Development and the Use of Chemistry Teaching Video Materials by Internet Browser

Noboru ASHIDA^a, Yoshihiro AOYAMA^a, Tadayosi YOSHIMURA^{b*},
and Brian T. NEWBOLD^c

^aDepartment of Electronics and Information Engineering
Fukui National College of Technology, Geshi, Sabae, Fukui 916-0064, Japan

^bDepartment of Chemistry and Biology Engineering
Fukui National College of Technology, Geshi, Sabae, Fukui 916-0064, Japan

^cDepartment of Chemistry and Biochemistry
Universite de Moncton, Moncton, NB, Canada, E1A 3E9

*e-mail : tadayosi@fukui-nct.ac.jp

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We have developed multimedia type chemistry CAL software by Netscape Navigator browser. We have converted CAL software, made by ExpandBook form, into HTML form, whose theme is for physical chemistry experiments. Multimedia type chemistry CAL material with video movie really helps students to visualize chemistry operations in practical experiments. Anyone can make a teaching document by HTML language easily if one memorizes a procedure. When we tried the intranet use of CAL software in a remote place (separate room) and video movies of CAL, it produced smooth movement and was useful for the learning student.

Keywords: HTML type CAL Software, Video Movie, Chemical Experiment

1 Introduction

Multimedia technology, which has progressed rapidly, can improve CAL (computer-aided learning) software in the field of chemical education. We developed multimedia type CAL software adapted to a QuickTime operation system in Macintosh. In particular, we edited a video movie into a short interval file and used it in CAL software. Short video presentation has a great advantage in chemistry teaching[1, 2]. In this method we developed CAL software of ExpandBook form[2]used alone, however, use from the outside (Internet) was difficult, and the dependence of the computer machine was higher for the CAL software.

Recently, the spread of Internet includes remarkable progress[3, 4]. We can establish a home page simply, because a functional word processor for Internet spreads. Internet spread recently to an education system, and then home page of HTML (Hyper Text Mark-up Language) form with a browser established in the field of education[3-5]. A browser can display a lot of multimedia information in World Wide Web (WWW), and is extremely useful for teaching materials development. We have developed multimedia type chemical CAL software by Internet browser. The advantage of developing teaching materials with a browser is that anyone can use them at any time anywhere in Internet.

2 Preparation of Chemistry CAL software with QuickTime

Chemistry teachers have a courseware for teaching in school. We enforce learning before the chemistry experimental training in our College, so the CAL materials program was developed for physical chemistry experiments in Japanese, as shown in Table 1. A student beginning an experiment uses the program and then puts the training into effect[6]. We enforced the training effect of experimental education with beforehand learning.

Table 1. Theme list of Physical Chemistry Experiments .

No.	Chapter title	Type
1	neutralization heat between acid and base solutions	HTML
2	dilution heat of dimethylformamide into water	DOS
3	molecular weight of acetone by Victor-Meyer method	DOS
4	molecular weight of nitrobenzene by steam-distillation method	DOS
5	molecular weight of naphthalene by depression of freezing point method	DOS
6	solubility of benzoic acid and the dissolution heat	DOS
7	partition coefficient between aqueous and benzene phases	HTML
8	ionization constant of acetic acid	DOS
9	physical properties (viscosity, density etc.) of ethanol and water solution	DOS
10	hydrolysis of ethyl acetate in acidic solution	DOS
11	hydrolysis of ethyl acetate in basic solution	DOS
12	inversion reaction of sucrose solution	DOS
13	adsorption of acetic acid on activated charcoal	DOS
14	point of zero charge of metal oxide colloid	DOS
15	electromotive force of concentration cell	HTML
16	decomposition voltage of electrolyte solutions	DOS
17	transport number of HCl solution	DOS
18	potential difference titration of neutralization	HTML

Multimedia type CAL material allows students to visualize chemistry operations in practical experiments. We filmed the manipulation of physical chemistry experiments whose themes were: No.1 neutralization heat, No.7 partition coefficient between aqueous and benzene phases, No.15 electromotive force of concentration cell, and No.18 potential difference titration (Table 1). We used ExpandBook Toolkit[7] as CAL building system, and prepared the beforehand CAL software with video movie[2]. A few minutes interval of video presentation can be very flexible time and encourage chemistry teaching in ExpandBook.

We have converted CAL software, made by ExpandBook form[2], into HTML form, whose themes cover physical chemistry experiments (HTML type in Table 1). Multimedia type chemical CAL material really helps students to visualize chemistry operations in practical experiments.

3 Development of Chemistry CAL Materials by HTML Language

Anyone can make a teaching document by HTML language easily if they memorize a procedure. The materials of chemistry teaching are divided into three types of information; (1) text information, (2) graphics information, and (3) video information. As shown in Figure 1, we just use text information in HTML form as a simple text. We can convert filed graphics into GIF(graphics interchange file format) file for Netscape Navigator (WWW) by the use of a GIF converter. After having filmed an experimental operation with a 8 mm video camera on video information, we can convert the filmed

video movie into QuickTime file. In that time, we cut a video movie at intervals of a few minutes to each section of experimental operation by the use of Apple VideoPlayer version 7.5.3. The memory size of video file is 93.8 MB/min. It is a very large memory because a hard disk of 1 GB becomes full with 10 files. Because a few minutes interval of video file is too big, it can't be utilized in CAL materials. We made the memory size smaller by compressing it into 5.73 MB/min (canvas size 160 × 120) by the use of Avid VideoShop version 3.0J, and could utilize it readily. Though a drawing quality of the video came off, it was compressed into one-16th of its size, and was available for hard disk.

The compressed video movie can start without any problem when we use it flexibly in a stand-alone computer. When a student wants to do an experimental study, the CAL software must start instantly. Time must not cause crowded reading of CAL software.

Figure 1. Flow chart for making HTML type chemistry CAL software.

4 Problem of Using School LAN

By using school LAN(Local Area Network), we put chemistry CAL software with server computer, and students tried to access it from a personal computer in a laboratory in order to learn individually before the experiment. There was a big problem, the cause of which was the paste account (HTML: embed style) of the video movie, as the following sentence shows:

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<embed src="../../video/file_name.mov">
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We need a time of three minutes to read the page set up two embed styles of 5 MB video movies from server computer. Three minutes of reading time is too long for students to study by CAL. We can not utilize an embed style of video movie with server and client connection of the current computer.

Why not utilize a video movie till the performance of the computer is equivalent to an embed style of video movie on school LAN? The answer is, when a student wants to look at a video movie on LAN, he/she reads it one by one from the server computer and then looks at it in order to study before an experiment. The reading time of a video movie is not so long for the student who wants to learn

before an experiment individually. The student reads the video movie of experimental operation with his/her learning as the objective. Therefore, we have set up the first image picture of the video movie on a page of CAL software, which is read and starts when one clicks video movie picture. Figure 2 shows a display set up for image style of video movie, and Figure 3 shows a display set up for embed style of video movie in CAL software.

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In this method, we can enforce activation of a video movie with effective CAL learning time. Naturally we want to utilize an embed style of video movie in a CAL system, however, this method is most effective with a video movie in performance with current machinery. When we tried the intranet use of CAL software in a remote place (separate room), the CAL video movie showed smooth movement and was useful for students learning on the LAN.

Figure 2. Display set up for image style of video movie in CAL software.

When we look at a video movie with Internet, however, it takes much waiting time very much to install a movie on a screen by oneself. For example, it took an installing time of 50 min for 0.8MB of video movie in the USA (from Wisconsin University) with Internet. Its animation time was 6 sec. In the current computer communication, we can use a movie file with LAN, but it is difficult to use it with Internet.

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インターネット・ブラウザによる化学教育 のビデオ教材の開発と試用

芦田 昇^a, 青山 義弘^a, 吉村 忠与志^b, ブライアン T. ニューボルト^c

^a福井工業高等専門学校電子情報工学科 〒916-0064 福井県鯖江市下司町

^b福井工業高等専門学校物質工学科 〒916-0064 福井県鯖江市下司町

^cモンクトン大学化学生物学科 E1A 3E9 カナダNB州モンクトン市

*e-mail : tadayosi@fukui-nct.ac.jp

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全世界的にインターネット網が張り巡らされて、あらゆる分野において利用が推進されている。教育分野においても、いろいろな活用が試みられている。その中でも WWW(World Wide Web) によるインターネット・ホームページは、利用度が高く、HTML(Hyper Text Mark-up Language) で簡単に作成できることから、その普及には目覚ましいものがある。

化学教育においても、インターネットを利用する方法が試みられ、本論文でその利用を検討した。本研究では、従来、物理化学実験の事前学習のためにビデオ映像を導入した CAL 教材を開発して個々のコンピュータで活用してきた。今回は、それを HTML ファイル変換してインターネット・ブラウザで利用する可能性について基礎的な検討をした。ビデオファイルを取り込んだ CAL 教材は、サーバーコンピュータからのビデオデータの取り込みに時間が数分間かかった。現有パソコンの通信性能では、今回は、ビデオ第一画面のペーストによる画像イメージで最初学習を進める方法を検討し、学習画面の読み込み時間の短縮・即応という成果を得た。また、イントラネット(学内)での利用においては、全画面のビデオ映像の取り込みという時間を要せず、必要なビデオ映像だけによる学習意欲の向上効果が認められ、有用な方法であった。

キーワード: HTML type CAL Software, Video Movie, Chemical Experiment