Development of a Teacher Training System for Upgrading Teaching Skills by Using ICT*

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Received for publication, January 15, 2011

An integrated Web system was developed for teacher training called Teacher’s Resources for Applying ICT Nationwide (TRAIN) in order to upgrade the instructional ability of teachers by using ICT. TRAIN enabled the watching through streaming of 218 short video modules that aim to be useful in improving the teacher’s ability and promoting the popularization of ICT in education within schools. Furthermore, a handbook was produced that explained the title, content, a screen shot and the instructor’s name, in half an A4-sized page for all of the video modules, which can be referred to when teachers select to watch them. In addition, in an attempt to boost support for self-training, in-school training and group training using TRAIN, 50 practical cases from the video modules were selected and case studies featuring advice have been produced. Instructional situations and practical cases related to these were provided together with TRAIN. 234 FAQs about the instructional ability of teachers by using ICT were provided, and study using these FAQs made possible. An evaluation for education boards’ viewers on TRAIN was also conducted.

Key words : Instructional ability by using ICT, teacher training, digitization of teaching, system development, TRAIN

1. INTRODUCTION

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) revised their curriculum guidelines during 2008 and 2009, and content relating to education using information communication technology (ICT) and information education is described in the general rules and the sections on each subject. In response to this, the Handbook on the Digitization of Education was compiled (MEXT 2009a), and the use of ICT in education is proceeding against this background.

In order to implement effective education through the use of ICT it is important that the level of teachers’ instructional ability by using ICT (MEXT 2007) is improved. Places are required where the teachers can learn the instructional abilities by using ICT, in which they are inadequate.

MEXT has developed and provided “Integrated IT in your class”, a practical case study provision system aimed at teachers with an emphasis on the use of ICT system. (Integrate IT into Your Class, 2003, Horita et al, 2004). While this system was not developed according to the levels for teachers’ instructional ability by using ICT, it is believed to be proving useful in making improvements.

Moreover, another system has been developed and provided for the acquiring of basic skills in manipulating ICT equipment (ICT Skill Studies for Teachers ICT@SCHOOL 2004). Using this system, teachers can improve their basic manipulative ability in giving instruction with the use of ICT.

Elsewhere, with regard to levels in the instructional ability by using ICT, MEXT (2007) announced an 18-item checklist and investigates the level of teachers every the end of March (MEXT 2009b). The MEXT target is that nearly 100% of teachers should be able to reach the levels for instructional ability in the use of ICT. However, there are concerns that this target will

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* This paper was originally published in Jpn. J. Educ. Technol., Vol.34, No.2, pp.115–123 (2010)
not be reached unless teacher training on instructional ability by using ICT is systematically promoted.

From 2003 a research group developed and operated the prototype Comprehensive Self-evaluation & Training System (Shimizu et al., 2005), which aimed to improve teachers' instructional ability by using ICT. The system cites 663 cases in instruction by using ICT, and connects them to the skills needed in order to provide instruction in such situations (basic computer and the Internet manipulation skills). The prototype system was an e-learning system in which, whenever the instructional ability in an instruction situation was inadequate, specific images or recommendations regarding the instruction were displayed and users were able to learn the requisite ICT skills.

This research expanded the hitherto systems and developed the TRAIN system, which adapts to the levels of the teachers' instructional abilities by using ICT (Shimizu et al. 2008).

TRAIN is an acronym meaning “Teacher's Resources for Applying ICT Nationwide.”

The objectives of this research were as follows.
- To integrate the existing system entities and develop a system to improve teachers' instructional ability by using ICT.
- To investigate websites related to instructional usage situations and connect them with instructional case studies, in order to improve the instructional cases cited in the levels for teachers' instructional ability by using ICT.
- To produce numerous short video modules enabling the acquisition of skills as shown in the checklists of the levels for instructional ability by using ICT, and provide these through TRAIN.
- To produce video modules with commentary based on specialized knowledge, and provide these through TRAIN.
- To produce a set of FAQs concerning improvements to instructional ability by using ICT, and try to build up collaboration in the TRAIN system.
- To conduct an evaluation of the TRAIN system.

2. AN OUTLINE OF TRAIN AND ITS CONTENTS

2.1. An Outline of TRAIN

TRAIN is a system that enriches users' understanding of the basic thinking by using ICT for classes and so on, and explains how to use ICT effectively in what types of situations. The development of the system was commissioned by MEXT and carried out at the National Institute of Multimedia Education, and is currently provided by the Center of ICT and Distance Education at the Open University of Japan (Teacher’s Resources for Applying ICT Nationwide TRAIN 2009). Figure 1 shows the first page displayed...
when users log on to the website.

As the figure shows, there is a text box for searches at the top, beneath which the further search categories of school type and level of instructional ability by using ICT are displayed. On the right-hand side are functions allowing searches for different subjects.

TRAIN was developed mainly using PHP. The subsystem enabling searches and display for the FAQ section was only implemented with Perl. The video modules covered in the following section are distributed from a Flash Media Server in Flash Video format.

2.2. Video Modules

When teachers are undergoing training by videos, it is difficult for them to continuously watch the videos for extended periods of time, and does not serve to lighten their workload. Moreover, it is considered possible to explain a single concept in the space of around 3 minutes. Therefore a large number of short video modules were aimed to produce in this research. The instructors asked to appear in the video modules were requested to keep their explanations to between 3 to 5 minutes. The result was the production of 218 training video modules on improving instructional ability by using ICT.

Figure 2 shows the results of a measurement of the length of the 218 video modules. As can be seen, the most frequent length of the modules was between “3 minutes and 30 seconds” and 4 minutes. The shortest was 1 minute and 53 seconds in length and the longest 6 minutes and 16 seconds. The average length was 3 minutes and 45 seconds, and the standard deviation was 57 seconds.

Figure 3 shows an example of the screen when a video module has been selected and played back.

The 218 video modules were classified and sorted as follows, in line with the levels for instructional ability by using ICT.

- Commentary concerning levels for instructional ability by using ICT and the effects of ICT: 36 modules
- Practical cases of classes effectively using ICT: 140 modules
- Cases of teacher training to improve instructional ability by using ICT: 42 modules

2.3. Videos with Commentary

Fifty video modules presenting practical cases by using ICT were selected from among the training video modules, and commentaries from a specialist perspective of instruction by using ICT were added in order to make them useful in improving users’ understanding the practical cases given. Two co-authors with abundant experience in tuition by using ICT took charge of providing the commentaries.

One of the commentaries is shown in Fig. 4. The example explains the key points in how to, having trained with the video modules, put what was learnt to good use in mathematics lessons.

2.4. Video Modules Outline Handbook

Arranging the content of 218 video modules required by learners, in a way that they can
search for it on a screen, is no easy task. Therefore a 120-page outline handbook was produced to enable users to see the content of the module at a glance. The A4-size handbook provides an explanation for each module in around half a page, providing its title, content, a screen shot, and the instructor’s name. The effective use of TRAIN was made possible through the use of this handbook in training. The handbook is also available for downloading on the website.

Figure 5 shows the front cover of the handbook, and Figure 6 shows an example of its contents. As can be seen in Fig. 6, as well as an explanation of the contents of the video module a screen shot of the video is also shown. On the top left-hand side, the type of instructional ability level, type of school, and relationship to the subject are displayed. This enables the content to be ascertained at a glance.

2.5. Provision of Examples

A great many examples of instructional and practical cases concerning teachers’ instructional ability by using ICT are available over the Internet. In the course of this research the following quantity of cases, classified and sorted them were collected, and arranged them so that they could be searched for in an integrated manner along with the contents developed.

Instructional cases: 578
Practical cases: 256

2.6. FAQ

TRAIN contains 234 FAQs on teachers’ instructional ability by using ICT, arranged in a search-type system. The contents of the questions in the FAQ consist of a sorted collection of questions and issues commonly experienced by teachers in the classroom. The contents of the answers to these questions was the work of researchers with a wealth of experience in tuition by using ICT, and teachers’ consultants and research directors in positions promoting or offering advice by using ICT. The top page of the FAQ is shown in Fig. 7. The 234 questions covered in the FAQ can be broken down as follows:

- What is instructional ability by using ICT?: 8 questions
- Training in instructional ability by using ICT: 30 questions
- Promotion of ICT in schools: 8 questions
- Developing an environment for use of ICT: 22 questions
- Preparing for classes by using ICT: 18 questions

![Fig. 5. Front cover of the handbook](image)

![Fig. 6. An example of the handbook’s contents](image)

![Fig. 7. The main screen of the FAQ on instructional ability by using ICT](image)
3. REGISTRATIONS AND SEARCHING

3.1. User Registrations with TRAIN

Users of TRAIN must first of all register. When the system first started to operate an ordinary user registration format was employed, but since many of the teachers commented that because there were so many items requiring completion the registration process was somewhat burdensome, a format in which users have only to enter the requisite details on a face sheet was adopted. As the face sheet to be completed in Fig. 8 shows, when users log on to a page requiring registration TRAIN displays a form for entering their user ID and password, and the face sheet for completion. Users who do not have a user ID can use TRAIN simply by completing the fields displayed.

There are only two or three required fields, namely “teacher/student,” “type of school,” and in the case of junior high and high schools, “subject.” When the face sheet is completed the same process as for user registrations occurs internally, and the user name and password are automatically generated and displayed. By switching the “New Registrations” button to a “use TRAIN” button, users are now able to use the system without being aware of user registrations.

3.2. Searching the TRAIN contents

The TRAIN contents search function provides three search methods: by keyword, by category, and by subject.

The keyword searches enable searches for contents related to the search term input by the user. The search method is a normal full-text search, and the results are displayed in the order in which they are found. In the category-based searches, contents related to the category selected by the user (5 main categories for the level of the teacher’s instructional ability i by using of ICT, and 18 sub-categories) can be searched. With the subject searches users can search content related to the subjects they selected. The results of the searches are displayed on the screen in a list. By clicking on the titles on the list their contents are displayed in a new window, and by clicking on the “Outline” button an outline of the contents is displayed in another new window. An explanation of the contents of the video modules can also be displayed.

Figure 9 illustrates a conceptual diagram of the search functions. The figure shows what the teachers using the TRAIN system see when they search for the contents they want.

Figure 10 shows an example of the video module search screen. Clicking on the “Commentary” button beside some of the videos displays the explanations outlined above in 2.3.
3.3. The display flow of the TRAIN system

TRAIN provides video modules, videos with commentary, an FAQ, and instructional and practical cases, all of which can be searched and used. There is also a video module handbook, and the videos can be watched after referring to this handbook.

The flow of the contents of the TRAIN system is shown in Fig. 11. Note that possible paths to jump to other contents are shown in this figure.

4. CHARACTERISTICS OF TRAIN, AND AN EVALUATION

4.1. In Comparison to Other Systems

One of the characteristics of the TRAIN system is that it is intended to improve teachers' instructional ability by using ICT, and it is pursuant to the levels of the teachers' instructional abilities by using ICT proposed by MEXT. Another is the way that the TRAIN subsystem has developed the system functions hitherto used, and integrated them. Moreover, as well as developing numerous video modules and FAQs essential for teachers' acquisition of instructional ability by using ICT, the system sorts and provides the information distributed on other related websites according to its own concept.

Table 1 shows a comparison of TRAIN with other websites that are useful in training aimed at instructional ability by using ICT of teachers.

The systems that were compared with TRAIN were Integrated IT in your class (Integrate IT into Your Class, 2003), ICT@School (ICT Skill Studies for Teachers, 2004), and ADAPT (Ability Development for Advanced Professional Teachers, 2004), the URLs of which are provided in the References below.

The comparison subject at the top of the table of "instructional ability level" shows the relationship with level of instructional ability by using ICT. The categories A, B, C, D and E are those specified by MEXT, the details of which are shown in Fig. 1. Since it is essential that the categories describing level of instructional ability by using ICT are understood, the fact that TRAIN enables training in this area is another of the system's special characteristics.
The lower half of the table is a comparison of the systematic elements. As can be seen, while the other systems are composed of a limited set of elements the TRAIN system’s structure integrates the contents provided and the search functions and other elemental technologies. Furthermore, TRAIN is being developed so that it can serve as a learning management system (LMS) in the future, with the incorporation of collaborative functions with other systems such as a system providing ICT manipulation skills, and the ability to record user logs.

4.2. Teacher Training Using TRAIN

The TRAIN system developed in this research is aimed mainly at current teachers and university students across Japan wishing to enter the teaching profession. It is also aimed at those involved in teacher training such as the directors of local education boards, training leaders, and the principals and deputy–principals of schools, and university teaching staff in charge of lectures related to instructional ability by using ICT as a part of teacher training.

The types of teacher training using TRAIN were envisaged as being the following categories of self-training, in-school training, group training and teacher training courses.

It is worth noting that one of the special characteristics of TRAIN is that effects can be raised by conducting a combination of the above-mentioned four types of training, for example, by conducting group or in-school research using TRAIN and then later self-studying again the parts that could not be studied

1) Self-training

This is a training type in which teachers use TRAIN to study on their own, either at home, or at school. As there are a great many short video modules, teachers can choose those they wish to learn about and train.

2) In–school training

This is a training type in which the teachers use TRAIN to study together. In particular, training can be centered on an in–school leader who selects the video modules and FAQs most suited to the specific needs of the school level

3) Group training

This is a format in which TRAIN is used for group training by the education board or education center etc. Under the instruction of the person in charge of training, the teachers who are the students can try to improve their instructional ability by using ICT.

4) Teacher training courses

TRAIN can be used in teacher training courses at universities’ teacher training departments and so on, to foster instructional ability by using ICT among students seeking to acquire their teaching licenses. Reports have been published on the practice and evaluation of teacher training using TRAIN (Honda et al, 2009 and Yamamoto et al, 2009), and the system has been found to be effective.

4.3. Impressions of TRAIN Users

Some examples of the impressions of those who have undergone training using TRAIN are presented below.

1) Impressions regarding training

- I’d only had training by using of apparatus until now, but I’ve been able to learn about instructional ability by using ICT.
- Being able to undergo lots of training that wasn’t too elaborate was effective.
- I’d always thought of training as being long and dull, but I was able to enjoy being taught in a short space of time.
- I hadn’t made any systematic study of using ICT, but I was able to get the gist using TRAIN.
- TRAIN is useful because it’s important to actually experience by using ICT in teaching practice.
- I’m grateful to have participation– and experience–based training rather than lectures.

2) Impressions after use

- The less–than–five–minute videos are good.
- I want to use TRAIN when I’m stuck.
- My horizons expand because once I have experienced one way of using ICT I want to try some more.
- It puts you at ease because you understand once you’ve actually seen it.
- There were lots of modules that I immediately wanted to try out at school.

3) Impression on future use

- If TRAIN is used then teachers will be able to study the instructional by using ICT that they are lacking in.
- Study can be done at home in a short space of time in between the busy hours teaching or dealing with school business.
- After going home or back to school after training, the content of the training can be gone over again or tried out on the spot.
- I can study alone.
- It will be a good reference for instructional
4.4. Results of the Evaluation of Education Boards

In order to evaluate TRAIN, survey questionnaires were sent to the education boards of prefectures, government ordinance-designated cities and other municipalities throughout Japan, 785 of which replied.

Table 2 shows the results of questions concerning the evaluation of the use of TRAIN. Respondents were asked about the extent to which, as the people in charge of the subject, they agreed that using TRAIN was important in improving teachers' instructional ability by using ICT, and were requested to select and indicate with a circle one of the following: 4. Strongly agree, 3. Slightly agree, 2. Do not really agree, and 1. Do not agree at all. The average value and standard deviation were calculated to create a score for the four-tier evaluation in each question, and a spatial estimation of the average values was conducted. Since the responses were numerous, from over 500 people in all, a spatial estimation using a t-distribution was conducted.

As can be observed in Table 2 the average value for all the questions was 2.93 or over, reflecting the high evaluation among education board figures of the TRAIN system.

The responses from prefectural and municipal education boards are shown in Table 3. It shows that the evaluations of the prefectural education boards are higher than those of the municipalities. This was because the use of ICT at high schools under the jurisdiction of the prefectures is behind that of municipality high schools, and their needs for training aimed at high schools are therefore more substantial.

5. SUMMARY

The following results of the research can be cited.

- A training system was developed for upgrading teachers' teaching skills by using ICT.
- The technologies of the subsystem are based on existing systems, but these were integrated

Table 3. TRAIN evaluation (comparison by institution of affiliation)

<table>
<thead>
<tr>
<th>Question</th>
<th>Prefectures (73 data)</th>
<th>Municipalities (702 data)</th>
<th>t value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think that the TRAIN system will be useful in training?</td>
<td>3.36 (0.55)</td>
<td>3.14 (0.56)</td>
<td>t=2.91</td>
<td>p&lt;.01</td>
</tr>
<tr>
<td>Do you think that the TRAIN system will be useful in improving instruction?</td>
<td>3.22 (0.50)</td>
<td>3.06 (0.52)</td>
<td>t=2.39</td>
<td>p&lt;.05</td>
</tr>
<tr>
<td>Do you think that instructional ability by using ICT will be improved by the use of the TRAIN system?</td>
<td>3.26 (0.55)</td>
<td>3.02 (0.56)</td>
<td>t=3.13</td>
<td>p&lt;.01</td>
</tr>
<tr>
<td>Do you want to use the TRAIN system for training?</td>
<td>3.34 (0.64)</td>
<td>2.95 (0.62)</td>
<td>t=4.44</td>
<td>p&lt;.01</td>
</tr>
<tr>
<td>Do you think that you will recommend the TRAIN system to other schools and teachers?</td>
<td>3.35 (0.55)</td>
<td>2.99 (0.62)</td>
<td>t=4.67</td>
<td>p&lt;.01</td>
</tr>
</tbody>
</table>
and developed and evaluated them as the Teacher’s Resources for Applying ICT Nationwide (TRAIN) system.

- Two hundred and eighteen (218) video modules were produced for training with regard to improving teachers’ instructional ability by using ICT.
- A video module handbook was produced for explaining the titles, explanations of the content, screen shots, and the names of instructors of the 218 video modules, each arranged over half a page of the A4 booklet.
- In order to boost support for self-training, in-school and group training using the TRAIN system, we selected 50 practical cases from the video modules, and produced these with added commentaries.
- Two hundred and thirty four (234) FAQs were created on instructional using ICT.
- The system developed in this paper was highly evaluated by analyzing questionnaire survey which was sent to education boards.

It is hoped that the TRAIN system developed in this research will prove to be used effectively in self-training, in-school and group training, and in teacher training courses, aimed at upgrading teaching skills by using ICT. It is also hoped that it will be useful in the future in promoting the digitization of education in Japan.

ACKNOWLEDGEMENTS

This research was conducted as a part of the Ministry of Education, Culture, Sports, Science and Technology’s Promotion and Evaluation of Projects to Improve Teachers’ Instructional Ability by using ICT and ICT Manipulation Skills, part of its Initiative Promotion Program on the Digitization of Education. Authors are very grateful to the Ministry for providing us with the opportunity to conduct this investigation and research. Authors would also like to express their gratitude to the various committee members who cooperated in promoting our research, and the many teachers who appeared in the video modules.

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