consciousness make good health action. Furthermore, health problems for aged people should be more severe. We believe people should raise health consciousness in younger ages for preventing health problem. Overweight may not only causes into health disorder, but also affects future life style, and so it is very important to care for weight. We focus on healthcare education as preventing health disorder of student youth and improving “health literacy.”

There are some researches for healthcare support systems. [2] researches and develops healthcare system in universities using Web and mobile system. [3] studies calories management for healthcare support using mobile phone applications. Above systems, however, have problems for our targets as below:

- System complexity for various carriers,
- Lack of health consciousness for nutrition, and
- Lack of communication between students and health office.

System complexity for various carriers causes from Japan-specific matters. In Japan, there are some carriers, which have many equipment types and no compatibilities for contents service. For that reason, we have to pay tremendous cost if we support all equipment. We thus introduce a generic mail-based communication system that can be used by almost all mobile phone terminals.

Furthermore, our system supports not only mobile phone terminals but also other equipments (PC, PDA, and so on) which can send/receive mails, and that leads various approaches by various equipments. We can operate the system only by normal mails, and that means users should not learn additionally how to use, and so the system can be regarded as easy-to-use, lightweight, and generic.

We expect so called “Recording diet method” effect by sending plain-text e-mails written by students themselves. The method is to lead dietary effect for users by recording their daily meal data, and then reinforcing consciousness of caloric intake. In Japan, “Recording diet method” is one of popular diet methods. For instance, [4] researches a recording system of caloric intake by taking and saving each meal image. [5] develops a Web-based “Recording diet method” system and examines field tests. This system expects to improve casual human communication by forcing students to describe health management data and to send mails. [6] explains that students who have moderate dietary and physical exercise habits tend to be tolerant to stress and emotional control, and interventional supports for personal stress and lifestyle is a effective method to train self-management for healthcare activity.

We have been researching learning education support systems[7], [8]. We have then applied and improved these researches into the healthcare system for aiming at innovated methodological system, and have had some field tests[9]. This paper addresses our new healthcare system for communication healthcare, which have solved some problems, which are indicated in Aimos field tests. We have had field tests by the new system. We discuss these matters, and then attempt interventional support to students by frequent
communication. We express features and effects of our system, and discuss field test results as follows.

2. Problem for Previous System

We had researched and had a field test for above health consciousness by Aimos. On that system, users send e-mails with everyday’s caloric intake and amount of physical exercise to a medical office, and the data are stored in a database on a server. Medical office staffs (including nurses) advise each user adequately using the database. The system is e-mail based communication system, and then all of users (not only students but medical staffs) communicate to each other by only emails. We evaluate the system by some field tests and find the following problems;

- Lack of consideration for user interface as prompting health care support
- No function of accessing user’s own data
- Gladual decrease of motivation of students

As Aimos was originally developed for lecture support system, WUI (Web User Interface) for medical office is designed mainly for checking of lectures and results of marking point and so on. For instance, result data are presented mainly with each student, though medical staffs need to review, weight data for all students at a glance. As above, WUI should be improved for medical office use. Students cannot access to their own data such as previous weight records, advices from medical office, and so on.

Furthermore, we find obvious fall of reply rate during the examination period in the field test, and that implies the lowering of motivation for students. We regard retention of motivation as essence for replying everyday’s questionnaire and maintaining healthcare.

As discussed above, we designed originally for healthcare support from scratch, and develop a new system which is essentially different from Aimos, improved from lecture support system. The new system supports flexible communication on Web and/or e-mail hybrid methods for sending information, though Aimos supports only Web interface for sending/receiving questionnaires. Furthermore, WUI is improved as medical office’s requests such as showing questionnaires replies, and so on.

User interface for students is not changed, where the new system receives questionnaire e-mails from students every day. The questionnaire flow is as follows: First, the system sends an e-mail, which consists of questionnaires, to each student everyday. The questionnaire prompts to reply caloric intake, weight, amount of physical exercise, and so on. Then each student reply with quotation of questionnaire texts, and the replies are automatically analyzed and stored by the system server.

3. Features of New System

Our new system is designed and developed as follows (see Figure 1);

- E-mail text-based communication independent with sorts of terminals
- Based on mailing-list system and approved various communications by one-stop account
- Users’ availability for checking their own data which is reflected by every day’s reply data
- Daily mail variation which is not automatically sent but nurses writes and sends every day, which let e-mails not routinely but humane

As mentioned above, each mail to students are not automatically delivered but written and sent manually by nurses, and that let mails human-like, which may avoid boring with the system. At the same time, we try to send personal mails more frequently. For instance, we have short advices to students who do not reply frequently, or have irregular meals. Furthermore, we modify the questionnaire; For instance, the last item “Tell the good thing of the day” is changed to a vague question “Tell any message or just a tweet” which is easier for students to write down.

We have field tests for students. The tests consist of below:

- Firstly, we collect health data (weight, caloric intake, physical exercise, etc.) through e-mail communication
- Secondly, the server analyzes the data and classified into the database.
- Thirdly, the medical office checks the database and makes some advices respectively if required

4. Results and Discussion

We have had a field test and the results are very interested. In this test time, we regarded as test subjects who reply more than two times, including students of very few replies during the test period.

Table 1: Field test statistics.

<table>
<thead>
<tr>
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<th>25</th>
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<tbody>
<tr>
<td>Return rate</td>
<td></td>
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<tr>
<td>Average</td>
<td>31%</td>
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<tr>
<td>Max.</td>
<td>59%</td>
</tr>
<tr>
<td>Min.</td>
<td>15%</td>
</tr>
<tr>
<td>Weight up/down rate</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>-0.29kg</td>
</tr>
<tr>
<td>Max.</td>
<td>-3kg</td>
</tr>
<tr>
<td>Min.</td>
<td>+3kg</td>
</tr>
<tr>
<td>Numbers of input characters (all)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>38.5</td>
</tr>
<tr>
<td>Max.</td>
<td>989</td>
</tr>
<tr>
<td>Min.</td>
<td>2</td>
</tr>
<tr>
<td>Numbers of input characters (as for free format)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>18.9</td>
</tr>
<tr>
<td>Max.</td>
<td>907</td>
</tr>
<tr>
<td>Min.</td>
<td>0</td>
</tr>
<tr>
<td>Free format ratio in questionnaire (Average)</td>
<td></td>
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<td></td>
<td>87%</td>
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In this test, there are few students who reduce weight very much. Reply rate is, however, much raised rather than our previous test (see Figure 2). This is quite interested because this test period includes some holidays, which may decrease motivation of students.

Weight change of students varies from -5kg to +3kg. In general, students who frequently reply seem to reduce
weight. Moreover, according to hearings after the field test, even students who rarely reply do not ignore e-mails from medical office but just read those. Those imply human-written mails promote to read mails, and by those mails, students feel tight connection to the medical office and so they may be relieved. We believe that is a main reason for improving reply rate, as students evaluate e-mails fairly good.

One sentence message included at the last part of the questionnaires filled about 87% of all mails. Among those, quite many mails are not concerned with dieting but just with student life. We assume the message communication is dealt with a kind of mental healthcare matters, though it is not sure.

Furthermore, we investigate the hearings by text-mining method. We introduce correspondence analysis[10] combined with Japanese token analysis. (see Figure 3)

For analysis purpose, we categorize students into 3 class:
- “minus” : students who reduce weight over 2kg.
- “fair” : students who reduce weight under 2kg.
- “plus” : students who gain weight.

This figure shows some correspondence with “minus” students with the words “Yaseru” (reduce weight), and with “plus” students with the words “Shokuji” (meal), though

Fig. 1: System flow.
those classification is not so clear. We have to investigate more precisely.

5. Conclusion

We have developed a new system and evaluate the system by the field test, where we have many important data and discussion. In the near future, we analyze the results more precisely, including data-mining methods. We may find the nature properties of rules and then improve the system. For instance, an inspiration mail is sent to who does not reduce weight well, or does not reply so frequently, and the mail may enforce consciousness to the student.

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