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Essay

An Interactive E-learning System for Practicing Team Care by Interdisciplinary Collaboration

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Abstract

In recent years, remote education systems using telecommunication tools such as television and the internet have been developed and applied not only in open universities and preparatory schools, but also in areas where educational resources are scarce. However, these systems do not make immediate responses to questions from the learners in real time. In addition, an interactive education system connecting the computer system and the learners who need to practice team care by interdisciplinary collaboration has yet to be developed. That is the reason why we present "interactive e-learning system for practicing team care by interdisciplinary collaboration" and explore the possibility of introducing such a system into practice. As regards future considerations, it is important to develop effective learning content for this system. This content promotes and reinforces the essential attitude and skills for practicing interdisciplinary team care. Determination of the effectiveness of its application depends on whether the learners can practice interdisciplinary team care virtually and apply their learning to real situations.

Introduction

Today e-learning systems, remote education systems using television and the internet, are widely used not only in open universities and preparatory schools, but also in areas where the education system is underdeveloped. By using such systems, educational resources can be shared among different areas, and as a result the educational gap can be reduced.

However, the conventional e-learning system cannot respond to questions from learners whose lesson is given over a broadcasting system. The lesson proceeds through one way communication without knowing how much the learners have learned or monitoring their state of mind. Furthermore, since only pre-organized teaching strategies and presentation patterns are shown, it makes the computerized learning program boring and causes a drop in the motivation to study [1].

We reviewed the progress of the use and development of remote education systems in team care education

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using television and the internet. We have discovered that there is a need for systems that focus on interdisciplinary team care, but the research effort on team care practice and the reviews on its education are relatively small.

In order to improve the quality of team care, it is important to focus on the methods of collaborative work within a team at the level of university and technical college education. After graduation, students need to apply new learning related to collaborative work with other specialized professions, and keep their motivation for further learning and the self-discipline to maintain a high standard in delivering the quality of their medical/welfare services. In addition, to clarify the above mentioned practices, both classroom instruction and clinical field work are required to provide the learners with consistent educational structure and processes. The necessity for interdisciplinary collaboration to practice team care as shown above is recognized by health care specialists [2–4]. Also, for interdisciplinary team care to be effective, simply gathering different specialists is not enough.

In other countries, pilot programs in interdisciplinary geriatric training are developed for medical and nursing students [5]. It is also reported that the clinical practice for studying the perspective of family care using a team-based approach is considered to be useful to learn collaborative practice [6]. Furthermore, clinical education based on the interdisciplinary model has been carried out at the University of California, San Francisco since 1997 [7]. Stubblefield et al. [8] reported the effectiveness of the program in the master course at the University of Washington to acquire the skills necessary for interdisciplinary team care. We have also done research for practicing interdisciplinary team care in Japan [9–12].

Lee, et al. [13] has promoted interdisciplinary community work and made progress on the development of the infrastructure to learn health science academically, and manage information systems powered by databases and curriculum management systems. However, there has still been no report on an interactive education system which allows learners to practice team care through a computer interface. Also, these systems do not make immediate responses to questions from the learners in real time. In addition, an interactive education system connecting the computer system and the learners who need to practice team care by interdisciplinary collaboration is yet to be developed. The environment which surrounds healthcare has been changing in Japan. Furthermore, in order to offer high-quality medical services, healthcare professionals need to continue learning about interdisciplinary team care. In order to solve these challenges, we present an "interactive e-learning system for practicing team care by interdisciplinary collaboration" and explore the possibility of introducing it into practice.

The objective of developing this system is to combine language processing, speech recognition and image processing technologies together to produce a cutting edge model of the interactive education support system for team care practice. This system enables learners to stop lessons freely to ask questions or to take a rest and restart it from the point of stoppage. Moreover, the system enables lecturers to grasp learners' learning situations and their state of mind, and consequently give learners advice such as changing a part of the course or taking a rest. As a result, instruction can be performed efficiently. In addition to this, the system we have developed applies the natural speech recognition technology and audio composition effect technology so that it can recognize learners' speech and presume their intentions from the speech. This allows the system to present audio and animation which vary according to learners' real time conditions, and thus it makes interactive learning possible.

The Structure of the Interactive Education System

The central components of the system are the 'Central System' and the 'Learner Management System'.

1) Central System

Contents of curriculum can be made and saved on memory devices in the central system which is composed of the main control computer, broadcast control computer, recording control computer and master creation computer. Instructional programs are made with a video camera which is connected to the master creation computer and the recorded data is sent to and sorted by the recording control computer and then stored on the hard disk. When the main control computer receives a request from the learners while the program is being broadcast, it can pass the request to the broadcast control computer which will search the requested record and display the result to the learner through the main control computer (Fig. 1).

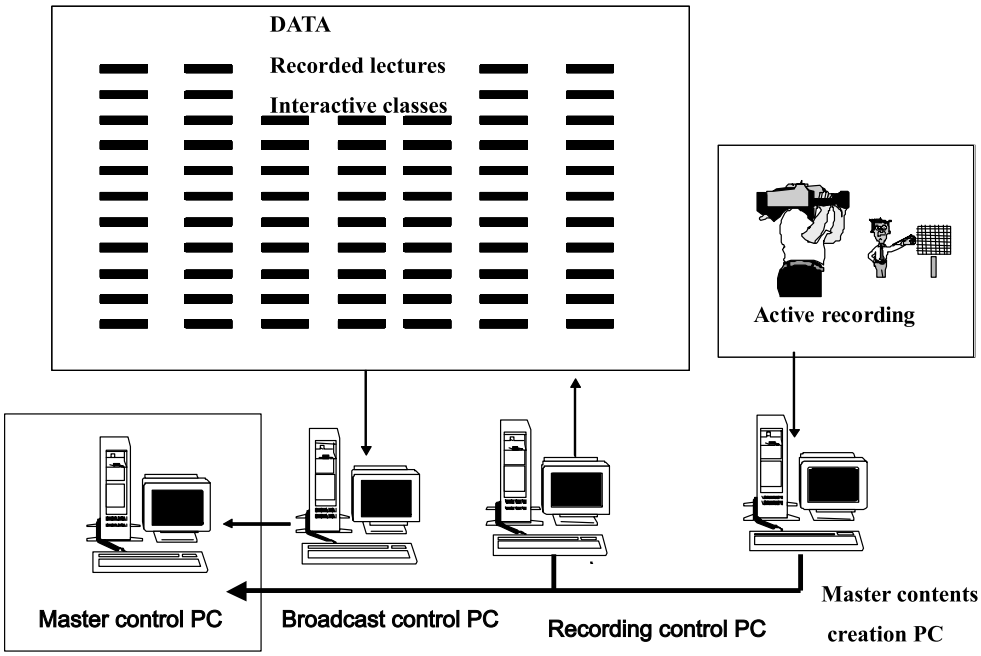

Fig. 1 Central System

2) Learner Management System

The Learner Management System (question server) consists of information collecting computer (ICC), a picture/voice data computer (PVDC) and an e-mail server computer (MSC), which are all controlled by the main computer (Fig. 2).

The learner management system collects information from the learners and carries out an identification process. For instance, it confirms the lecture schedule and manages the course credits of the learners. The PVDC deciphers oral questions from the learners using speech recognition technology and sends the replies in an audio format. Also, it discerns the learning level and the state of mind of the learners from the visual and audio (facial expression and voice sound) information it collects. The MSC receives questions via e-mail from the learners and sends out replies to them.

The PVDC collects a student's information (complexion, idiosyncrasies of speech) at the time of the first contact. It estimates the user's change of emotion, and change of condition based on that information. It asks for a user's condition verbally, with questions such as 'Do you feel alright?' and 'Are you okay?'. It further assesses the user's state of mind through analyzing the user's voice with a speech recognizer. The recognition accuracy level decreases in a multi-speaker environment, or an environment with a high level of noise interface. However, if a microphone with high speech recognition performance is used, a robust

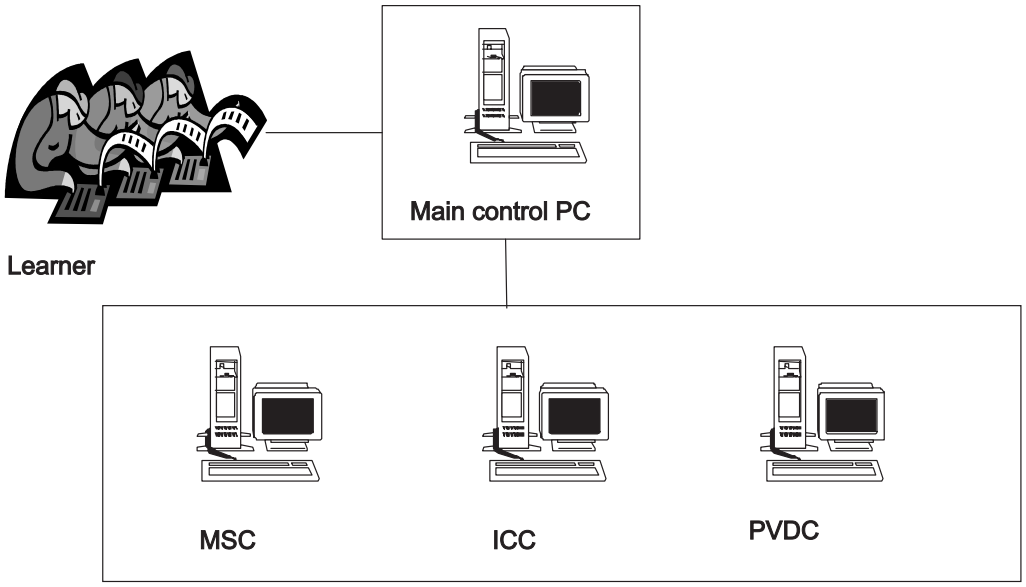

Fig. 2 Learner Management System: Question Server

performance is realizable in such environments.

3) Total Management System

The level of understanding, motivation, the state of mind and attentiveness of the learners are managed under this system. From the analysis of sound, rhythm, tempo, accent, speed and frequency of speech, the state of mind of the learners are deduced. This analysis combined with an evaluation of the questions the learners ask makes it possible to give advice on issues such as continuation or discontinuation of lecture or even transfer to a lower level class.

Learner Interface

The Learner Interface consists of a CCD camera, microphone and speaker in the learner's computer. The learner can ask questions verbally using a microphone. The questions are sent to the voice data computer, then the voice is deciphered and the question is processed. The samples of the answer can be searched from a "Q & A" database automatically, and sent to the learner. If the answer cannot be found in the Q&A database because there is no answer present, or there is a deciphering error in the voice data computer, the learner can enter a question using the keyboard for further help. The question will be sent to the mail computer if the answer dose not exists in the "Q & A" database and will be considered by the lecturer. The answer will be sent to the learner by the mail computer and added to the "Q & A" database later.

The pictures of the learners which are taken from CCD camera are sent to the information computer. By using image processing technology, the central system can monitor the state of mind and attentiveness of the learners (Fig. 3).

User's study condition is assessed by this system in the following steps:

1) Analyze user's motions with a CCD camera.
2) When there is no motion at regular time intervals, the system assesses user as "sleepy, sleeping, studying with intensity".
3) Gauge users reactions to questions generated by the system.

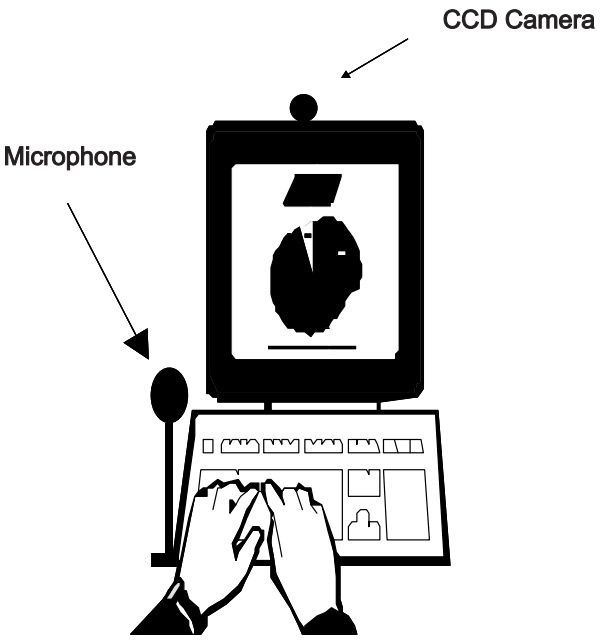

Fig. 3 Learner Interface

The system assesses the situation as a) slow answer (sleepy), b) without answer (sleeping), c) prompt answer (into studying).

Description of Demonstration System and Discussion

1) Demonstration System

A demonstration system of the education of team care practice has been built to test the effectiveness and practical usefulness of the system.

The learner needs to log in to the system using the password registered beforehand. Then, the learner chooses a lecture from the lecture table. While taking the lecture, the learner can stop it anytime, ask a question and restart it at the point of stoppage. The system grasps the learner's learning conditions and their state of mind and gives advice such as changing a part of the course or taking a rest. As a result, instruction can be performed efficiently.

Figure 4 is a scene of a lesson using the demonstration system. First, the learner studies a patient's case carefully in order to commence practicing virtual team care. In the next step, the system asks, "Who is going to take the leadership for supporting the patient?" Then, the learner is asked to select the most appropriate answer from the choices displayed. For example, (1) psychiatric social worker (PSW) takes leadership in the hospital, and (2) public health nurse (PHN) takes leadership in the community.

After selecting an option, an explanation of the right answer will be displayed on the screen. For instance, "In the case of patient discharge, the person who takes the lead in assisting the patient moves from hospital to community. Therefore, it is very important to transfer the patient information between the staff of the hospital and the community support institutions. Then, this information lets the PSW and PHN decide who takes the lead and should perform case management so that the expected role can be grasped clearly". Additionally, if the learner's answer is not certain about this explanation, he/she can ask questions to the system via e-mail (Fig. 5). Since this system is a Japanese system, figures 4 and 5 are related to the portion shown in Japanese.

Fig. 4 Learner Interface: Lesson Scene in the Demonstration System

Fig. 5 Advice to a Learner from This System

2) Deployments of User Evaluation and Future Studies

The following are examples of the interview evaluations from the students (n=50) and teachers (n=5) who used this system.

First, these are the results of students' responses.

Is it easy to understand this system compared to conventional study?

1. The conventional study method is easier to understand. 11%
2. Same 31%
3. This system is easier to understand. 44%

4. Other 14%

Are you interested in learning by this system compared to the conventional study method?

1. The conventional study method was more interesting 9%
2. Same 28%
3. Using this system was more interesting. 51%
4. Other 12%

These are teachers' comments.

1) Students showed more interest in learning.
2) Students participated in the class more actively.
3) Teachers can easily measure the students' understanding of the course content.
4) It is problematic to learn how to use the software.
5) More time is required to prepare for high quality course materials.
6) Once materials are created, you can use the same ones many times. No need to produce them again.
7) There are fewer repeated questions from students.
8) The most difficult issues for the students are clarified.

3) Discussion of the User Evaluation

The students found the system more interesting and easier to understand than the conventional study method and teachers stated students participated more actively in class. Furthermore, teachers reported that the system clarified some of the more difficult issues for the students. Based on this evaluation, the initial results of using this system are very encouraging and suggest the system is effective.

However, we need to improve this system by responding to their feedback. For example, the accuracy of the speech recognizer needs to be increased to reduce the occurrence of incorrect recognition of questions asked by students. Although this problem can be resolved by inputting texts via a keyboard, a more reliable speech recognition tool needs to be adopted. Also, we must improve the depth and breadth of the course materials and address the problems of cost and copyright. We want to run further tests and improve in these areas.

Conclusion

We are yet to see a computer based interactive education system for team care practice in Japan. This is the main motive for us to develop an "Interactive E-Learning System for practicing team care by interdisciplinary collaboration" and explore the possibility of introducing it into practice. It leads to an improvement in students' motivational levels and enables the teacher to evaluate and examine the relevance of a student's course level. It also provides feedback on a teacher's teaching skills in an objective way. In the future, it is important to develop effective learning contents for this system. In doing so, the way the learning materials are developed and promoted is a key factor. Ultimately, determination of the effectiveness and usefulness of this system depends on whether the learners can practice interdisciplinary team care virtually and make use of on-line learning in real practice.

References

1. Lin Y, Kokichi T, Fuji R: "A interactive E-Learning System using Natural Language Processing Technology", *Proceedings of the Third International Conference on Information (Info'2004)*, Tokyo, Japan, Nov. 29-Dec., pp227–230, 2004.
2. Alpert HB, Goldman LD, Kilroy CM, Pike AW: Gryzmish: toward an understanding of collaboration. *Nurs Clin North Am.* 27:47–59, 1992.
3. Fagin CM: Collaboration between nurses and physicians: no longer a choice. *Acad Med.* 67:295–303, 1992.
4. Huntington JA, Shores L: From conflict to collaboration. *Am J Nurs.* 83:1184–1186, 1993.
5. Croen LG, Hamerman D, Goetzel RZ: Interdisciplinary training for medical and nursing students: learning to collaborate in the care of geriatric patients. *Journal of the American Geriatrics Society*; Jan, 32:56–61, 1984.
6. Makaram S: Interprofessional cooperation, *Med Educ.*; 29 Suppl 1:65–69, 1995.
7. Diana T, Edie W: Primary Care Education & Clinical Training at UCSF: An Inventory & Preferred Future, University Publications ♯4672 1/02 University of California San Francisco, 2002.
8. Stubblefield C, Houston C, Haire-Joshu D: Interactive Use of Models of Health-Related Behavior to Promote Interdisciplinary Collaboration, *J Allied Health.* 23:237–243, 1994.
9. Book written and edited by Betty F, Yoichiro T, Motoshiro M, Tetsuya T: "*The health care system for people with mental disorders –an attempt of creating team-based medical care model by interdisciplinary collaborations*"(in Japanese), Nishi Nihon Houki Shuppan Co., Ltd., 2001.
10. Book written and edited by Motoshiro M, Yoichiro T, Betty F, Tetsuya T: "*The health care system for people with mental disorders, continued – the guideline for interdisciplinary team care model and practice*" (in Japanese), Nishi Nihon Houki Shuppan Co., Ltd., 2003.
11. Isao N, Tetsuya T, Eriko A : The trend of research on interdisciplinary collaborative team care (in Japanese), *Shikoku Acta Medica*, 59:182–188, 2003.
12. Tetsuya T, Eriko A, Yasuko M, Fumiko H, Isao N, Toshiko T, Yoichiro T, Motoshiro M: Effect measurement of team care by interdisciplinary collaboration in mental health and welfare (in Japanese), *Shikoku Acta Medica*, 59:84–89, 2003.
13. Lee MY, Albright SA, Alkasab T, Damassa DA, Wang PJ, Eaton EK: Tufts Health Sciences Database: lessons, issues, and opportunities. *Acad Med.* 78:254–264, 2003.